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Accelerating the progress towards
the 2030 SDGs in times of crisis

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Welcome Message by the Conference Chairs

This summer was a memorable experience for us at Mid Sweden University, having the opportunity to organize and host the 27th annual conference of the International Sustainable Development Research Society – ISDRS. We were proud to accommodate over 400 research presentations from 47 countries around the world, all of which engaging in the important endeavour of creating more knowledge to make our world a more sustainable one.

This document constitutes the published Proceedings of the conference. The volume contains abstracts, full papers and posters accepted after a rigid review process. They were selected for publication in the proceedings after a double-blind review process consisting of two stages, starting with acceptance of an abstract for either oral or poster presentation, further the opportunity to submit a full paper which was again peer reviewed.

Without the help of many hands this achievement would not have been possible. First of all, we would like to express our thankfulness to all the engaged reviewers which invested their private time to secure the highest scientific excellence and soundness. The review procedure was made possible through the support by the organizing team consisting of the conference manager Inger Axbrink, as well as Karin Knobloch, Richard Zaring, Elena Paschali and Matilda Eliasson. The digital conference itself had not been possible to organize without our IT support and the large number of students and volunteers, supporting the different sessions of the event.

The major effort of compiling and organizing all documents for the proceedings and producing an accessible graphic design was made by Matilda Eliasson supported by Karin Knobloch, Inger Axbrink and Catrin Johansson.

The main contribution of the proceedings is of course originating from the numerous authors. We express our gratitude in this way to you. Without your dedication and effort the work on this volume would not even have been started. We sincerely hope that the knowledge collected here will continue to make a difference and inspire towards enhanced efforts for transforming our societies in a more sustainable direction.

Prof. Catrin Johansson

Professor in organizational communication
Department of Media and Communication Science
Mid Sweden University

Prof. Volker Mauerhofer

Professor
Department of Ecotechnology and Sustainable Building Engineering
Mid Sweden University

Keynote and Plenary Speakers

Ranjula Bali Swain

Ranjula Bali Swain is Professor of Economics, Södertörn University, Stockholm, Sweden and Visiting Professor and Research Director at Center for Sustainability Research (CSR) & Misum, Stockholm School of Economics. Her research focusses on sustainable development, environmental economics and development.

Hans Bruyninckx

Executive Director, European Environmental Agency – EEA. Dr Hans Bruyninckx became the Executive Director of the European Environment Agency on 1 June 2013. In 1996 he completed a PhD in international environmental politics at Colorado State University and since 2010 headed the HIVA Research Institute in Leuven which specialises in policy research. Over the last 20 years, he has conducted research in more than a dozen countries, in areas including environmental politics, climate change, and sustainable development.

Joji Carino

Joji Carino, Ibaloi-Igorot from the Cordillera, Philippines. She is the Senior Policy Advisor of Forest Peoples Programme, and is a lead writer, together with Maurizio Farhan Ferrari of Local Biodiversity Outlooks 2. Joji has been an active campaigner and advocate, over the past 35 years on indigenous peoples human rights, at community, national and international levels, and is a recognised leader in indigenous processes covering biodiversity, indigenous knowledge and sustainable development. She strongly supports community-based research and monitoring, also coordinating a network of Centres of Distinction on Indigenous and Local Knowledge.

Marie-Claire Cordonier Segger

Professor Marie-Claire Cordonier Segger, DPhil (Oxon), MEM (Yale), BCL&LLB (McGill), BA Hons (Carl/UVic), Leverhulme Trust Visiting Professor, University of Cambridge, Senior Director, Centre for International Sustainable Development Law (CISDL), Executive Secretary, UNFCCC CoP26 Climate Law and Governance Initiative, and Full Professor of Law, School of Environment, Entrepreneurship & Development, University of Waterloo.

Mark Elder

Director of Research and Publications at the Institute for Global Environmental Strategies (IGES) in Japan. He has co-authored several publications on SDGs. Realising the Transformative Potential of the SDGs; reports Assessment of the G20 Countries' Concrete SDG Implementation Efforts, and Assessment of ASEAN Countries' Concrete SDG Implementation Efforts; peer reviewed articles "An Optimistic Analysis of the Means of Implementation for Sustainable Development Goals: Thinking about Goals as Means" in Sustainability and "The Design of Environmental Priorities in the SDGs" in Global Policy; a policy brief on "Strengthening the Linkages between Air Pollution and the Sustainable Development Goals;" and Chapter 20 of UNEP's Global Environment Outlook (GEO-6).

Jane Kabubo-Mariara

Jane Kabubo-Mariara is the Executive Director of the Partnership for Economic Policy and a Professor of Economics of the University of Nairobi, Kenya. She is the president of the African Society for Ecological Economics, and a member of the German Institute of Global and Area Studies Advisory Board among other roles. Jane has over 30 years' experience in capacity building and research and has served in various corporate and scientific advisory roles globally. Her research interests include climate change impacts and adaptation, youth and women empowerment, multidimensional and child poverty. Jane has published widely in leading economics journals. She holds a PhD, Master and bachelor's degrees in economics from the University of Nairobi.

Elizabeth M. Mrema

Executive Secretary, Convention on Biological Diversity – CBD. Ms. Mrema has worked with the UN Environment Programme (UNEP) for over two decades and was the Director of the Law Division at UNEP. Prior to joining the Law Division in June 2014, she was Deputy Director of the Ecosystems Division, in charge of coordination, operations and programme delivery from 2012 and also served for one year as Acting Director to the same Division. In 2018, she was the Acting Director of the Corporate Services Division. Prior to these duties, she also served as Executive Secretary of the UNEP/Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals from 2009-2012. Ms. Mrema's work at UNEP has focused on development, implementation and enforcement of environmental laws, including multilateral environmental agreements at national, regional and international levels, among others.

Hien Ngo

Biodiversity and pollination expert at the Commission on Genetic Resources for Food and Agriculture, FAO – Food and Agricultural Organisation/United Nations Hien Ngo joined FAO in 2020. From 2014 until recently, Hien worked at the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) as the head of the technical support unit for both the IPBES pollination assessment and subsequently the IPBES global assessment on biodiversity and ecosystem services. Hien has previous experience at the FAO as a consultant from 2012 – 2014. Hien has a background in biology with undergraduate degree at Simon Fraser University (Canada) and a master's degree at York University (Canada) looking at bee diversity in coffee agroecosystems in Costa Rica. Thereafter, she continued her work in Southeast Asia, both in Vietnam and the Philippines. Hien has co-authored approximately 35 peer-reviewed publications, technical reports and book chapters.

Åsa Persson

Åsa Persson is Research Director and Deputy Director at the Stockholm Environment Institute, and Adjunct Lecturer at Department for Thematic Studies, Linköping University. Her recent research focuses on global governance, including the implementation of the SDGs, the climate change adaptation, and the planetary boundaries framework. In the SDG context, she is particularly focusing on policy coherence and inequality. In 2020, she was appointed by the UN Secretary-General to the Independent Group of Scientists to prepare the 2023 Global Sustainable Development Report. She is a member of the Scientific Steering Committee of the Earth System Governance Project. She received her PhD degree in environmental policy from the London School of Economics & Political Science in 2007.

Marcos Regis da Silva

Executive Director Inter-American Institute for Global Change Research (IAI). Marcos REGIS DA SILVA holds the position of Executive Director with the Inter-American Institute for Global Change Research (IAI). In this capacity, he is responsible for the strategic direction of the IAI, implementation of its strategic plan and scientific agenda and leadership regarding the role of the IAI in the current environmental governance discussions. Prior to joining the IAI, he held several executive and managing positions within the system of UN conventions (CITES, CBD) and NAFTA. He holds a PhD from McGill University where he was an Adjunct Professor for many years.

Jeffrey D. Sachs

Jeffrey D. Sachs is a University Professor and Director of the Center for Sustainable Development at Columbia University. He is President of the UN Sustainable Development Solutions Network and a commissioner of the UN Broadband Commission for Development. Sachs has been advisor to three United Nations Secretaries-General, and currently serves as an SDG Advocate under Secretary-General António Guterres. He is an expert on public health and epidemics and has advised the World Health Organization at the highest levels during the past 20 years. Sachs was twice named among Time magazine's 100 most influential world leaders and was ranked by The Economist among the top three most influential living economists.

Richard Welford

Professor Richard Welford is Senior Advisor to the ELEVATE group of companies, a global sustainability consultancy based on Hong Kong and Chairman of CSR Asia. He is working with Asian blue chip companies on their sustainability strategies. Richard is a visiting professor at the Sasin School of Management, Bangkok and the University of Technology, Sydney. He is the author of thirteen books and over 100 articles linked to corporate sustainability. He is the editor of four journals linked to sustainable development and is a past President of the International Sustainable Development Research Society. He sits on the Board of five companies and NGOs.

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1. Sustainability and Science

1a. Theoretical approaches

Abstracts

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Pulsing and sustainability

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Abstract

Two dominating angles in the debate regarding sustainability and sustainable development has been if there are limits to growth or not, often captured with the opposites Malthusians versus Cornucopians, and if different forms of economic capitals are possible to substitute with each other or not, strong versus weak sustainability. Within the Cornucopian and weak sustainability view, continued economic growth and technological optimism are common positions. Within the Malthusian and strong sustainability view, leveling off the growth curves to a relatively stable steady state is the most common position. The system scientist and ecologist Howard T. Odum viewed sustainability as the economists' equivalent to the ecological climax concept, a supposed long-term steady state for the system. However, within the science of ecology the steady state, "final", climax has since long been abandoned. The systems ecologist C.S. Holling and coworkers has, successfully, proposed a model of continuous renewal in a closed loop four-stage model, often referred to as the "lazy eight" (since graphically it looks like a number "8" laying down). H.T. Odum came to a very similar conclusion, based on general systems models. From these models he predicted that a steady state sustainability outcome is less likely than a pulsing pattern. This mainly because the short-time competition of available resources will create such a pattern, rather than a long-term steady state pattern. Pulsing has, so far, not been discussed to a large extent in the sustainability literature. This paper will examine sustainability and sustainable development in relation to the pulsing view, 20 years after H.T. Odum's propositions on the topic. Pulsing has four main stages according to Odum: 1) Growth, 2) Climax or transition, 3) Descent, 4) Regeneration. From a sustainability point of view each of these phases probably should have different characteristics and need different management strategies. The pulsing pattern, according to general systems theory, also appears on several time scales and hierarchical levels, at the same time. This will also have impact on available management choices for decision makers.

SDG targets: The paper do not address specific SDG targets, rather it address' the fundamental mechanism underlying them.

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A Sustainable World needs Transformative Science: Ontological Reflections on Contemporary Economic Science

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Abstract

Modern sciences promise to deliver the means to achieve the medical and technological progress needed to overcome the crisis provoked by COVID-19, thereby resuming previously charted economic growth trajectories. However, especially in times of crises, sciences are showing their paradoxes by pointing to the fact that not only their fundamental notions and theories, but also objectified facts are rooted in the social sphere (Gretzel et al 2020, 191-192).

After pointing at ontological inconsistencies of modern sciences, like the Fact-Value Antinomy (Putnam 2004), this presentation recalls that all sign-systems and languages, like mathematics, theories but also empirical facts, are aspects of the same societal world, wherefore they should not be confused as isolated entities of an illusory world of 'scientific thinking' (Brodbeck 2019). Following Kuhn (1962) who reminded us that *scientific revolutions* are driven by the social, psychological and *ethical* nature of sciences, it is argued that a crisis like COVID-19 shows the potential to challenge current paradigms, especially the way we think about values and facts in relation to the *economic* foundations of our society.

Therefore, major ontological discrepancies of contemporary economic science are critically reflected. Following the science paradigm, economists relate *measured* and objectivized '*things*' to the *empty* abstract measuring-unit *money*, so as they receive their *price*. However, this '*calculative* form of thinking' has led to a new type of *pecuniary* socialization: Not only production processes, but also social acts of exchange, technological processes, and even skills and the arts, stop being social processes initiated by humans, rather become abstract elements in *economic equations* (Brodbeck 2019). As a consequence, the uniqueness and diversity of social acts of exchange is transformed into '*identical*' monetary values, i.e. objectified things of nature become *comparable* but *empty* units (Brodbeck 2019, 16). However, the reference to such a misleading ontology led to the paradox that economics cannot be considered an empirically exact science exactly because humans do *not* behave like mechanical objects of classical physics.

The presentation concludes by showing, that contemporary economic science, although represented through a system of factual statements ('hard facts') should be uncovered as '*implicit ethics*' guided by the ontological assumptions of modern sciences (Brodbeck 2019; Gretzel et al 2020). As a precondition to transform economic thinking towards a critical science capable to cope with the needs of a truly *sustainable* world, a post-mechanist economic theory (Brodbeck 2019) which defines '*The Economy*' as a socio-communicative network in line with SDGs is deduced in the outlook.

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Full papers

Innovations in Theoretical Approaches for Spatially Determining SDGs on Landscape Scale and Regional Planning Level –

Application for Sustainably Governing Spree Forest and Lusatia Region in Germany

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Abstract

United Nations Sustainable Development Goals (SDGs) and Planetary Boundaries composite demand are showing up challenges in different theoretically scaled and levelled routs for sustainably fulfilling these planetary and Earth systems most existential overall aims. The need for an understanding about global general goals and regional to local governing structures has to be combined: assessment, monitoring and governance approaches have to be found in combination with landscape planning, land use based approaches, land system and sustainability science. Theoretical approaches have to be integrated while advancing landscape scaled, regional levelled assessment methods for fulfilling the innovation of spatially determining SDGs and therefore serving against regional crises situations.

The initial theoretical research is including global to local planning levels and is embedded in an incrementally worked out theoretical framework with an applied research part. The case studies and field data in rural and urban areas of the German Lusatia Region and inner part Spree Forest Region inhabit intrinsic drivers of finding ways to over bridge deficiencies of several theoretical and applied adjusted objectives: 1. operationalising the combined deductive, inductive research parts while verifying theoretical research and framework within an applied case study; 2. scale and planning level as well as instrumental flexibility deficiencies while transmitting global transformation needs to the regional, local planning level and backwards (counter-current principle); 3. general insecurity factors and possible prediction instabilities in sustainable, climate-and water-related development paths for planning, management and decision making sectors; 4. transdisciplinarity of proper sustainability and land system sciences as well as of land-, climate- and water-related planning aspects in sorts of data management; 5. exchange and communication acceleration of planning results while applying on the ground. These main objectives were assessed in this small excerpt of research work on the basis of how to quicken up processes for resilience building especially in case of implementing sustainable development goals and optimizing response to climate change and several further ongoing crises. Innovative instrumental assessment structures were created in combination to a new approach of

spatially determining SDGs for an accelerated Climate Smart Planning as well as Integrated Drought and Water Management. The problematic of possibly installing too many new to be introduced instruments have been carefully treated within theoretical and applied verifications. Above named objectives (1.-5.) are important parameters of that discussion.

Research results examine a possible assessment or monitoring framework for supporting sustainable change management in times of climate crisis. The here integrated assessment methods are outlining a first overview and summary of research results. They are helping to provide a greater, constructive transparency on global to regional planning level.

Global SDGs are getting coupled with innovative and well known assessment methodologies. Specific SDGs such as SDG 11, 13 with a combined Climate Smart Planning or SDG 17, 15 with a combined Integrated Drought and Water Management are amplifying Lusatia and Spree Forest Regions` effective applicability for gaining more regional resilience. This research is supporting the processes around acceleration and assessment of climate change-, crises-related as well as sustainable development and land resilience options while enhancing interdisciplinary sustainability science.

Keywords: Spree Forest and Lusatia Region, SDGs, Cultural Landscapes, Land System Science, Spatial Determination Framework

1. Introduction for global SDGs in the German Spree Forest and Lusatia Region

This research is treating the innovative theoretical and partially applied approach of and scope for gaining a transition into an activating regional management and capacity building for sustainable development. The approach is compiled on the basis of a self-developed, theoretical verbal-argumentative landscape-meta-model, being influenced by the existing model of DPSIR (Driver-Pressure-State-Impact-Response-Model, developed from PSR-Model, EEA, 1999; EEA, 2001; OECD, 2003) and a further own former developed MCL- (My Cultural Landscapes-) approach (Reinstädtler, 2005). Also the planning processing around the EU-Water Framework Directive (WFD, RL 2000/60/EC; WFD, 2000; comp. Reinstädtler, 2011; Reinstädtler, 2013) was part of observation within evaluations for spatially depicting boundaries tendencies such as watershed areas or the here selected landscape units. Spatial, environmental, regional and landscape management was coupled to a most interdisciplinary, landscape scaled and regional levelled case study on land system and land use relations (comp. Reinstädtler, 2010) in times of insecurity factors, climate change and crisis (comp. Reinstädtler, 2011; Reinstädtler, 2013; Reinstädtler, 2017; Reinstädtler, 2019). It resulted in the land system approach and theoretical framework for spatially determining the globally set Sustainable Development Goals (SDGs) (UNGA, 2014a,b) in Spree Forest Region and its surrounding Lusatia Region. The placing was delivered by help of the geographical and landscape planning instrumentation of landscape units (microgeochores) and mapping (for instance with ArcGIS). The research question and hypothesis for this section of research was about the possibility

for implementing SDGs in spatially determined areas for bettering regional governance. Land system science and landscape planning base evaluation steps around different land use formations into the theoretical framework(s). How processing this scale-overarching endeavour might be successful will be cleared up: a description of assessment process and methodological combined theoretical approach is following as partial excerpt of the greater land based framework called CA(LU)²WA or „Climate Adaptive Land Use within Landscape Units and Drought and Water Management".

Observation perimeter is the Region of Lusatia and inner part Spree Forest Region. The climate is mainly sub-continental (comp. Tockner et al., 2009). The greater observation region of Lusatia is located in eastern part of Germany, situated between the cities of Dresden and Berlin. Being divided in Upper (mainly Federal State of Saxony) and Lower (mainly Federal State of Brandenburg) Lusatia, it comprises the Spree Forest Region, lying north-west of the City of Cottbus in Lower Lusatia. The inhabited river of Spree landscapes and catchment in the European centred German Region of Lusatia borders upon Poland and Czech Republic.

This case study shows that a transition into sustainable societies and land systems as a whole is possible in a stepwise, incremental way. Main objective of this article is to assess the sustainable governance possibilities within Spree Forest and the greater frame of Lusatia Regions landscapes. An already in entire Lusatia Region applied observation on landscape scale and regional level helped to advance sustainable land systems while enforcing regional governing of SDGs and protecting a sustaining grade of landscape parts. This theoretical and applied research with intensive case studies and field data in rural and urban areas of the German Lusatia Region and enclosed Spree Forest Region consisted of an intrinsic driver of finding ways to over bridge deficiencies of several theoretical as well as applied adjusted objectives. The for answering the research question important developmental transition-topics of this research are structuring this articles results: 1. operationalising the combined deductive, inductive research parts while verifying theoretical research within an applied case study; 2. scale and planning level as well as instrumental flexibility deficiencies while transmitting global transformation needs (SDGs) to the regional, local planning level and backwards (counter-current principle); 3. general insecurity factors and possible prediction instabilities in sustainable, climate- and water-related development paths for planning, management and decision making sectors; 4. transdisciplinarity of proper sustainability and land system sciences as well as of climate- and water-related planning aspects in sorts of data management; 5. exchange and communication acceleration of planning results while applying on ground.

1.1 Landscape units for spatial placement of global SDGs on regional level

In order to combine landscape protection and sustainable land development with regional management in times of climate and further crises, sustainability capacity building was relied on SDG`s blue-green-ecologic-economic-cycles and a combined resilient land systems support.

Following natural environment areas (comp. figure (fig.) 1) were most predestined and have next to Reinstädtler (2005) served as example for spatially delineating instrumentations.

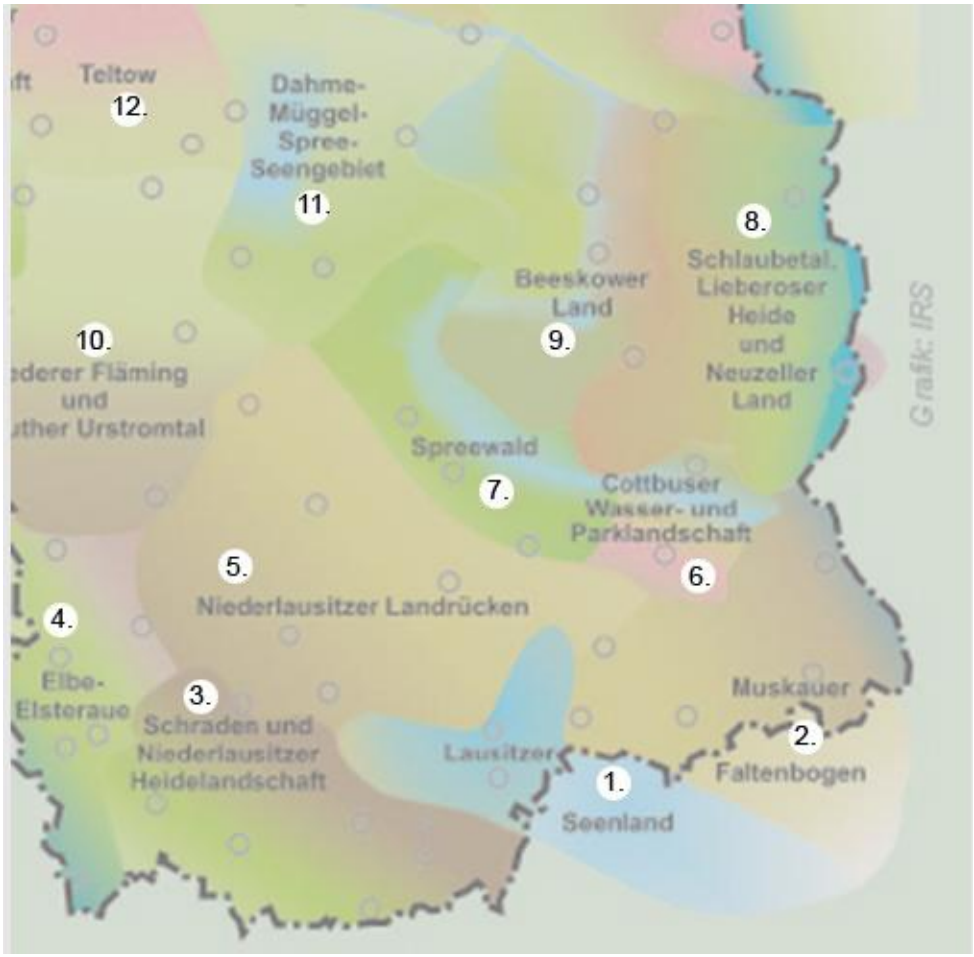

Figure 1. *Mainly Brandenburgian and Lower Lusatia Regions` categorization of the existing natural environment areas (comp. numbers and names in text) being suggested as cultural landscape-spaces of action (slightly changed excerpt of map after original drawing by IRS in MIR and SVS, 2007, p. 13)*

The Leibniz Institute for Research on Society and Space (IRS) as well as MIR and SVS (2007, comp. fig. 1) suggested cultural landscape-spaces of action (CLSA) for Lusatia Region: (1.) Lusatia Lake Landscape, (2.) Muskau Arch, (3.) Schraden and Lower Lusatia Heath Landscape, (4.) Elbe-Elsteraue Water Meadow, (5.) Lower Lusatia Land Ridge, (6.) Cottbus Water- and Park-Landscape, (7.) Spree Forest (Spreewald, with example of LU 1), (8.) Schlaube Valley, Lieberose Heath and Neuzelle Land, (9.) Beeskow Land, (10.) Anterior Fläming Heath and Baruth Glacial Valley, (11.) Dahme-, Müggelspree Lake-Landscapes, (12.) Teltow (MIR and SVS, 2007).

For this research the natural environment area or so called CLSA of "(7.) Spree Forest" was of interest for detailed assessing and describing the own derived theoretical systematic and methodological processing approaches behind spatially determining SDGs. Spree River Landscapes within Spree Forest (Spreewald) implement one of the worldwide most outstanding cultural

landscapes: the internationally recognized UNESCO Man and Biosphere (MAB) Reserve Spreewald. Therefore the in this research excerpt by the author suggested and derived Landscape Unit 1 (LU1) and its enclosed UNESCO MAB Reserve Spreewald is an advantageously example in sorts of sustainable and traditional land management. Lusatian land-systematic and processing on its theoretical approach for Lusatia Region and Spree Forest Region could have been shown. The here derived LU1 is called "Alluvial Fan Influenced Landscape with Wetland and Fließe Structures" (comp. tab. 1, later fig. 5).

Table 1. *Exemplary in the Region of Lusatia existing Landscape Unit 1 (also comp. later fig. 5, derived by the author)*

LU Nr.	**Nr. in Fig.1,4**	**LU Name**	**LU Examples in Lusatia Region**
LU 1	Fig.1: Nr. 7, or fig.5: Nr. 1;	**Alluvial Fan Influenced Landscape with Wetland and Fließe Structures**	Spree Forest Inland Delta, with having implemented UNESCO Man and Biosphere Reserve Spreewald, none similar characteristics in other places within Lusatia Region (but partially inclusive similar existing protected sites such as Upper Lusatia Heath and Pond Landscapes, UNESCO World Heritage Site Muskauer Park (Park Muskau)) next to multivariate other protected sites).

1.2 Natural and cultural status quo in the observation area

The in the year of 1991 to a MAB Reserve declared Spree Forest inhabits a 475 km² wide perimeter of a protected area (DUK, 2011; Reinstädtler, 2014) and serves in this research as main observation area within Landscape Unit 1 (LU1, comp. tab. 1, later fig. 4). The protected area in Spree Forest and Lusatia Region is a through Spree River and human-induced land use-forms intensively influenced cultural landscape. It needs estimations, assessments, monitoring and planning directions for further supporting sustainable development and governance coupled to regional management on landscape scale and within LUs.

Natural and cultural status quo of environment in the observation perimeter is most important for understanding the suggested methodology behind instrument and innovation: biosphere reserve Spree Forest features a network of 1575 kilometres of linear, natural and artificial watercourses with about 500 installed weirs and other hydraulic structures (Balla and Kalettka, 2003; LUGV, 2012, also comp. for general Lusatian water conditions Gerstengarbe et al., 2003; Moss, 2008) on biosphere reserve perimeter (DUK, 2011). The meander and small channel water systems of wetlands and water meadows are evolving because of very rare, low and approximately 0,2 ‰ gradients in the valleys (Vött, 2000; after Helbig, 1938 and Gringmuth, 1953). Lying in the geological formations of the Brandenburgian land of top moraine and comprising lowlands in a relief of moraines, terraces of fluviatile and periglacial valley sands, the Lower Spree Forest is predestined for these typical wetland-, water meadow patches and landscape formations (Reinstädtler, 2014, comp. Werban, 1995) with having covered around 15 000 hectares by meadows, pastures and wet grasslands (LUGV, 2012,

comp. Krausch et al., 1994). Approximately 2800 hectares of these meadow communities are particularly valuable in terms of nature conservation, such as the large sedge meadows (Reinstädtler, 2014). Habitat types covered by the Flora-Fauna-Habitats Directive (European Council, 1992) such as alluvial meadows of river valleys of the Cnidion dubii, lowland hay meadows and hydrophilous tall herb fringe communities (Balla and Kalettka, 2003) have next to many faunistic outstanding species particular nature conservation value (LUGV, 2012, comp. Jentsch and Klaeber, 1992). Same importance has the existing typical landscape characteristics for landscape esthetical aspects and landscape identity. These aspects foster regional identity (Reinstädtler, 2014) and therewith create benefits for regional management, marketing and a sustainable blue-green-ecologic-economic cycle in reconciliation with nature, environmental or landscape protective needs (Reinstädtler, 2017). Some of the aims within UNESCO MAB Reserve Spreewald management are to preserve these grassland communities and faunistic habitats through conservation agriculture. But survival of all named habitat types and enclosing biodiversity – as one part of landscape and regional identity in the Biosphere Reserve – depends on water inflows by the river of Spree and on the status of adequate groundwater and surface water at the site (LUGV, 2012; MUGV, 2012). Therefore landscape water household or hydrological balance is one of the priorities set in the management aims of UNESCO MAB Spree Forest (Reinstädtler, 2014; Reinstädtler, 2017). Those urgently have to be acknowledged while fostering sustainable governance and measurements within.

2. Data and Methodology for Approaching Transformations of Scale-Overarching Global SDGs into Regional Landscape-Scaled Implementation

The present study was carried out based on primary and secondary data sources. Primary data were collected from field investigations from the years of 2009 until 2019 (with core data from 2009 to 2016). The results of this research as part of a greater research study are based on case studies in Lusatia Region, comparative studies of worldwide cultural landscapes systematic and a concluding self-derived theoretical, transparent and comparable cultural landscape framework (MCL), a SWOT-analyses, a self-developed INASTAREC-sustainability screening on Lusatia Region, an own conception on an innovative theoretical approach and resulting planning, verbal-argumentative modelling frame. Semi-structured interviews or discussions were held with an interdisciplinary expert clientele from global up to regional, Lusatian sphere: world resource and climate experts, regional water engineers and further diverse regional Lusatian experts, further landscape and land use experts from Global Landscape Forum (GLF) 2013, 2015, 2017 and 2018 as site panels of UNFCCC COP 19 (Warsaw, PL), COP 21 (Paris; FR), COP 23 (Bonn, GE, with own research presentation and discussion), COP 24 (Katowice, PL) or sustainability experts from Sustainable Innovation Forum

(SIF) 2017 and 2018 as site panels of UNFCCC COP 23, COP 24. Besides these data sources own studies, pre-works (Reinstädtler, 2005) or publications have been used for this study.

Secondary data were collected in form of a broad, interdisciplinary aligned literature review. Also descriptive meta-analyses were fulfilled for different topics such as sustainability grade in Lusatia, planning insecurity factors or regarding the needs (against risks and for capacity building in resilience strengthening), measurements and strategies for land systems and land use forms in times of climate change. In case of planning insecurity factors a higher precision grade was laid in theoretical assessments. Regarding the (global) climate change and climate crisis analysed 16 different land use forms and environmental media guaranteed a regional, Lusatian land system overview. The collected data were reconstructed, analysed and partially visualised through using MS EXCEL, ArcGIS 10.1 or further software for mapping and graphs.

A formation of already short- and predominantly long-termed existing land use forms next to geomorphologic1, other abiotical (climate, air, soil, water), biotical or none human-induced biotical (flora, fauna) environmental media are the basis for selecting the LUs definition(s) and perimeters (comp. Reinstädtler, 2005) such as here for the example perimeter of LU1 (comp. tab. 1).

3. Results and Discussion

The idea behind this study is to merge known and accepted sustainability and land system science concepts with the existing DPSIR-approach depicting Driver-Pressure-State-Impact-Response-factors of socio-cultural, economic and environmental subsystems and own derived landscape frameworks. Those frameworks are MCL (Reinstädtler, 2005) and CA(LU)²WA (Reinstädtler, 2011; Reinstädtler, 2013; Reinstädtler, 2017; Reinstädtler, 2019) from landscape science as well as landscape, spatial planning and EU-WFD (WFD, 2000) background. The added value of this developed „CA(LU)²WA proactive landscape meta-model" might be a benchmarking-framework for different international located regions applicable assessment, comparison and monitoring design. The advantage of this conceptional framework is the fact, that main foundational parts of the model (MCL, Sustainability Screening, sustainability indicators, parts of CA(LU)²WA, etc.) were not only theoretically developed, but were applied in-situ on "Real-Landscape-Laboratory-Level" (R3L). This approach is up to that evaluated in a change detection role at the landscape and watershed (comp. Lein, 2014) scale and on diversified social aspects in order to safeguard sustainable development cross section.

[1] The geomorphologic- natural physical predisposition of a natural region is in general providing the abiotic frame for the biotic facility potentials (e.g. with species and ecosystems) as well as for the utilization potentials (e.g. agricultural, silvicultural, raw material extraction) (Lutze, 2014, p. 9).

The most interdisciplinary character gave up several tasks to be approved on theorization of land and its changing factors due to land use (comp. Turner et al., 2020) and especially climate change. In times of Anthropocene synergistic, cumulative or simply driving effects up to tipping points and planetary boundaries (comp. Rockström et al., 2009a,b; Foley et al., 2010; Barau and Ludin, 2012) needs the strongest, but flexible framework preparing for sustaining landscapes (Jacobs, 1986; Reinstädtler, 2005; von Haaren, 2011; Reinstädtler, 2011; Reinstädtler 2013; Reinstädtler, 2014), possibly also for sustainable landscapes (Wu, 2013a,b) or for landscape resilience (Schmidt, 2020; general resilience: Biggs et al., 2015). As land system science "seeks to improve observation, monitoring, understanding, modelling, and sustainability of land systems and their change" (Turner et al., 2020; after Verburg et al., 2013; Verburg et al., 2015; Robinson et al., 2018; Turner et al. 2007) its synergy to sustainability science and its aims is intrinsic. The further in this theoretical basis envisaged landscape approach is strengthening the cultural landscapes inhabiting land use forms and their developmental influences on land and inhabited multilayered systems in general. The landscape concept standing behind this research work is differing from the traditional ecosystem concept (although overall concepts are similar): in kind of assessment matters it is focusing on groups of ecosystems while the interactions among them are acknowledged through the spatial units of LU. The widened perspective of a landscape approach is the one provided in the European Landscape Convention (ELC, European Council, 2000, art. 1). Further on landscapes are fundamentals for regional planning (comp. Reinstädtler, 2005; Reinstädtler, 2011) and thus for life quality, economic, cultural, ecological, tangible and intangible drivers as well as for ecosystem services (MEA 2005). Landscape ecological planning is indispensible followed as a planning of ecologically sustainable landscapes, which includes considering the flows of energy and materials among system components and between the system and its surroundings, the spatial structure of the system, and the evolution of the system over time explicitly including the values, actions and impacts of humans (Botequilha-Leitao et al., 2006). Landscape planning (comp. Antrop, 1997; Marsh, 1998; Antrop, 2000) with its instruments and regional-based plans can melt together at its best with the common understanding of sustainable management (van Mansvelt and van der Lubbe, 1999), which is also approved in these researches' outcomes.

Having now these main systematic in theories highlighted, the results and discussion of this part of a broader research are depicted.

3.1 Operationalising an innovative theoretical research approach within existing approaches and the applied case study in Lusatia and Spree Forest Region

Right after a slogan "Making the UN SDGs happen - less preaching, more practice... what else?" thoughts, views, comments and approaches had and still have to be fostered in order to be able to

answer the following question: how do we rebuild trust through better organization and methodologies so there can be better partnerships between business, governments and civil society to deliver the SDGs? In proceeding the path to success, one of the multivariate needed and possible answers is the in this research by the author developed method within a (not here completely shown) broader framework of a spatial determination of global SDGs within regional based LUs (comp. for LU and climate change Reinstädtler, 2011; Reinstädtler, 2013; Reinstädtler, 2017; Reinstädtler, 2019; also comp. assessments for general potentials of LU in field of landscape ecology Bastian, 2000; Bastian and Steinhardt, 2002; or in field of landscape balance Krönert et al., 2001a; Krönert et al., 2001b). A functional, decision-centric and proactive benchmarking approach was developed for bringing forward environmental assessment or monitoring through applying the DPSIR-approach twofold: (1.) DPSIR in the entire holistic landscape assessment cycle (comp. fig. 2.); (2.) DPSIR for each environmental medium (comp. fig. 3.).

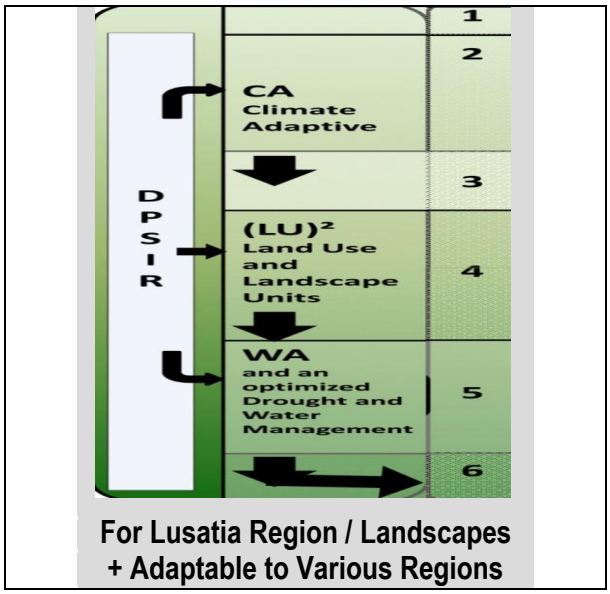

Figure 2. *DPSIR in the entire landscape assessment and CA(LU)²WA model for Lusatia Region (with assessment-step-no. 1–6)*

This deeper assessment brings forward sustainability initiatives and access progress for more sustainable development examples (comp. Lein, 2014) within the instrument of LU. Better operationalisations, organizations and methodologies are enabled. So emphasize was laid on the relevance of an innovative landscape-based, protective as well as sustainable regional development and its challenges of implementation. But also combined opportunities for sustainable landscape-based economy (comp. Reinstädtler, 2005) were examined with integrating landscape conservation and sustainable, smart as well as adaptive development options with mainly focusing here on diverse land use forms. Throughout the established six-stepped environmental and sustainability assessment within CA(LU)²WA model (comp. fig. 2, 3) and LU1 (comp. upcoming fig. 5, Nr.1) it is more easy to spatially implement especially the SDGs such as SDG 11, 13 with a combined Climate Smart

Planning and SDG 17, 15 with a combined Integrated Drought and Water Management. Those SDGs are amplifying Lusatia and Spree Forest Regions` effective measurements applicability for gaining more land(scape), systems and climate change resilience.

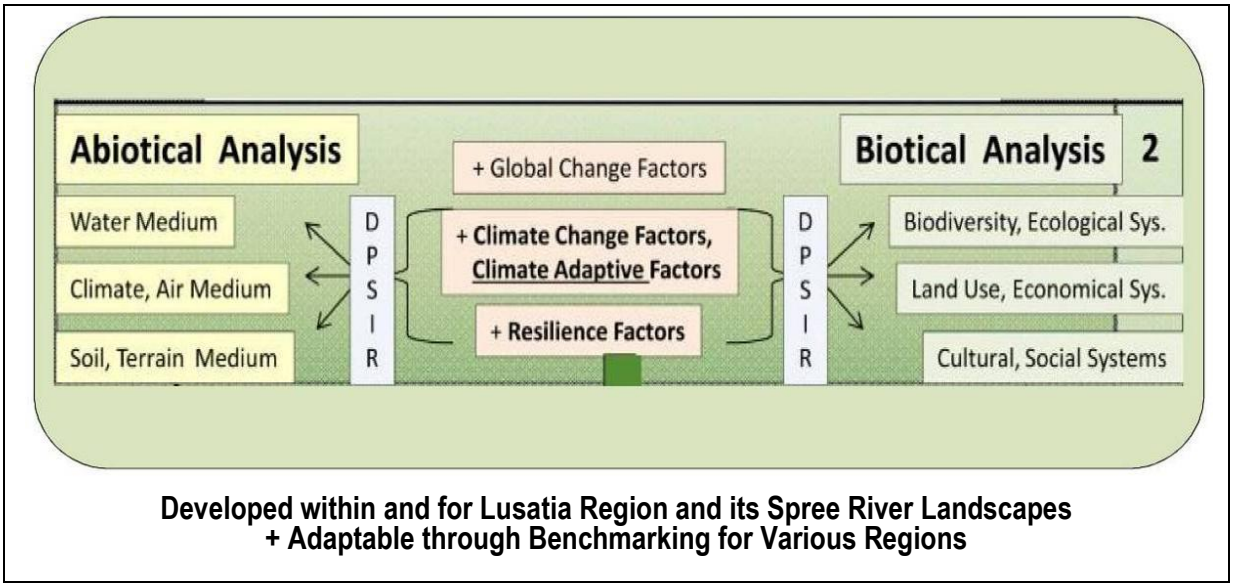

Figure 3. *DPSIR-matrix in each environmental medium in landscape assessment and CA(LU)²WA-processes for and within Lusatia Region (in assessment-step.-no. 2, both developed and derived by the author)*

3.2 Scale, planning level and instrumental flexibility for strengthening global to regional sustainability and climate change resilience

While transmitting global transformation needs of sustainability (SDGs) and climate change resilience to the regional, local planning level (comp. Leeuwen et al., 2009) and backwards (counter-current principle, comp. fig. 4, 5), it needs scale-, planning level- and instrumental flexibility. In the same way blue-green-ecological-economical efforts should be considered on landscape scale and regional level synergistically together with global demands (comp. fig. 4, 5; comp. Reinstädtler, 2011; Reinstädtler, 2013).

Landscapes are optimized platforms for sustainability and transformation research on land systems level: especially landscape planning processes already inhabit protecting, maintaining or developing (also recreational) demands, measures and mission statements (the German Leitbild-concept). Further on abilities of fostering functioning ecological systems, strengthening social abilities, securing physical health, enduring cultural (mixed or natural) heritage and in the same time facilitating economical, commercial and service functions are given within landscape planning or landscape initiatives (Reinstädtler, 2011). The potential for landscape, sustainability and land based transformation research as well as for sustainable regional governance is getting clearer with comparing Milder et al. (2014; as cited in Freeman et al., 2015): integrated landscape initiatives term

about and are defined that (1.) explicitly seeks to improve food production, biodiversity or ecosystem conservation, and rural livelihoods; (2.) works at a landscape scale (comp. CORDIS, 1995; Buttimer, 1998; Reinstädtler, 2005; Reinstädtler, 2011; Reinstädtler, 2013; Sayer et al., 2013; Reinstädtler, 2017; Reinstädtler, 2019) and includes deliberate planning, policy, management, or support activities at this scale; (3.) involves inter-sectoral coordination or alignment of activities, policies, or investments at the level of ministries, local government entities, farmer and community organizations, NGOs, donors, and/or the private sector; and (4.) is highly participatory, supporting adaptive, collaborative management within a social learning framework.

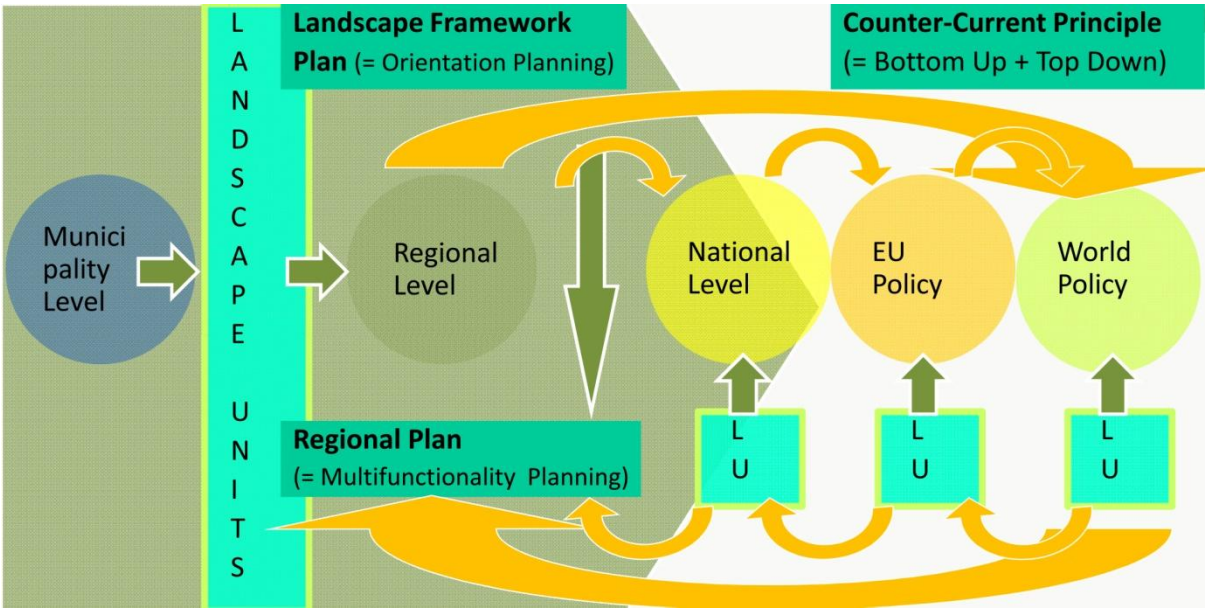

Figure 4. *Landscape Units (LU) as a transferor into Global Regions and backwards (counter-current principle)(changed by the author after Reinstädtler, 2011, p. 57; Reinstädtler, 2013, p. 61)*

On concretized and applied regional level of Lusatia and Spree Forest Region (comp. fig. 4, 5) it means to deal with demands, measurements of and strategies for already former swamps, being reclaimed and turned into the existing cultural landscape as well as for climate and global change syndromes.

Also influences through the transitional area of the River Spree and diverse partially economic land use forms by e.g. settlement, agrarian and forestry use as well as by lignite open-cast mining have to be acknowledged. These changing processes are giving ideas about the complex-cause and effect syndromes or more uncertain parameters of insecurities and (global, climate) change risks being partially responsible drivers for landscape or land use changes as well as partially for economical development possibilities or resulting economical mismatches. Further drivers like enhancing, shifting and varying land use concerns, globalisation pressures and dynamical processes in general together with influences of current political directions or spatial planning procedures are combined with more

uncertain parameters for economy, environment and society (Reinstädtler, 2013). These are some of the impacts foremost influencing the sustainability grade within traditional or modern (natural and cultural) landscapes of the 21st century in general, protected sites such as UNESCO MAB Reserves or the regions` sustainably economic management capabilities (comp. Reinstädtler, 2012).

Figure 5. *Map with the exemplary in the Region of Lusatia derived and within the water network of Brandenburg placed parts of the Landscape Unit 1 of "Alluvial Fan Influenced Landscape with Wetland and Fließe Structures" of Spree Forest Inland Delta and exemplary determined SDGs (drawn by the author, changed on the basis of map of "GEOBasis-DE/BKG 2016" and "Land Brandenburg 2016", data license: dl-de/by-2-0 (www.govdata.de/dl-be/by-2-0), "www.mlul.brandenburg.de/lua/gis/gewnet25.zip", "Gewässernetz des Landes Brandenburg, 2016")*

The instrument of LU is now enabling to transform, implement and compare throughout diversified levels and scales of actions from the regional to the national planning, European or worldwide policy level in order to foster sustainable development and goals throughout coupled needs, measurements or strategies for planning and decision making features (comp. fig. 4, 5; comp. Reinstädtler, 2011; Reinstädtler, 2013). Within this processing the spatial planning instrument of the counter-current principle with a parallel bottom-up and top-down approach is essential.

3.3 Over bridging general insecurity factors and possible prediction instabilities in sustainable, climate-and water-related development paths

Insecurities of planning, managing and decision making for climate change and possible stronger desertification, flooding or landscape-water imbalanced situations should be buffered. In the same time the framework has to introduce one of the scientific outcomes: climate smart planning, its

adaptation (and partially mitigation, also comp. for climate smart landscapes Minang et al., 2015) and an integrated drought and water management (Reinstädtler, 2017). Therefore a type of modelling has been developed being able to connect interdisciplinary, integrative, needed multidimensional parameters within the modelling-matrix: the self-developed, cohesive conceptual CA(LU)²WA-framework (also comp. Niemeijer and de Groot 2008) and its transmitter of LUs (comp. later fig. 6) is concerned with the problem of how the dynamic changing nature of complex systems, including climate (with abrupt or accelerating changes), ecosystems, landscapes and water cycles, social, cultural systems or economies can be captured within its assessment and monitoring road map inclusively. Living in a highly dynamic world with many changes occurring simultaneously (Montanari et al. 2013, p. 1258), this research is suggesting and introducing this theoretical framework as one part of the strategic solution-finding for reaching better integrative planning for sustainable development and governance or management securities on landscape scale: the aim was to establish a regional adapter, but global transferor for SDG 11, 13 and smart climate adaptive (and partially mitigative) planning and for SDG 17, 15 and a landscape water balance (comp. fig. 5).

Acknowledged spatial planning conflicts or challenges were further integrated through for instance supporting a more intense anticipative, precautionary, long lasting to the extent of more than for a decade justified spatial planning (comp. Frommer et al., 2011). Also multiplicatory factors such as the uncertainty factors throughout climate change (comp. Wilby and Dessai, 2010, Reilly and Schimmelpfennig, 2000) and planning instruments or scarce obligation for administrative and proprietary instances (Frommer et al., 2011) were part of model development for LU-investigations. A better understanding of climate change and their risks (with its needs of diverse land use forms) as well as an understanding for corporative, ecologic and economic potentials or conditions for adaptation (research) were acquired (comp. BMUB, 2008a). Up to that knowledge deficits in sorts of sectoral (also versus interdisciplinary), but also spatial and regional correlated fields had to get detected. Strategies for enhancing planning or technical solutions had to be developed in form of measurements, methods and an overall integrating framework.

3.4 Transdisciplinarity of proper sustainability and land system sciences as well as of climate- and water-related planning aspects in sorts of data management

This proactive landscape meta-model is termed „Climate Adaptive Landscape Units and Land Use within Drought and Water Management" (CA(LU)²WA). The most important parts of the verbal-argumentative CA(LU)²WA-Landscape model were (I.) the state of landscape in change, (II.) the abiotic and (III.) biotic facts (in sorts of sustainability and resilience grade), (IV.) existing hazard-, vulnerability-, risk analyses, (V.) climate models (and in case other modules such as hydrological models) and (VI.) the scenario-module (comp. fig. 6).

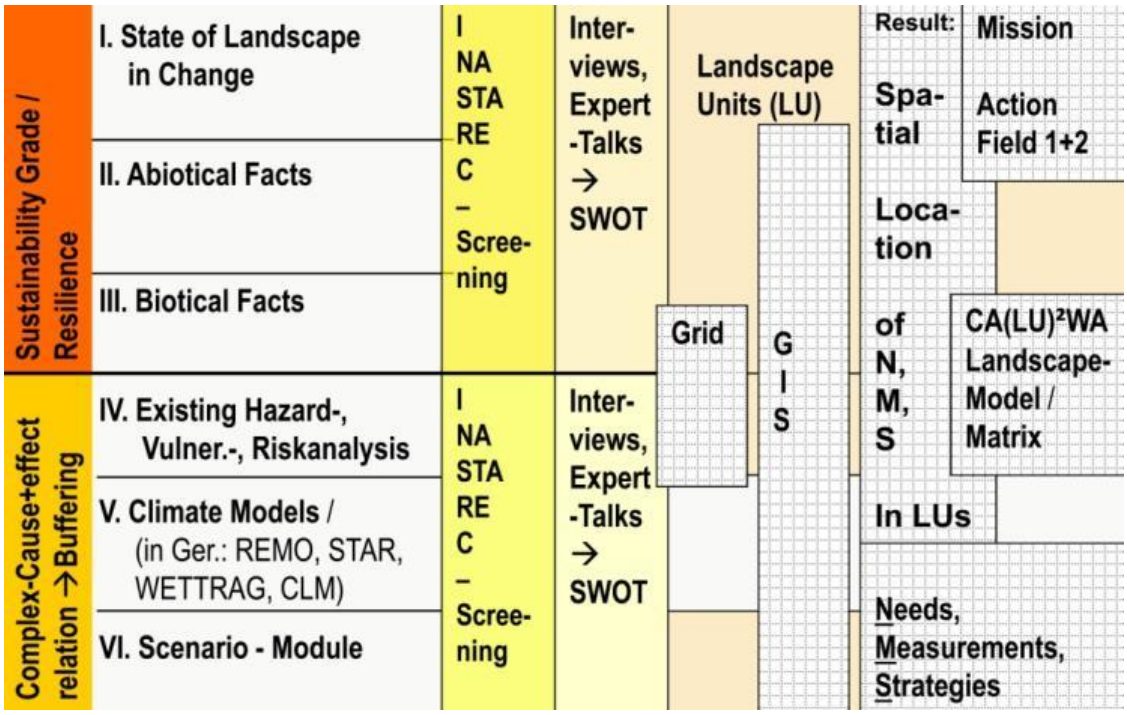

Figure 6. *Content, data-grid as well as methods within CA(LU)²WA-matrix and LUs (changed after Reinstädtler 2011, p. 62)*

Some of the main used primary data and partially combined secondary sources for feeding the grid of CA(LU)²WA-matrix were the „INASTAREC-Sustainability Screening“ as a pre-assessment phase, the interviews, expert-talks with its SWOT-matrix, being involved as a subsidiary member of the Nature Protection Council of the City of Cottbus, scientific presentations and discussions as well as the LUs themselves.

Up to that – and next to others – the German Adaptation Strategy (BMUB, 2008a) provides qualitative secondary data for part five of feeding the verbal-argumentative landscape model in form of giving advices for general, to Lusatia Region adaptable needs, measurements for climate change adaptation or potentially comparing evaluations of results of the four main for Germany existing regional models WETTREG, STAR, REMO, CLM (comp. BMUB, 2008a). From these ensemble-appraisals it is possible to derive fairly robust assertions in correlation to alteration corridors (BMUB, 2008b), which is most crucial for proper spatial, regional, environmental and landscape planning.

3.5 Governance, exchange and communication acceleration of planning results while applying on the ground.

It is about accessing a verbal-argumentative modelling framework from viewpoint of land systems, landscape, environmental and spatial evaluation or planning as well as of stakeholder integration and

information needs in order to reach an aligned road map or even a Decision-Support-System (DSS). How to integrate above named challenges and to develop a regional levelled, but on globally2 regions transferable framework for sustainable and responsible spatial development was reflected on through the lens of an integrated landscape management and assessment processing (comp. fig. 7).

Specifications in Lusatia inclusive Spree Forest Region, the pre-assessment of the on Lusatia Region oriented „INASTAREC-Sustainability Screening“ (comp. fig. 7, 6) or the indirect participating interviews and expert-talks as well as the spatial positioning of needs, measurements and strategies in the spatially determining, enclosing landscape units (LU) were helping in building up the framework (comp. fig. 6 and UNESCO, 2006, UNESCO, 2007). The within the model-processing adjusted methods and further instruments of DPSIR, sustainability screening (INASTAREC), SWOT-analyses and Climate Sensitive Regions (CSR, Stock, 2010; IPCC, 2001) (comp. fig. 7) were helping to balance these needs.

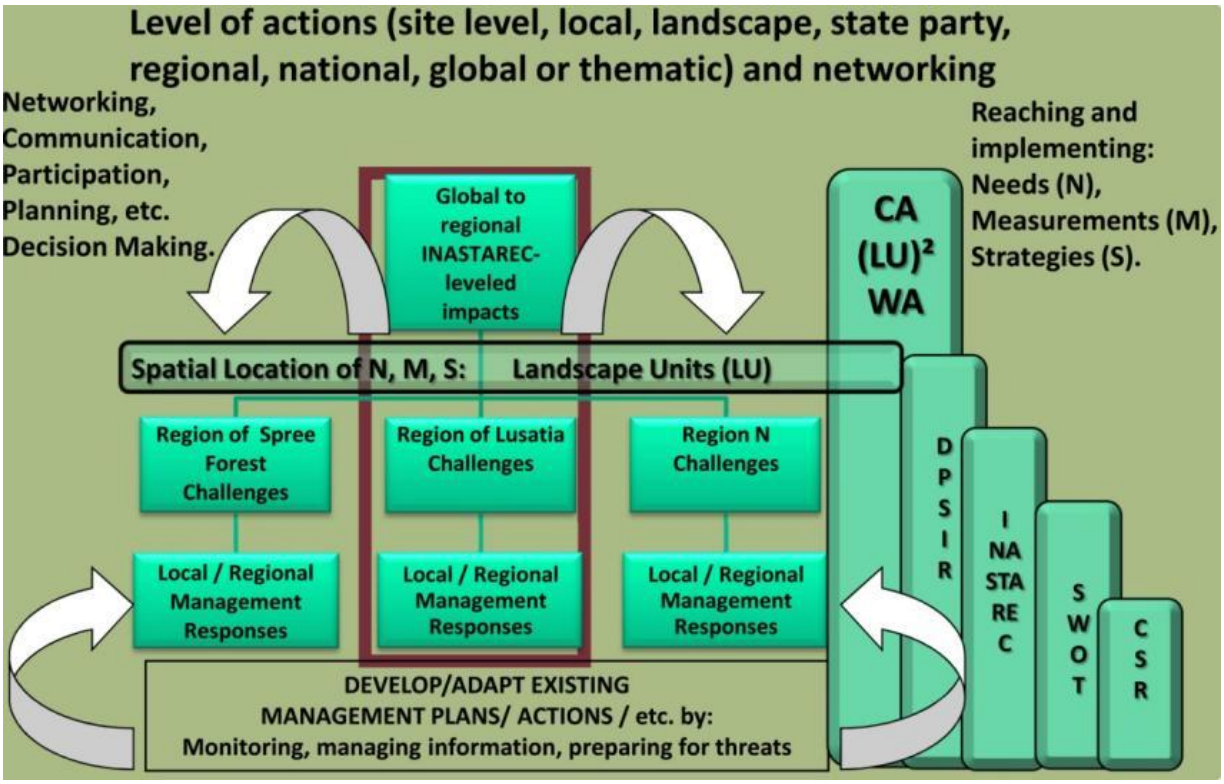

Figure 7. *Coordination of the needs in a region for networking, communication, qualitative and to the regions comparable assessing, planning and decision making and the spatial location of needs (N), measurements (M) and strategies (S) through CA(LU)²WA-matrix, its instruments (drawn and all detailed instruments derived by the author, after Reinstädtler, 2017; part. after UNESCO, 2006, UNESCO, 2007)*

[2] One example for the to be on global level for diverse, internationally located regions implemented mechanisms: the five key transmission mechanisms (UNDP, 2007, van Leeuwen et al., 2009, also comp. for food security Islam et al., 2017) had to be implemented conceptually in the assessment for the CA(LU)²WA and implemented LU processing frame.

Monitoring, managing information and preparing for threats have to stand on the local agenda (comp. fig. 7 and UNESCO, 2006; UNESCO, 2007; UNESCO and Colette, 2007). Such an agenda is supported through processes such as networking, communication (comp. Krätzig and Warren-Kretzschmar, 2014), participation, planning, decision making (comp. Mahmoud et al., 2009; Wilson and Mc Daniels, 2007; Willows and Connel, 2003) and are integrated in the CA(LU)²WA-Model (comp. fig. 7, 6).

4. Recommendations and Conclusions

This research implements the greater necessity and therefore recommendation of sustainability, but also integrative (landscape, land systems), cross-border and transformative (scale- and level-overarching) research. So one emphasized pillar and strategic outcome of using and implementing spatially SDGs as flagship-motivation on regional level and within the LUs was fulfilled. The pillar of communication and constructive cooperation between sectoral and integrative, holistic or transformative approaches is further a most important and integrated one. Bettering or in the best solving the challenges within climate and global change syndromes and in pressures of unsustainable land degradation and water management challenges is getting more controllable. The third main important pillar, which has to be strongly recommended, is the fact of the greater worldwide and regional specific to be applied need of the planners and geographers counter-current principle, which is already integrated in the German spatial planning system. The counter-current principle (combined bottom-up and top-down approach) will help in balancing the ongoing and needed transformative processes in between the different planning levels from regional to global and backwards. Facilitation and a better sustainable regional governance and management are being enabled in Spree Forest and Lusatia Region, but also in worldwide regions.

Restructuring capacities in field of spatial placement and provision within the LUs for reaching sustainable development and fulfilling the SDGs on regional level is shown by example in this case study. It is getting an option for planning instances or decision makers, next to other stakeholder.

This research work therefore is supporting the processes around acceleration and assessment of climate change-related as well as sustainable development and land resilience options in times of crises while enhancing interdisciplinary sustainability science.

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Theory home of different environmental and sustainability assessment methods

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Abstract

Sustainable development and sustainability are developing fields. Crucial is our ability to assess sustainability, or to assess our position in relation to the sustainability goals we want to achieve. For this indicators and indices of sustainable development and sustainability are important, as well as sustainability assessment methods, sometimes called "the toolbox" available to assess sustainability and sustainable development. This paper is an attempt to give an overview of how different assessment methods and a few indices are connected to different theory foundations. A first group of methods has an explicit strong connection to specific theories. In this paper exemplified by Cost-Benefit Analysis (CBA) and Position Analysis (PA), explicitly connected to the theories of the two main opposing paradigms in economy: CBA based on neoclassical economy and PA based on institutional economy. A second group do not have an explicit connection to theory, but is still strongly connected to what is often named the "standard theory" in natural science and engineering. Examples from this group are: Index of biotic integrity (IBI), Life cycle assessment (LCA), Material flow analysis or accounting (MFA), Substance flow analysis (SFA), Environmental risk assessment (ERA), Material intensity per service unit (MIPS), etc. A third group can be considered as almost, but to a small extent not yet fully accepted by the "standard theory". The closest one among these in this paper is exergy analysis, which is not fully based on the theory of thermodynamic equilibrium, as the previous mentioned second group methods. Eco-exergy analysis, still in a developing phase, is located even further out on this branch. Emergy analysis is also based on the "standard theory" but is also a cross-over with general systems theory, and includes a new novel approach to non-equilibrium thermodynamics. A fourth group is suggested for Ecological footprints where the conversion from kg and joules to hectares (ha) is within the "standard theory", but not the next step where the hectare is converted to the imaginary unit global hectares (gha). This can be said also about the conversion in emergy analysis from joules to solar equivalent joules (sej), but that conversion has a more strong theoretical underpinning than the conversion leading to the global hectare. Two other footprint methods, Carbon footprints (CF) and Water Footprints (WF) connects more clearly to the second group since they do not take the step to global hectares. A fifth group is made up indices, in this paper represented by the Human development index (HDI) and the Happy planet index (HPI). As a conglomerate of indicators that have no clear theoretical connection, they are considered having a weak connection to theory. The paper concludes

that sustainable development and sustainability are such a diverse field that any outcome of "data" whether directly measurable or generated by indices or methods are interesting and needed. However, in their interpretation, a level of knowledge about their connection to theory is important to include.

Keywords: Sustainability theory, sustainable development theory

1. Introduction

Sustainable development and sustainability are developing fields in science. Crucial in this development is our ability to assess sustainability, or to assess our position in relation to the sustainability goals we want to achieve. For this indicators and indices of sustainable development and sustainability are important, as well as sustainability assessment methods, sometimes called "the toolbox" available to assess sustainability and sustainable development. There is no strict border between indicators and assessment methods, rather it can be described as a circular continuum from indicators, indicators in frameworks, indices, assessment methods, and indicators and indices produced by assessment methods. Methods are often connected to specific sets of theory in a way that indicators are not. However, indicators often do not stand free from different discourses: predominant views and ways of talking about the subject.

This paper is an attempt to give an overview of how different assessment methods and a few indices are connected to different theory foundations.

2. Methods

A set of popular assessment method and indices for sustainability or sustainable development were picked. Different patterns of organization with regard to theory connection were identified and categorized as Strong (S), Weak (W) or Uncertain (U) connection to theory. The outcome is presented in Table 1.

3. Results

Below follows a short description of selected sustainability and sustainable development methods and indices. In section 3.16 they are categorized according to Strong (S), Weak (W) or Uncertain (U) connection to theory.

3.1. Cost-benefit analysis (CBA)

Cost-benefit analysis (CBA) is an economic assessment method clearly founded in the theory of neoclassical economics (Grönlund, 2019). It has a scope that is broad with an aim of expressing all aspects in a common unit, money. The relevant costs and benefits are identified, and in a perfect

neoclassical economy world, a world of perfect markets, "…costs and benefits would indicate to any decision maker every relevant information for economic welfare" (Wriesberg et al. 2002). Economic, environmental, and social aspects or elements are all expressed in monetary values. As far as values are available and depending on the level of detail. Where no functioning market mechanism are in place, they are estimated with various methods such as contingent markets, travel costs, replacement costs etc. The costs and benefits are summed up and compared for the examined alternatives. Cost-effectiveness analysis is a type of CBA where the benefits are set as constant, similar to a functional unit in LCA

3.2. Positional analysis (PA)

Positional analysis (PA) was developed in the 1980s-1990s by the institutional economist Peter Söderbaum (Söderbaum 2017, 2020; Brown 2017). It is founded in the diverse theories of institutional economics.

PA has its focus on decision support (Ingemarsson and Karlsson, 2002). The method itself does not point out the criteria for decisions, nor its components. Rather the decision outcome lies in the hands of the decision-makers, and is based on a participatory approach. "Positional analysis is democratic, flexible and participatory, and can include monetary and non-market aspects and approaches" (Ingemarsson and Karlsson, 2002). PA form available and relevant information in a systematic decision framework, enabling relevant comparisons easy. In addition e.g. the irreversible effects of sustainable land-use decisions can be included in a more clear way than e.g. CBA (Ingemarsson and Karlsson, 2002).

3.3. Life cycle assessment (LCA)

Life cycle assessment (LCA) aims to assess different environmental impacts during a product's lifetime, for which it produces an inventory of environmental aspects based on mass and energy balances. These environmental aspects are then categorized in impact categories, such as global warming potential, acidification, eutrophication, ecotoxicity, ozone depletion, depletion of resources, landscape degradation, etc. These categories can be normalized and weighted against each other for a final decision support of which choice is the best from an environmental point of view (Grönlund, 2019).

3.4. Material Flow Accounting (MFA)

Material Flow Accounting (MFA) is based on the law of conservation of mass: what goes in must also come out (except for the extreme rare events in the biosphere when mass is converted to energy in nuclear reactions like radioactive decay). MFA tracks the so-called fate of the material entering an economy, a nation, region, community, company or household. For countries the material flows are presented at e.g. the website www.materialflows.net, hosted by Vienna University of Economics and Business. The results from an MFA can be used for prioritization of policy measures, to increase resource efficiency, to secure a sustainable supply of material, or to optimize waste management

(Wriesberg et al., 2002). MFAs can have a scope of cradle-to-grave similar to LCA, or be restricted to regional activities.

3.5. SFA

Substance Flow Analysis (SFA) is, as MFA, based on the law of conservation of mass, but have a focus of single substances instead of larger or the total material flows. Often the environmental effects are in focus, and often in connection to cause-effect modelling (Wriesberg et al., 2002). The results can be the basis for an environmental risk assessment (ERA). As with MFA, fate modelling is a common approach.

3.6. Material Input per Unit of Service (MIPS)

Material Input per Unit of Service (MIPS) is an extension of MFA or SFA, where the material flow is connected to the service performed by the activity. Typically, MIPS can be used to make a production more effective, and also to achieve what is called "de-materialization", where the same benefit is achieved with less material use, and therefore less environmental impact. MIPS can be used at all the levels of products, companies, nations, regions (Schmidt-Bleek 1994).

3.7. Environmental Risk Assessment (ERA)

Environmental Risk Assessment (ERA) examines the risk that threatens humans, ecosystems and society related to technology, processes or substances in either a qualitative or a quantitative way (Wrisberg et al., 2002). ERA has a wide variation in application and scope. ERA can be divided into Health Risk Assessment (HRA) and Ecological Risk Assessment (EcoRA). The most obvious difference between them is that EcoRA deals, in principle, with millions of species rather than only one (man). The risk assessment are normally composed of the following steps: hazard identification, effects assessment, and exposure assessment (Wriesberg et al., 2002).

3.8. Ecological footprints (EF)

Ecological footprints (EF) is a consumption based measure that aims to capture how much resources a person use, in comparison with what is available in the biosphere, called the biocapacity (Wackernagel and Rees, 1995). The method collect data of consumption and then converts is to the land area (in hectares) needed for that production, and sequestration of the waste produced. Six land area categories are used (one of them water area): cropland, grazing land, forest land, fishing area, carbon land, built-up land. The carbon land is the virtual land that would be needed to sequester the fossil carbon emissions. In a nation, real hectares are used for the different types, but to be able to compare the six categories within that country a normalization calculation is performed, that give them values diverting from the real area. In a next step, the areas are normalized in relation to global areas, and then the unit is changed to global hectares (gha). The same procedure is done for the biocapacity calculation. The footprint divided by the available biocapacity then produce the unusual unit "number of planet Earths", which is a measure of how many planets' biocapacity we would need to cover our current consumption.

3.9. Carbon footprints (CF)

The carbon footprint (CF) measures how much carbon dioxide is discharged over the life cycle of products or other activities. It includes also the other gases of significant importance to the global warming problem, and therefore its unit is carbon dioxide equivalents (Fang et al., 2014). CF is used as a basis for calculating carbon offsets. CF is often measured from a life cycle perspective, and is part of several LCA softwares.

3.10. Water footprints (WF)

The water footprint (WF) includes all the freshwater that was used to produce a product or a service. This is called the virtual water of that product or service (Allan, 1998; Hoekstra, 2009).

The real, directly measurable water content of a product, is often much less than the virtual freshwater used up earlier in the production chain. The water footprint is in that way similar to the concept of embodied energy, and can also be called “embodied water” (Fang et al., 2014).

3.11. Exergy analysis (ExA)

Exergy analysis (ExA) has its focus on the quality aspect of energy flows and storage. Exergy is the part of the energy that can perform work in a system. The weakness of ExA is that its focus is only on the efficiency of processes; the step-wise consumption of the energy quality, which is what exergy measures (Grönlund, 2019).

3.12. Emergy analysis (EmA)

Emergy analysis (EmA) has a holistic approach with its basis in systems science and thermodynamics (Grönlund, 2019). The method has gained interest since it includes energy and material flows, but also economic flows within the same theoretical framework (Odum, 1996). Another feature of emergy analysis is its ability to relate the results to the baseline of annual renewable flows in the full biosphere (similar to how the Ecological footprint compares the annual baseline of global biocapacity to produce the “number of planet Earths” mentioned above. The method emphasizes the organization of the system studied (the system properties), and always connect the chosen level of scale to other important scales in time and space.

3.13. Index of Biotic Integrity (IBI)

Index of Biotic Integrity (IBI) is a method developed to evaluate ecosystem health or ecosystem integrity (Ekbladh and Strid Eriksson, 2002). In principle the method produce an inventory of the species present in an ecosystem connected to a specific state of ecosystem health or integrity. After collecting a significant number of correlations of this type, diagrams can be produced. This allows sorting out index species and index organism communities, which are used in the assessment of new

systems. Examples of organism communities are diatoms for running water, evertebrates for lakes, fish macrophytes.

3.14. Human development index (HDI)

The Human development index (HDI) is a tool that measures the social well-being of countries around the world, and is composed of three dimensions: Health, Education, and Living standards. To assess these dimensions four indicators are used: life expectancy at birth for Health, mean years of schooling and expected years of schooling for Education, and gross national income per capita for Living standards. The outcome is used to rate the relative development of a country. It is meant to go beyond the gross domestic product (GDP) as a tool for measuring the development of a country. In 2010 a new version was introduced with an added inequality factor, forming the Inequality-adjusted Human Development Index (IHDI).

3.15. Happy planet index (HPI)

The Happy Planet Index (HPI) is an index that combines human well-being and environmental impact. The HPI of a country is a function of its average subjective life satisfaction times its life expectancy at birth, divided by the ecological footprint per capita. This gives an index that is weighted to give higher scores to nations with high socio-economic sustainability and low ecological footprints. Also HPI has included an inequality factor in recent versions.

3.16. Analysis

In Table 1 the methods and indices mentioned above are organized in a matrix according to connection to theory of some kind. The categories are Strong (S), Weak (W) or Uncertain (U) connection to theory.

A pattern of three categories can be distinguished: 1) S only, 2) S and U, 3) W and U

A group within the “S only” category is standing out with the comment “Natural science ‘standard theory’ ”. A difference in the “W and U” category is that Ecological footprints is a method and HDI and HPI are indices.

4. Discussion

When the methods and indices in part 3 are compared from a theory perspective in Table 1, a pattern emerges of tree or five categories or groups.

In the first category, “S only”, several methods stands out with the comment “Natural science ‘standard theory’ ”. In natural science papers there are rarely any theory section. This, since there is a “standard theory”, that almost everybody agrees upon. Only when diverting from this a theory chapter is needed, as for exergy, emergy or eco-exergy, clarified below. In social science, on the contrary, there are often stronger disagreements on theory, and so called different schools of thought emerges. These are necessary to present and establish explicitly to make the conclusions logical and showing their limits.

Table 1. *Methods and indices organized according to connection to theory of some kind. The categories are Strong (S), Weak (W) or Uncertain (U) connection to theory.*

	Strong connection	Weak connection	Uncertain connection	Comment
Cost-benefit analysis (CBA)	S			Neoclassical economy
Position analysis	S			Institutional economy
Emergy analysis	S			Extended natural science "standard theory". Systems science, thermodynamics, systems ecology
Index of biotic integrity (IBI)	S			Natural science "standard theory"
Material flow analysis or accounting (MFA)	S			Natural science "standard theory"
Substance flow analysis (SFA)	S			Natural science "standard theory"
Life cycle assessment (LCA)	S			Natural science "standard theory" – connection to "standard" environmental science
Environmental risk assessment (ERA)	S			Natural science "standard theory"
Material intensity per service unit (MIPS)	S			Natural science "standard theory"
Exergy analysis	S		U	Almost natural science "standard theory"
Eco-exergy analysis	S		U	Extended natural science "standard theory"
Ecological footprints		W	U	
Carbon footprints	S			
Water footprints	S			
Human development index (HDI)		W	U	
Happy planet index (HPI)		W	U	

So, with the first category, "S only", divided into two groups, and also the "W and U" category divided into a method and two indices, we end up with five different groups, discussed below.

A general conclusion from the investigation is, however, that sustainable development and sustainability are such a diverse field that any outcome of "data" whether directly measurable or generated by indices or methods are interesting and needed. However, in their interpretation, a level of knowledge about their connection to theory is important to include.

4.1. Methods with explicit strong connection to specific theories.

A first group of methods has an explicit strong connection to specific theories. In this paper they are exemplified by Cost-benefit analysis (CBA) and Positional analysis (PA), which are explicitly connected to the theories of the two main opposing paradigms in economy: CBA based on neoclassical economy and Position analysis based on institutional economy.

CBA stemss, and are embedded in the theory currently dominating economy: neoclassical economy ("market economy theory"). It must be noted, though, that in its application in real cases CBAs are not always standing on "hard-core" neoclassical data. This since no nation's economy in the world currently fully use neoclassical economy based monetary values. Instead, each country to some extent use regulations and incentives, not fully according to the neoclassical economy fundamentals. It is, however, fair to say that the CBA stems from and are strongly connected to the neoclassical economy theory.

PA stems from, and stands on the theories in institutional economy. It must be pointed out, though, that institutional economy is a multi-faceted field, which do not have one clear theory framework comparable to neoclassical economy. Rather PA is often mentioned in the context of multicriteria analysis, where a mosaic of different pieces with different origins forms the field. This is also underlined by the connection to ecological economics, which is a field also characterized by a mosaic of different theories and underpinnings.

4.2. Methods with strong connection to the less explicit natural science "standard theory"

A second group have a more "hidden" connection to theory, but are still strongly connected to one theory. It is the large group of assessment methods connected to what is considered the "standard theory" in natural science and engineering. Compared to social science, natural science is to a much larger extent characterized by a series of "natural laws" that forms a common basis for many fields, as physics, astronomy, chemistry, geology, biology, geography, ecology, meteorology etc. Methods that are based upon this 'standard theory' in Table 1 are IBI (from biology and ecology), MFA, SFA, and MIPS from physics and chemistry, ERA from physics, chemistry and biology, LCA from physics, chemistry and environmental science. As said above, this is the reason why there are almost always no theory section in the natural science based papers, since almost everybody agrees upon "standard theory", and that that "standard theory" is known to everybody. Only when diverting from this a theory chapter is needed, as we will see below for some methods.

Carbon footprints and Water footprints from Table 1 also belong to this group, and are well founded in the natural science "standard theory", but will be discussed under section 4.4 below, together with the Ecological footprint method.

4.3. Methods to some extent not yet fully accepted by "the standard theory"

A third group can be considered as almost, but to some extent not yet fully accepted by the "standard theory". The closest one among these in this paper is exergy analysis, which is not fully based on the theory of thermodynamic equilibrium, as the previous mentioned second group methods. Eco-exergy analysis, still in a developing phase, is located even further out on this branch. Emergy analysis is also based on the "standard theory" but crosses over with general systems theory (from Systems science), and a new novel approach to non-equilibrium thermodynamics.

The exergy concept has only a slight diversion from the "standard theory". As shown by e.g. Giannantoni (2002) the theory "package" behind the exergy concept – the four laws of thermodynamics – are only fully valid under so called "thermodynamic equilibrium". What characterizes systems that contains life is, however, that they are far from "thermodynamic equilibrium" (one main property of all living organisms is to stay away from "thermodynamic equilibrium"). Therefore, thermodynamic calculations are in theory performed by a comparison with standard conditions. The exergy concept deviates from this by instead comparing with the real condition. The difference in technical systems are often very small so it does not matter much. However, it does not fit fully with the thermodynamic theory "package", so physicist therefore prefer the concept entropy, which is within the borders of thermodynamic theory, instead of exergy, that to some small parts are slightly outside the theory border. One of the more famous attempts to address this theory problem is the theory of dissipative systems, developed by the 1977 Nobel laureate Ilya Prigogine, which is often described as close to equilibrium thermodynamics.

The emergy concept address the above-mentioned "thermodynamic equilibrium" problem, but with a very different starting point. Its originator, H.T. Odum, realized that the four basic thermodynamic laws had limitations in their use, when he tried to describe living ecosystem (most prominent the Silver Springs investigation in the 1950s). Starting instead from a systems science approach of how energy flows were connected and interacting, he came up with another solution. Emergy can be seen as a property of any system (most of them far from thermodynamic equilibrium). For most technical systems the difference between an energy analysis and an emergy analysis is small, but for systems including life or complex technical systems, the difference becomes significant. Some investigators use energy values as basis for the emergy calculations, while others use exergy values.

The eco-exergy concept, recently developed by S.E. Jørgensen, S.N. Nielsen and co-workers address the "thermodynamic equilibrium" problem with a solution closer to thermodynamics. It diverts less from the four-law thermodynamics than the emergy approach when using the exergy value as a starting point. However, in its approach to the far from equlibrium challenge, it uses a completely different additional factor, when using the relative differences in length of the genome in different organism

groups. This includes the “life” factor to the calculation, but not in a way that connects in theory to thermodynamics.

4.4. Methods with a weaker connection to theory

A fourth group is suggested for Ecological footprints (EF). In its basis EF uses theoretically solid units as kg, J, and hectares (ha). The unclear parts are introduced when the hectares are converted to the unit unique for the method: global hectares (gha). The method description for EF is clear and transparent, it is rather the theoretical basis for the conversion to gha that yet lacks connection and validation from other theories. This is probably one reason to the fast increase in the use of Carbon footprints (CF) in recent years. CF stops the footprint calculation at carbon dioxide equivalents, which has a strong acceptance within the natural science “standard theory” mentioned in section 4.1. Water footprints (WF) has a similar position, as long as it stops at the volume units: m^3 or km^3. This is the reason why CF and WF are included in the second group above (4.2): that they do not take the step to global hectares.

Both Emergy analysis (EmA) and Eco-exergy analysis have parts that are not yet widely accepted in the scientific community, as discussed under section 4.3. For emergy analysis the argument can also be lifted that part of it yet lacks connection and validation from other theories. However, the conversion in emergy analysis from joules (J) to solar equivalent joules (sej), has a more strong theoretical underpinning than the conversion leading to the global hectare.

4.5. Indices, with a weaker connection to theory

A fifth group is made up indices, in this paper represented by the Human development index (HDI) and the Happy planet index (HPI). As an amalgam of indicators that have no clear theoretical connection they are considered having a weak connection to theory.

Bell and Morse (2018), after pointing out that there are no fully consensus definition of sustainability indicators (SI), define SI as encompassing indices ("amalgams of indicators"). SI do not necessary have a theoretical home, but still they are used by different groups as arguments in a larger context, and can also be calculated in different ways. Bell and Morse (2018) give a reflective example of four different ways of presenting GDP numbers.

4.6. Categorization possible?

In the introduction, it was said that there is no strict border between indicators and assessment methods; rather it can be described as a circular continuum from indicators, indicators in frameworks, indices, assessment methods, and indicators and indices produced by assessment methods. This paper covered 13 methods and 2 indices. At least one method was difficult to distinguish from the two indices: carbon footprint. And it must of course be noted that the Happy Planet Index (HPI) includes the method Ecological footprints (EF).

4.7. Environmental science and the C.P. Snow gap

The theory discussion is important for e.g. the scientific branch Environmental Science. Grönlund (manuscript) suggested that Environmental science has a larger context and an inner core, see Figure 1.

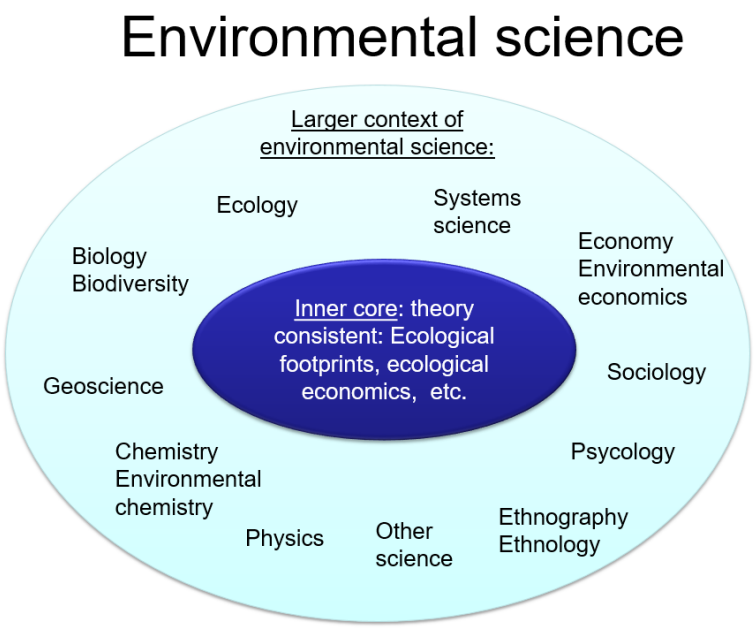

Figure 1. *The scientific branch of Environmental Science, divided into a larger context with acceptance of major theory collisions, and an inner core where more consistent theory is developing (Grönlund, manuscript).*

In the larger context any scientific theory from any other scientific branch is relevant, and neoclassical based environmental economic results can be used together with ecology theory results to explain and give context to individual investigations. This despite that neoclassical economy theory and ecology theory in important parts are very contradictory (notably regarding limits), and is one of the often launched examples of the C.P. Snow gap (Snow, 1959), describing the "two cultures" in science with major difficulties communicating with each other. In the inner core of Figure 1 theory is developing that is consistent with both sides of the C.P. Snow gap. Such theory development has yet not come very far. The example of EF given, is above considered as a weak theory. Also ecological economics, mentioned above in connection to PA, does not yet have a consistent theoretical framework, but is a mosaic of different theory foundations, but with an explicit aim of including both the ecology and economy science sides. Worth mentioning in this context can be that Systems science seem to be one of the few scientific branches accepted and used by both sides of the C.P. Snow gap.

In this context it is also worth a thought that the great ecology pioneer, E.P. Odum (the older, and more famous, brother of above mentioned H.T. Odum), author of the dominating ecology textbook during the 1950s and 60s (no one else dared to write a textbook in the field for 17 years!) "Fundamentals of ecology" (Odum 1953, 1959), renamed the third edition of his last textbook from "Ecology and our endangered life-supporting systems" to "Ecology : a bridge between science and society" (Odum, 1997).

5. Conclusions

This paper is an attempt to give an overview of how different assessment methods and a few indices are connected to different theory foundations.

A first group of methods has an explicit strong connection to specific theories. In this paper exemplified by Cost-Benefit Analysis (CBA) and Position Analysis (PA), explicitly connected to the theories of the two main opposing paradigms in economy: CBA based on neoclassical economy and PA based on institutional economy.

A second group do not have an explicit connection to theory, but is still strongly connected to what is often named the "standard theory" in natural science and engineering. Examples from this group are: Index of biotic integrity (IBI), Life cycle assessment (LCA), Material flow analysis or accounting (MFA), Substance flow analysis (SFA), Environmental risk assessment (ERA), Material intensity per service unit (MIPS), etc.

A third group can be considered as almost, but to a small extent not yet fully accepted by the "standard theory". The closest one among these in this paper is exergy analysis, which is not fully based on the theory of thermodynamic equilibrium, as the previous mentioned second group methods. Eco-exergy analysis, still in a developing phase, is located even further out on this branch. Emergy analysis is also based on the "standard theory" but is also a cross-over with general systems theory, and a new novel approach to non-equilibrium thermodynamics.

A fourth group is suggested for Ecological footprints where the conversion from kg and joules to hectares (ha) is within the "standard theory", but not the next step where the hectare is converted to the imaginary unit global hectares (gha). This can be said also about the conversion in emergy analysis from joules to solar equivalent joules (sej), but that conversion has a more strong theoretical underpinning than the conversion leading to the global hectare.

Two other footprint methods, Carbon footprints (CF) and Water Footprints (WF) connects more clearly to the second group since they do not take the step to global hectares.

A fifth group is made up indices, in this paper represented by the Human development index (HDI) and the Happy planet index (HPI). As a conglomerate of indicators that have no clear theoretical connection, they are considered having a weak connection to theory.

Sustainable development and sustainability are such a diverse field that any outcome of "data" whether directly measurable or generated by indices or methods are interesting and needed. However, in their interpretation, a level of knowledge about their connection to theory is important to include.

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Posters

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Theory home of different environmental and sustainability assessment methods

Introduction

Sustainable development and sustainability are developing fields. Crucial is our ability to assess sustain-ability, or to assess our position in relation to the sustainability goals we want to achieve. For this indicators and indices of sustainable development and sustainability are important, as well as sustainability assessment methods, sometimes called “the toolbox” available to assess sustainability and sustainable development. This paper is an attempt to give an overview of how different assessment methods and a few indices are connected to different theory foundations.

Results

Five cathegories were idenfied in the investigation:

1. Methods with an explicit strong connection to specific theories. In this paper exemplified by Cost-Benefit Analysis (CBA) and Positional Analysis (PA), explicitly connected to the theories of the two main opposing paradigms in economy: CBA based on neoclassical economy and PA based on institutional economy.
2. Methods which do not have an explicit connection to theory, but is still strongly connected to what is often named the “standard theory” in natural science and engineering. Examples from this group are: Index of biotic integrity (IBI), Life cycle assessment (LCA), Material flow analysis or accounting (MFA), Substance flow analysis (SFA), Environmental risk assessment (ERA), Material intensity per service unit (MIPS), etc.
3. Methods that can be considered as almost, but to a small extent not yet fully accepted by the “standard theory”. The closest one among these in this paper is exergy analysis, which is not fully based on the theory of thermodynamic equilibrium, as the previous mentioned second group methods. Eco-exergy analysis, still in a developing phase, is located even further out on this branch. Emergy analysis is also based on the “standard theory” but is also a cross-over with general systems theory, and includes a new novel approach to non-equilibrium thermodynamics.
4. Methods to a larger extent not yet fully accepted by the “standard theory”. The main example in this investigation is Ecological footprints where the conversion from kg and joules to hectares (ha) is within the “standard theory”, but not the next step where the hectare is converted to the imaginary unit global hectares (gha). This can be said also about the conversion in emergy analysis from joules to solar equivalent joules (sej), but that conversion has a more strong theoretical underpinning than the conversion leading to the global hectare. Two other footprint methods, Carbon footprints (CF) and Water Footprints (WF) connects more clearly to the second group since they do not take the step to global hectares.
5. Indices, in this paper represented by the Human development index (HDI) and the Happy planet index (HPI). As a conglomerate of indicators that have no clear theoretical connection, they are considered having a weak connection to theory.

The paper concludes that sustainable development and sustainability are such a diverse field that any outcome of “data” whether directly measurable or generated by indices or methods are interesting and needed. However, in their interpretation, a level of knowledge about their connection to theory is important to include.

Method or index \ connection	Strong	Weak	Uncertain	Comment
Cost-benefit analysis (CBA)	S			Neoclassical economy
Positional analysis	S			Institutional economy
Emergy analysis	S			Extended natural science “standard theory”. Systems science, thermodynamics, systems ecology
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Material flow accounting (MFA)	S			Natural science “standard theory”
Substance flow analysis (SFA)	S			Natural science “standard theory”
Life cycle assessment (LCA)	S			Natural science “standard theory” – connection to “standard” environmental science
Environmental risk assessment (ERA)	S			Natural science “standard theory”
Material intensity per service unit (MIPS)	S			Natural science “standard theory”
Exergy analysis	S		U	Almost natural science “standard theory”
Eco-exergy analysis	S		U	Extended natural science “standard theory”
Ecological footprints		W	U	
Carbon footprints	S			
Water footprints	S			
Human development index (HDI)		W	U	
Happy planet index (HPI)		W	U	

Discussion

Is categorization possible? There is no strict border between indicators and assessment methods; rather it can be described as a circular continuum from indicators, indicators in frameworks, indices, assessment methods, and indicators and indices produced by assessment methods. This paper covered 13 methods and 2 indices. At least one method was difficult to distinguish from the two indices: carbon footprint. And it must of course be noted that the Happy Planet Index (HPI) includes the method Ecological footprints (EF).

The theory discussion is important for e.g. the scientific branch Environmental Science. Figure 1 suggests that Environmental science has a larger context and an inner core. In the larger context any scientific theory from any other scientific branch is relevant, and neoclassical based, environmental economic results, can be used together with ecology theory results to explain and give context to individual investigations. This despite that neoclassical economy theory and ecology theory in important parts are very contradictory (notably regarding limits), and is one of the often launched examples of the C.P. Snow gap (Snow, 1959), describing the “two cultures” in science with major difficulties communicating with each other. In the inner core of Figure 1 theory is developing that is consistent with both sides of the C.P. Snow gap. Such theory development has yet not come very far. The example of EF given, is above considered as partly based on weak theory. Also ecological economics, mentioned above in connection to PA, does not yet have a consistent theoretical framework, but is a mosaic of different theory foundations, but with an explicit aim of including both the ecology and economy science sides. Worth mentioning in this context can be that Systems science seem to be one of the few scientific branches accepted and used by both sides of the C.P. Snow gap. In this context it is also worth a thought that the great ecology pioneer E.P. Odum, author of the dominating ecology textbook during the 1950s and 60s (no one else dared to write a textbook in the field for 17 years!) “Fundamentals of ecology” (Odum 1953, 1959), renamed the third edition of his last textbook from “Ecology and our endangered life-supporting systems” to “Ecology : a bridge between science and society” (Odum, 1997).

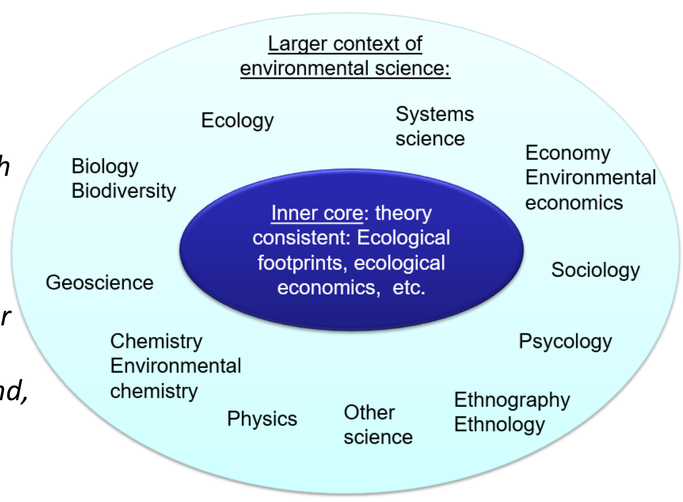

Figure 1. *The scientific branch of Environmental Science, divided into a larger context with acceptance of major theory collisions, and an inner core where more consistent theory is developing (Grönlund, manuscript).*

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1. Sustainability and Science

1b. Research methods and methodologies

Abstracts

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Closing the loop on Transdisciplinary Research: Reflections of the project team

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Abstract

Abstract

There is growing use of transdisciplinary research, to attempt to solve complex issues, particularly when seeking to find solutions to sustainability challenges. Transdisciplinary research is designed to bring academics and non-academics together and to connect different academic disciplines to improve the value, inclusiveness and quality of research. Ramchandani (2017), when explaining transdisciplinary research, discusses the "*emergence of a new discipline **transcending** the boundaries of disciplinary perspective."* In this paper we utilised a transdisciplinary research project (ECPE), in its final stages, and asked the project team to reflect back on their experience of participating in transdisciplinary research. The research draws upon interviews undertaken with academics who participated in the project, including individuals who had and others who had not previously participated in transdisciplinary research. The participants were from a range of academic disciplines. This research aimed to 'close the loop' on the project, to harness feedback from those engaged in the project, to understand the opportunities and challenges of transdisciplinary research, from individual perspectives. The findings of this research offer knowledge and learning for future transdisciplinary projects, linked to each stage of a projects lifecycle. To further 'close the loop' we interviewed the non-academic participants (partners), from both the public and private sector, (who contributed to the design of the research) to gain insight into their experience of transdisciplinary research.

Key themes emerged through the research, in particular the importance of *language* when individuals were working with academic departments beyond their current discipline. Collaboration, compromise and communication were prominent themes in the research findings. This is echoed by Witjes and Vermeulen (2020), "*therefore collaboration between academic actors from different disciplinary backgrounds is key for the success of transdisciplinary*." Transdisciplinary research has gained traction; this research provides an insight into the experience of the project team and thus provides a foundation to consider how the challenges experienced by individuals can be transformed into organisational strengths for the future.

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The stock price reaction to environmental pollution events: A systematic literature review and a research agenda

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Abstract

Accounting for the increasing academic interest in examining the stock price reaction to environmental pollution events, this systematic literature review covers 38 stock-based event studies from 1990 – 2020. Therefore, we systemize the field and conclude that the extant literature can comprehensively be attributed to 4 research panels: pollution disclosures, environmental violation, legal penalty, and law enforcement disclosures, environmental disaster disclosures, and multi-facetted disclosures. In a first step, following this defined structure, we review the empirical findings of the extant literature which, unsurprisingly, provides a homogeneous picture regarding the stock price reaction to environmental pollution events irrespective of the research sample. In a second step, we review the underlying theoretical frameworks and outline how researchers motivate their hypotheses. In a third step, we review the characteristics of the event study methods employed following 7 pre-defined criteria. We then use these 3 distinct reviews to identify limitations and to derive recommendations. In total, we derive 4 research, 2 theoretical, and 7 methodological limitations and provide consecutive recommendations that help to advance this field and to improve future research.

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A systems model of SDG target influence on the 2030 Agenda for Sustainable Development

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Abstract

Achieving the Sustainable Development Goals (SDGs) by 2030 requires assessing interactions, monitoring progress, and designing policy from a systems perspective. Efforts towards achieving a goal or target can often create synergies and thus leverage progress towards achieving others (Sachs et al. 2019). Hurdles also emerge given trade-offs among social, economic, and environmental aspects in persisting development paths. Past research has explored interactions among SDGs using quantitative approaches (Kroll, Warchold, & Pradhan, 2019; Lusseau & Mancini, 2019; Pedercini, Arquitt, Collste, & Herren, 2019; Pradhan et al., 2017; Zhou & Moinuddin, 2017), qualitative frameworks (Nilsson et al., 2016; Sachs, Schmidt-Traub, Mazzucato, et al., 2019), and expert knowledge (e.g. Fuso Nerini et al., 2019). However, mixed-methods that go beyond first order interactions and consider feedback processes are lacking.

We create a SDG systems model by combining a correlation analysis of SDG indicator data with literature research and expert knowledge. The influence of targets and goals on the overall objective of achieving the SDGs is assessed. Overall, we find more levers than hurdles, with SDGs 3 (*Good Health and Well-being*), 5 (*Gender Equality*), and 17 (*Partnerships for the Goals*) showing the most leverage potential while SDGs 10 (*Reduced Inequalities*) and 16 (*Peace, Justice and Strong Institutions*) are shown to create potential hurdles. However, influence at target level varies greatly within each goal, with the top three leveraging targets (5.5, 17.8, 17.6) and hurdle targets (16.8, 10.6, 15.5) representing five different goals. By conducting a sensitivity analysis to assess the dependency of findings on SDG target weights in the model, we find that the results are robust regarding this specification. Likewise, a regional analysis of continents and income groups shows that the SDG levers and hurdles are globally representative. At continent level, only Africa contributes less to SDG hurdles, indicating fewer trade-offs in relation to SDG progress.

The novel SDG systems model contributes several key findings. First, we use a data-driven approach to go beyond second-order effects of SDG interactions (Weitz et al., 2018) and capture complex feedback loops. Model results vary from the correlation analysis, with only SDGs 10 and 16 identified as potentially acting as systemic hurdles in both cases. Second, we show that most countries share both challenges and opportunities for achieving the 2030 agenda, with relatively low variation among continents and income groups. Third, our results highlight the crucial role of gender equality [SDG 5] and international cooperation [SDG 17] for achieving *a sustainable world*.

Since the model relies on underlying historic SDG indicator data, results may shift along with development pathways. The systems model should allow for increased systemic monitoring of SDG progress and can be adapted to regional or country scales. We encourage further comparative SDG

systems model research especially at these scales, since a more thorough understanding of directional relations may allow for more detailed and complex interconnections. Persisting hurdles among targets must be recognized and overcome in the long-term, while levers may multiply benefits towards achieving the SDGs.

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Open innovation model: global warming as a challenge and driver for innovation.

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Abstract

'Global warming'represents an ecological (also socioecological) issue of importance and concern. Due to the escalation of global warming, it is time for humanity to think and act responsibly and determine sustainable solutions. Global warming, in addition to climate change, has caused the world to undertake new responsibilities (e.g. IPCC 2007), which not only include further climate change, but in the long term, also hold humanity accountable in the prevention of new political and/or social conflicts, war on resources, new environmental catastrophes as well as serious crises in the market economies (e.g. UNDP 2007; UNEP 2008). The special challenge of global warming can be tackled by 'sustainable development'.

Asian high economic growth in recent decades has resulted in the region's equally high growth in carbon emissions. As a consequence, a significant part of global carbon emissions are now coming from China, India, ASEAN and other Asian developing economies. Based on the regional distribution of global CO_2 emissions between 1990 and 2010 Asia-Pacific's share in global carbon emissions jumped from 25% in 1990 to 44% in 2010. Especially china alone more than doubled its share to 25%. In this regard, specifically, this paper has featured an urgent area of case studies within the Asia Pacific Region, which is the Association of Southeast Asian Nations (ASEAN) countries, including Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. The countries within the ASEAN group have shown significant records of contributing greenhouse gas (GHG) emissions in recent years, especially in Indonesia, Thailand and Vietnam (GCCSI, 2014). Asian high economic growth in recent decades has resulted in the region's equally high growth in carbon emissions. As a consequence, a significant part of global carbon emissions are now coming from China, India, ASEAN and other Asian developing economies. In this regard, specifically, this paper has featured an urgent area of case studies within the Asia Pacific Region, which is the Association of Southeast Asian Nations (ASEAN) countries, including Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. The countries within the ASEAN group have shown significant records of contributing greenhouse gas (GHG) emissions in recent years, especially in Indonesia, Thailand and Vietnam (GCCSI, 2014).

In the current academic debate, it is undisputed that a solution or a suitable answer regarding the challenge of global warming can only be found through utilizing the asset of human knowledge. The key to success, as being determined by our propositions, lies in using the available and newly created 'knowledge' in correspondence with Open Innovation Model (e.g. Carayannis and Campbell 2010).

Our thesis is as follows: the innovation model represents a suitable model in theory and practice offered to society to understand the link between knowledge and innovation, in order to promote a lasting development. In this paper we address the potential of a nation-state in the twenty-first century and on

the following pivotal question: How can sustainable development, with regard to global warming, be practiced step-by-step with and within the innovation model?

1. Sustainability and Science

1c. Assessing sustainability

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Navigating through the Emerging Paths of Organizational Assessment: The Relationship between Sustainability and Circular Economy Assessment

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Abstract

Adopting the sustainability paradigm into organizational practices and strategies seems to be the only viable strategy to respond to changing market conditions and people's demands for sustainable products. To assess and communicate an organization's progress towards sustainability, Sustainability Indicators (SIs) have been extensively developed and used. Especially in the last five years, sustainability literature has been captivated by the Circular Economy (CE) concept, as it is receiving increasing attention by academia, industry and policymakers. There is a strong drive from private and public organizations to implement CE and a large number of CE indicators and assessment approaches have emerged in addition to already existing SIs. In many cases CE assessments are executed in parallel to ongoing sustainability assessment efforts or even replace them. However, the relationship between sustainability and CE assessments remains ambiguous and literature highlights that increased circularity does not necessarily lead to overall sustainability. Therefore, it is often not clear in what way CE assessments enrich, deteriorate or repeat sustainability assessments. This research aims at exploring the relationship between sustainability and CE assessments by comparing and analysing organization-level indicators from the literature in an integrative review. The main contribution of this research will be a content analysis of the selected articles identifying the relations between sustainability and CE assessment. Expected findings are a bibliometric comparison of CE and sustainability assessments covering the distribution of articles over the years, their geographical distribution, type of publication and distribution per journal. The bibliometric analysis will be followed by a content analysis. Guiding questions cover the similarities and differences between sustainability and CE assessment in the (i) aims and scope of the assessments (e.g. sustainability dimensions covered); (ii) approaches and methods in use (e.g. stakeholder engagement); as well as (iii) the progression of the assessments (e.g. current state of implementation). most importantly, the implications for sustainability and CE assessments are addressed. This study contributes to closing a gap in the sustainability and CE assessment literature and assists decision makers in assessment implementation.

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Perception of young people about Local Sustainability: a case study in rural areas, Beira Baixa, Portugal

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Abstract

Based on literature it is indeed vital to create and develop tools to educate and engage young people on Sustainable Development (SD) and Sustainable Development Goals (SDG) to improve their knowledge, skills and attitudes. Involving students in this process allows for awareness of challenges and solutions regarding SD and SDGs. In particular, in rural areas with a high level of human desertification and deforestation, it is important to increase the sensibility of the youth about sustainability issues and to promote change in the community. The case study of this research takes place in the context of a special program, that aims to establish scientific partnerships between Secondary Education Schools (SESs) and the Higher Education Institutions (HEIs) and it refers to the Beira Baixa region. This region is predominately rural, having one of the lowest rates of youth in the country (10.6%). The main objective of this study is to reflect on the perception that youth have about SD, based on the results from a questionnaire applied to a convenience sample from the region's student population in Secondary Education. The general aim of the questionnaire was to measure the young people´s perceptions and awareness about sustainability concepts and self-assessment of the local sustainability. The results showed most of the students were familiar with the term SD. However, most of them associated it to the environmental dimension, whereas the institutional dimension is the least associated to SD. When asked about what is important to evaluate in their region's SD and, specifically which of the SDG are more important to their region, the main ones are Good Health and Well-Being (SDG3) and Affordable and Clean Energy (SDG7). Students were also presented with a list of 40 themes that could be included in the Indicator System (IS) and asked to scale from 1 to 5 (where 1 is nothing important and 5 is very important) to assess the importance of each theme for their municipality. The most chosen themes by students are associated with social and immaterial themes (e.g., Health, Education, Housing, Freedom and Happiness). On the other hand, the least valued themes by respondents are "Noise" and "Marine and Coastal Environment". We asked if in the development/designing of an IS that allows the evaluation of the SD, the choice of the indicators should have in consideration the "opinion" of the citizens and a large majority (83.8%) of them considers that it should take into consideration the public participation. It was possible to observe that the practice of local sustainability is already well promoted as well as its progress, but it is essential to involve youth in this practice, especially in rural areas, that could be pertinent to assess local sustainability and monitor SDG achievement, to promote environmental conscience, and to the change in values and attitudes towards sustainability. This abstract is especially related to "SDG+Target: 4.7". In times of crisis, through education for sustainability, it will be essential to promote citizenship, to which this program intends to contribute.

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How Are Corporations Reporting Circular Economy Issues?

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Abstract

Information published within non-financial reports allow companies to respond to demands for transparency and demonstrate how their business activities are contributing to a more sustainable society. Despite growing attention from academia and practitioners towards the advantages of the circular economy (CE), how CE is being integrated within non-financial reporting remains under explored. As CE strategies are increasingly implemented within the private sector, the demands of stakeholders for transparency of the impacts of these new strategies continue to emerge. Therefore, the aim of this research is to observe how commitments and progress towards circularity are currently being included within the non-financial reports of the world's most sustainable companies, according to certain rankings. By analysing the reports of companies with already established and recognised sustainable practices, different pathways of reporting CE issues can be identified. To achieve this aim, a sampling strategy was employed to identify companies who: publish non-financial reports in English and are included within more than one publicly available sustainability ranking or awards list. More specifically, the most recently published lists of three global rankings (which are developed from corporate non-financial information for the year 2019) were chosen: the Dow Jones Sustainability Index, the Corporate Knights Global 100 and the annual Sustainability, Environmental, Achievement & Leadership (SEAL) Awards. A final set of 43 companies were selected, not restricted by sector or geographical location. A qualitative content analysis approach was adopted to analyse the non-financial information included within these company's sustainability reports, integrated reports, annual reports and other relevant documents published for the year 2019. Preliminary findings suggest that the majority of companies analysed do mention CE within their non-financial reports. CE is most commonly mentioned in a narrative format through descriptions of the CE strategies implemented, collaborative projects they are involved in and future CE ambitions. Furthermore, several companies were found to describe business activities and/or apply metrics commonly associated with CE within academic literature but did not explicitly link them with CE within their non-financial reports. The preliminary insights obtained from this content analysis have identified a lack of consistency concerning how CE is presented and evaluated from companies who are publicly recognised for their commitment and achievements in sustainability. These findings have created a basis for the development of best practices to assist companies to uniformly report progress towards CE informed by current reporting trends.

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Dissemination of sustainability GRI reports in Colombia in the period from 2005 – 2016

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Abstract

Dissemination of sustainable practices, as a subfield of sustainable management, studies how these types of practices diffuse among networks of firms and Identifies characteristics of firms' adoption of sustainability reporting. This research evaluates the dissemination process of sustainability reports guided by the Global Report Initiative (GRI) in Colombia by analyzing the population of firms adopting the reporting practice and by characterizing differential performance in reporting. Literature related to theory of diffusion of innovations and the dissemination of sustainability reporting, shaped the framework of analysis. Quantitative analysis of a database of GRI certification provided empirical information, including 264 cases in the period of 2005 – 2016. Outcomes illustrate the dissemination process of GRI reports over 11 year-period and identifies firms and organizations adopting diverse reporting frequencies (annually, bi-annually, and dropouts). It shows a relative higher number of firms and organizations in Colombian publishing GRI sustainability reports, in comparison to neighboring countries. Most of the GRI reporting firms are large and privately owned. Companies from the financial and energy sector make up the main proportion. This study is one of the first in analyzing the dissemination of GRI reports in Latin American and offers initial explanations to understand the dissemination process of environmental reporting in Colombia. Outcomes of this study provide insights to managers of companies interested in publishing sustainability reports and to managers of the GRI certification program responsible for the dissemination of its services. Moreover, it adds to the academic literature by emphasizing the dissemination of the specific environmental management practice, such as sustainable reports.

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Sustainability reporting and organizational learning: Evidence of GRI reporting in Colombia

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Abstract

Management for sustainability includes the publication of sustainability reports, as main practices for evaluating and communication advances of organizational improvements and societal contributions. Reporting helps people to register and reflect on outcomes, that's why management literature recognizes reporting as a mechanism for organizational learning part of Demming's cycle. In this research, we evaluate organizational learning resulting from sustainability reporting. Literature on environmental management practice of organizational learning, and sustainability reporting served as framework for analysis. Content analysis of sustainability reports registered by firms in the Global Report Initiative database, and interviews with sustainability mangers, of 12 Colombian firms, with different reporting frequencies, provided empirical evidence for this study. Research outcomes identify diverse types of learning, first in sustainability management practices, and second in communication practices of societal contributions. This research adds to literature by relating sustainability reporting to organizational learning in sustainability management. Moreover, it provides sustainability managers with arguments to pursue sustainability reports as mechanisms for advancing learning in sustainability management. This research evidence the sustainability reporting is a good practice firms should employ to advance organizational learning and the communication of their societal contributions.

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Overcoming Data Friction by Connecting Diverse Stakeholder Needs to Address Sustainability Challenges: A Typology of Data Portals in Monsoon Asia.

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Abstract

The increase in types and volume of data provides new avenues and potential for a sustainability transition. Data friction, however, can hamper the exchange of knowledge. The role of data-intensive approaches in integrating knowledge and their use by multiple stakeholders to translate the knowledge into action is not understood. This paper develops an analytical framework to analyse nine web data portals in Cambodia, India and Thailand, using a case-study approach and collecting data from primary survey questionnaire and literature review.

Our study shows that most web data portals are primarily providing information, and a few portals transform the knowledge into action, yet, focus on singular themes. Data-friction among various stakeholders restricts the exchange of knowledge among stakeholders. Our results have broad implications, and we suggest using a spatial scale to link knowledge among researchers and use natural hazard mitigation to connect diverse stakeholders' needs.

A scale-based picture, focusing on landscapes, institutions and practices is proposed which can be used to align diverse fields by acting as "bridge" for improved science-policy interface and decision making, facilitated through cognitive proximity, matching, and coordination. A scale-based approach can play a key role in connecting human behavior, a social science thematic topic, with ecosystems, a natural science thematic topic.

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Environmental accounting and reporting changes in Italian local governments

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Abstract

Environmental accounting and reporting has been adopted by different organisations worldwide, including public sector organisations. Local governments are among the public sector organisations that have adopted the most environmental accounting and reporting practices. Despite some research on 'why' local governments develop these tools and 'what' environmental information is included in formal documents, it is still unclear how contextual factors (including legislation and characteristics of the surrounding area) influence the content of documents and the process that led local governments to adopt, in the majority of cases voluntarily, changes across time to accounting and reporting practices.

The purpose of this research is to contribute to a better understanding of changes in local governments' accounting and reporting practices. Particularly, 'why', 'what' and 'how' environmental aspects (related to the territory under local governments' jurisdiction, the immediate surrounding area, the organisational performance and externalities caused by their operations) are included in accounting and reporting practices, and the significance of the changes across time.

This research adopts an interpretative approach using two case studies of Italian local governments to conduct a longitudinal analysis of changes. The framework on context, content and process, suggested by Pettigrew and Whipp, is used to distinguish changes under each dimension and analyse their interconnections. Data is collected through the analysis of official documents and triangulated with semi-structured interviews to key stakeholders in both case studies. Findings are analysed within each case study and in a cross-case analysis.

The legal framework defines the boundaries of the accounting information on the territory under local governments' jurisdiction and their immediate surrounding area. Organisational environmental performance and externalities are excluded from the requirements, which originates a limited representation of reality in terms of environmental aspects. Local governments prioritise their role as 'managers' of the territory and as influencing citizens' behaviour.

The formalism that characterises Italian local governments indicates that what is not mandatory is considered less critical. An interplay between contextual elements, namely the local outer context, political commitment and organisational culture justifies the implementation of changes beyond what is regulated and implementation of transformational changes.

The member of the cabinet for the environment as well as international networks act as agents of change. Local governments engage in international networks to gain access to funding and implement changes, leading to the adoption of the dominant environmental agenda. Key stakeholders, like citizens, are not engaged in the accounting and reporting process. Thus, there is no evidence that the

environmental aspects addressed and related changes are in line with stakeholders' needs and expectations, which jeopardises its significance in the creation of value for society.

The present research portrays how changes across time occur using official documents that reflect environmental aspects. Findings from the current research have implications in other EU member states due to the harmonisation of accounting and reporting practices and the common practice across the EU in using external funding to conceptualise and implement changes. This implies that other local governments could also be representing a limited account related to environmental aspects.

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Assessing sustainability across circular inter-firm networks: Insights from companies engaged with circular economy practices

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Abstract

Companies employing circular economy (CE) practices are often implicitly expected to conduct their business in a sustainable way. However, this claim is more often based on narratives than on actual sustainability assessment. Since companies with CE practices are usually embedded within a regional or global network of supply chains, it is essential that the comprehensive sustainability impact of these network actors is considered. While the academic literature on sustainability assessment approaches for circular inter-firm networks has already been summarised by the authors, relatively little research has addressed how industry practitioners assess the sustainability impacts across their supply chains related to CE practices.

Therefore, this paper compares the results from the aforementioned literature review on sustainability assessment on an inter-firm level with companies' actual assessment practices going beyond company borders, and describes whether assessing sustainability in supply chains is relevant to them. The empirical data were collected through 43 semi-structured interviews with companies engaged with CE practices in Italy and the Netherlands. The direct comparison of supply chain assessment approaches discussed in literature and those applied in industry aims to identify gaps and overlaps to advance the application of sustainability assessment across circular inter-firm networks. It was found that CE actors saw sustainable supply chains as a priority, even though about a third of the respondents did not conduct any sustainability assessments of their supply chains. The main reasons for this were the small company size with few supply chain partners, or in the case of larger companies, that clients did not give significant weight to the sustainability impacts of products. The companies which conducted supply chain assessments mostly did so in a qualitative way, together with their upstream and downstream partners, or opted for a life cycle assessment. In general, two thirds of the respondents found that CE practices enabled them to collaborate more intensely with their network actors.

Finally, while the supply chain assessments were less elaborate than described in literature, almost three quarters of the respondents mentioned they applied supplier selection criteria instead of a complete assessment, ranging from certification requirements to having a long-lasting relationship. It thus became clear that rather than relying on assessment results, companies engaged with CE practices placed high importance on supply chain management tools and a relationship based on trust with their supply chain partners. In a next step, the identified supply chain assessment approaches will be benchmarked according to literature-based criteria of sound sustainability assessment on an inter-firm level.

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The value of a unified Sustainable Development Goals (SDGs) database. How the selection of SDG data matters

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Abstract

The 2020s are a crucial decade for actions towards achieving the 2030 Agenda and its Sustainable Development Goals (SDGs). To close the gap between science, policy, and society, SDG research needs to provide reliable results to ensure that scientific outcomes are translated into concrete actions. Quantitative SDG research primarily uses databases provided by the United Nations (UN), the World Bank Group (WBG), and the Bertelsmann Stiftung & Sustainable Development Solutions Network (BE-SDSN). In order to understand how the selection of data affects our understanding of SDG interactions, our approach is threefold: We compile the UN, WGB, and BE-SDSN SDG data into one database to show the value of a unified framework.

To analyze SDG interactions, we statistically investigate synergies and trade-offs at global, income, and regional scale across the UN, WBG, BE-SDSN, and unified SDG database. We apply network analyses to examine key goals and targets within the SDG system across all four SDG databases. Our results highlight a few insights on how the selection of data forms SDG results.

First, we show the varying data availability across the UN, WBG, and BE-SDSN SDG databases. Second, by comparing all four SDG databases, we obtained more different than similar understandings of SDG interactions. Differences in synergies and trade-offs mainly occur for those SDGs that are not based on the Millennium Development Goals or that are environmentally-oriented. Those SDGs [SDG 13 - 16] are still not well quantified to represent the actual purpose described within the targets. Third, the choice of SDG data forms the SDG interactions differently on income and regional scales. Fourth, the most influential target does not necessarily belong to the most influential goal. Fifth, due to the increased data availability and consistency, the unified SGD database offers a more pronounced few on SDG interactions as well as on key goals and targets.

In summary, our results evidence that the selection of SDG data forms scientific results, and thus implementation strategies that might neglect trade-offs and spill-over effects – one reason the world is not on track to meet the SDGs by 2030. As the current Covid-19 pandemic has also shifted the foundation on which SDG indicators were built in 2015, the global indicator framework needs to be revised and a unified SDG monitoring framework implemented.

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Assessing the Sustainability Performance of the Sharing Economy

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Abstract

Background of the research

With the rapid spread of businesses using one or another kind of resource sharing, the concept of the sharing economy has become an often researched topic. As a result, a number of related concepts have emerged, such as 'collaborative consumption' and 'access-based consumption' and these are often used interchangeably to describe initiatives aiming at a better utilization of resources (see e.g. Möhlmann, 2015, McArthur, 2014, Mallargé et al., 2017 and Ferrari, 2016).

Apart from economic concerns, the sharing economy also raises a number of questions relating to its environmental and social impacts (Soltesz and Zilahy, 2020). We still have to see if the promises of resource savings are going to lead to more sustainable societies or various types of rebound effects will hinder significant changes to the environmental impact of our lifestyles. Social issues have also risen relating to the organisations of the platform economy, which should be answered to better understand the sustainability performance of the sharing economy.

In order to answer these questions, the measurement of the sustainability impacts of the sharing economy is of crucial importance. Yet, the tools developed over the years to assess company environmental and social performance show serious limitations when they are to be used in the case of the sharing economy.

Depending on the type of sharing economy businesses, companies may be able to influence the use of the resources, which provide the basis of their operations or they may not even possess these resources. Car2go does own its car fleet, but its control over how their cars are used is limited. Uber does not even own the car fleet operated by their platform and has no direct influence on the choice of cars owned by their members.

Research activities, preliminary results

While these operators often claim that their services are environmental sound compared to traditional products and services, in fact this is based more on an overall expectation and not on their direct control of environmental aspects and impacts.

In order to gain a better understanding of how sharing economy businesses can utilise established tools of corporate environmental performance evaluation, an empirical analysis is being carried out at the Budapest University of Technology and Economics.

The research focuses on identifying the relevant indicators to be used by sharing economy businesses and will contrast it with actual company practice based on the review of company communication readily available through the internet.

The first results show that sharing economy businesses often do not provide detailed information about their environmental and social performance, but are still promoting an image of a sustainable enterprise to their customers based on general statements about the industry.

During the next few months up to the ISDRS conference several sharing economy businesses will be analysed through their sustainability communication and suggestions for good practices will be established.

Relationship to SDGs and conference objectives

This proposed abstract aims at dealing with goals identified by *SDG 12, m*ore specifically, it fits under 12.2 and 12.6.

2. Education

2a. Provision, quality of and access to education

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WORKFORCE PLANNING AND ACCESS TO HIGHER EDUCATION IN NIGERIA

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Abstract

Given the report of a national committee on manpower planning, successive governments have made a significant progress in promoting access to higher education in Nigeria since the 1960s. Unfortunately, lack of synergy between the national manpower board and government agencies in charge of the regulation of higher educational institutions has affected the employability of graduates from higher educational institutions in Nigeria. Therefore, this article examines workforce planning and access to higher education in Nigeria, with a focus on the following research questions: (1) How does workforce planning affect access to higher education in Nigeria?, (2) To what extent has the national manpower board performed its functions in Nigeria?, and (3) What are the reasons for the underlying inverse relationship between the levels of access to higher education and human capital index in Nigeria? These questions were addressed through a systematic review of relevant literature on workforce planning, access to higher education, employability, and human capital development in Nigeria. The theories of structuration and human capital provide a basis for an understanding of the importance of workforce planning and access to higher education. The findings revealed that the issue of workforce planning has contributed to the proliferation of higher educational institutions but it received inadequate attention in national development plans in Nigeria. Also, the national manpower board has not adequately performed its functions, hence the missing link between access to higher education and human capital development in Nigeria. Moreover, a new class of the educated workforce has emerged with inadequate opportunities for decent jobs, thereby making it difficult or impossible for them to attain upward social mobility in Nigeria. The national manpower board has become moribund, while the increasing levels of access to higher education and human capital index are moving in different directions in Nigeria. This article is directly relevant to SDG 4 dealing with quality education and SDG 8, which focuses on decent work and economic growth. The issues raised in this article will enhance an understanding of the topic of the conference, Accelerating Progress Towards SDGs in Times of Crisis.

Keywords: Access to Education, Employability, Human Capital Index, Workforce Planning

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Digitalization and Sustainability in Higher Education in Covid Pandemics

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Abstract

"Complex problems are characterized by the fact that sometimes contradictory answers can be correct. You don't learn to deal with that at any school. It's based on the courage to question your own truths - and to always ask the question: What if the opposite were true?" Dirk von Gehlen

Sustainability addresses an understanding of values in dealing with resources, people, animals, plants and nature as well as cycles in present and future. The development towards sustainability includes a value attitude with regard to an equal balance of ecological, social and economic goals. The principles of sustainable development include the design of human systems considering ecological and social carrying capacity limits and scientific principles. The earth's ecosystems must remain intact in their assimilation, buffering and regenerative capacity to enable life and human economic activity in the long term. This includes designing socially and economically resilient structures and systems. Education and education for sustainability is a crucial module in reaching these goals and distributing sustainable values.

The global pandemic had and still has immense impact on education and caused and still causes a ground-breaking shift in higher education systems. The global COVID-19 pandemic does not only focus on health and social issues, but the topic of digitalization as well. Universities have to (re)act very fast and demonstrate their adaptability: Within shortest time, the university life was reduced to a minimum. Simultaneously, the courses were transferred into digital formats. How this transformation was done, by which advantages and disadvantages they were accompanied, how sustainable these processes are and how the future of higher education can look like, was surveyed by this questionnaire at the Chemnitz University of Technology. The questionnaire was aimed at both staff and students of the university. The main goal was to identify impellent forces of resource consumption, potential rebound effects and give digital equipment. Between July and end of September 2020, the survey Digitalization and Sustainability in Higher Education was executed at the Chemnitz University of Technology due to the conversion from in-person teaching to digital courses. We got approximately 400 complete surveys by students and stuff. The surveys will be repeated in the winter term. The questionnaires were analysed by means of descriptive statistics and qualitative content analysis.

The results show a high diversity regarding the behaviour and responses to changes in digital teaching and learning due to the pandemic. Digital teaching and learning at home offer many advantages and challenges at the same time - as well as learning and working at the university campus do. In fact, there are financial and infrastructural boundaries of digital teaching, e.g. limitations in available bandwidth. Moreover, we identified severe lacking knowledge and action regarding the connection between sustainability and digitalization. Potential rebound effects are lower than expected. The reduction of mobility reduces greenhouse gases, sufficient electronical equipment mainly was already given, so that there is no immense over-consumption, and additional home shopping is adequate. The study also shows, which aspects can be taken up constructively to further develop digital teaching.

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EDUCATION POLICIES AS DRIVERS OF ECONOMIC DEVELOPMENT; OYO STATE AS A CASE STUDY

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Abstract

The 2030 Agenda for Sustainable Development is defined by the United Nations as *a plan of action for people, planet and prosperity* and comprises of 17 Sustainable Development Goals (SDGs). Of the 17 development goals, goal 4 particularly stands out in relevance to this work, as it seeks to foster inclusive and equitable quality education and promote lifelong learning opportunities for all. Goal 4 is not only crucial in such a time as this, but also crucial for such a country as Nigeria which has been named *the poverty capital of the world.* In seeking to implement poverty reduction strategies locally, education is undoubtedly a pivotal strategy without which other strategies though executed, may be short-lived. The seeming correlative relationship between these two economic variables, *education* and *poverty*, serve to strike a nexus between sustainable goal 4 and sustainable goal 1. Invariably, sustainable goal 1 may not be entirely attainable without specific recourse to sustainable goal 4. This in itself is a key to diverse pragmatic recommendations, programs and interventions for the achievement of these two goals in particular. This, the Oyo State Government has recently identified and so passionately strives for. Of the 10,193,918 children who are presently out of school according to the Federal Ministry of Education, 170,536 (62,733 hawkers and 107,803 almajiris), are resident in Oyo State and have become the policy target of the State Universal Basic Education Board. Have the resultant policies however been properly thought-through, or are they sheer zealous expressions of intent?

This work specifically relates to Sustainable Development Goal (SDG) 4 + Target 4.1, which seeks to ensure that by 2030, all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.

This paper, being my proposed contribution is pivotal to the Conference's theme - **Accelerating Progress Towards SDG's In Times of Crisis,** as it proffers recommendations as to better and speedy implementation of the Sustainable Development Goal 4, exploring the use of policy as a tool.

Full papers

Teaching Agricultural, Biological and Ecological Knowledge and the Impact of These Courses on Rural Development in Transcarpathia

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Abstract

The education system in Ukraine combines the traditions of the European and Eastern blocs. The Transcarpathian region in the southwestern part of Ukraine is home to a significant number of Hungarian minorities. After World War II the borders of Hungary were reconstructed and the area became part of the Soviet Union and, since 1991, has been the part of Ukraine. To this day, Hungarian is spoken in the region, they adhere to the traditions of the Carpathian Basin and maintain a close relationship with Hungary. From the first time the training of the horticultural engineers in the Ferenc Rákóczi II. Transcarpathian Hungarian College of Higher Education, has played a significant role in helping the Hungarians of Transcarpathia to remain in their homeland. Due to the increasingly difficult living conditions and increasing emigration, the development of the agricultural sector plays an important role in the survival of the majority rural Hungarian population. The agricultural sector also helps to increase the population retention power of the region. The horticultural engineer training in Beregszász has been working for 20 years to educate local Hungarian horticultural professionals to support to solve the shortage of specialists in Trascarpathia, and to increase the relevant horticultural professional and technological knowledge at the region. The main purpose of the education is to train those horticultural professionals, who have the appropriate expertise to set up an independent horticultural farm in their place of residence, to organize horticultural production, processing and sales, and to carry out engineering tasks. The goal of this study is to present the opportunities in this region for young adults who want to study in Hungarian, to further their education in topics that require biological and ecological knowledge, related to agriculture, livestock breeding, rural development and sustainable development. The study focused on selected outsourced undergraduate education which is performed under the

supervision of the Ferenc Rákóczi II Transcarpathian Hungarian College of Higher Education. This course provides training to advance sustainability. The obtained degree can be used by students not primarily for the purpose of further education, but for the practical application of the acquired knowledge and to ensure their livelihood in Ukraine. The training of a skilled workforce is an important benefit for the development of the region. Since 1999 during the 20-year existence of the horticultural engineering course, 170 students have been able to receive a degree throughout 17 graduate years. Analysing the data of the graduated students, it is possible to support the fact that the training helps to increase the population retention power of the agricultural sector, and with it an increased amount of people is staying in the Transcarpathian homeland. Since the 20-year existence of the training, nearly 95% of graduates have sought to establish themselves in their home country. Only 5% of students chose a job opportunity in Hungary. However, working abroad is not exemplary at all. Further analysing the correlations of the territorial data of graduated students, it can be observed that the district of Beregszász provides 58% of the graduates. This can be explained by the fact that the district has the largest proportion of rural Hungarian-speaking population, as it is considered to be the centre of Hungarians mainly engaging in agriculture. Our results show a significant correlation with the territorial distribution dominance of the winning tenders of the Egán Ede economic stimulus subsidies, which has been operating since 2016. This also upholds the specific importance of the agricultural sector in the Hungarian-inhabited region of the district of Beregszász. The Beregszász is followed by the district of Ungvár (by almost 23%), and the district of Nagyszőlős, where the proportion of graduates reaches about 10.5%. The share of the scattered regions is small (it is only possible to find graduate students in the districts of Munkács, Huszt and Rahó, but the proportion of graduates in these districts does not reach 10% in total). The proposed results relate to the 4th and 12th SDGs, especially to the Targets 4.3., 4.4., 4.5., 4.7., 12.2. and 12.8. as we examined the phenomena which teaches and supports people to use natural resources sustainably while ensuring their livelihood and promote universal understanding of sustainable lifestyles. Our results relate to the topic of „Provision, Quality of and Access to Education" of the Conference that the presented training and courses eliminate discrimination in education, provide equal access to affordable technical, vocational and higher education for the minority in Ukraine, increase the number of people with relevant skills for financial success, and provide education for sustainable development and global citizenship.

Keywords: Teaching, Rural development, Transcarpathia, Biology, Agriculture

1. A brief historical overview of outsourced agricultural science courses and vocational training in Transcarpathia

Following several integrations, in Budapest the Faculty of Horticulture operated within the framework of Szent István University between 1999-2003, Corvinus University of Budapest between 2003-2016, and again from Szent István University from January 2016. From 2021, after the name change, Szent

István University will operate under the name of the Hungarian University of Agricultural and Life Sciences. Meanwhile, a very specific structure of cross-border training has developed, which has successfully overcome borders and effectively integrated European distance learning methods and experiences.

The Cross-Border Correspondence Department, which started in 1993, is managed by Dr. Gergely Simon, associate professor, from 2012 to the present, while the outsourced training in Beregszász has been run by dr. Irén Pólin leads.

In 1993, the first outsourced horticultural engineer training started in Transylvania, Nyárádszereda, then in 1999 in Beregszász, Transcarpathia, and in 2018 in Komárno, Slovakia.

2. The educational form and structure of the outsourced trainings in Beregszász

The horticultural engineer training is an eight-semester (accredited from the 2007/2008 academic year) correspondence system, accredited in Hungary, with a college-level, BSc equivalent equivalent to the Bologna system. The degree in horticultural engineering in Hungarian and English, awarded at the University of Budapest, is accepted and localized by the Ministry of Education of Ukraine. Due to the previous changes in the law, it was possible for the courses outsourced from Hungary to operate in Ukraine, as well as for non-accredited courses. From the 2015/2016 academic year, under the authority of the Adult Education Center, the Horticultural Engineer, Animal Husbandry Engineer, Agricultural Engineer and the youngest food industry engineers were transferred to the Department of Biology and Chemistry. The Department of Agriculture has been formed. A II. Ferenc Rákóczi Hungarian College of Transcarpathia also provides full professional and other operational support for the outsourced trainings. Thanks to the local developments of the Hungarian government, the department of Biology and Chemistry of the institution supports the efficient operation of the outsourced trainings with modern equipment and professional assistance.

In the previous SzIE academic year 2013/2014, the Animal Husbandry Engineer undergraduate course started at the college as an outsourced training, but training did not continue from 2016. The professional range was further expanded, under the guidance of the Faculty of Agriculture and Environmental Sciences, with a BSc in Agricultural Engineering undergraduate degree.

In the academic year 2018/2019, EFOP-3.10.1-17-2017-00001 ("Strengthening thematic cooperation in the field of public education and higher education with the neighboring countries of the Carpathian Basin in the implementation of the consortium formed by the Office of Education, the University of Debrecen and Szent István University") in the framework of a tender, for the two faculties of the Buda Campus (Faculties of Food and Horticulture) in collaboration with 18 students, a four-semester Vine and Wine professional engineer and specialist consulting training has started in correspondence department. In the 2019/2020 academic year, the university started a training course in Food Industry Engineer in the correspondence department.

In the spring semester of the 2020/2021 academic year, EFOP 3.10.1. Within the framework of the tender, the Horticultural Enterprise Development professional engineering training was launched. Depending on the needs, the launch of several short 30-40 hour adult training courses with horticultural and food industry profiles (Precision Farming, Herb Grower, etc.) is among the future plans.

For a long time, those interested could only apply for the trainings during the period of the higher education admission procedure. Nowadays they can apply to the Hungarian parent institution during the normal and supplementary admission procedure. As the students of Transcarpathia graduated a year earlier, unlike their Hungarian counterparts, they are already applying to the College at the age of 17. As a result, great emphasis must be placed on filling the missing knowledge in the basic subjects, because the professional subjects are based on the knowledge acquired here (Orosz I., 2011). Significant (the same amount of correspondence training as in Hungary) knowledge must be acquired per subject. This is aided by the College Library and the expanding e-learning materials available on the Internet. Meeting the challenges of distance learning in the 21st century, online education is also playing an increasingly important role, which can now be realized in the recently handed over video conferencing room of the college.

From the very beginning, students can obtain a degree in a state-funded form, for which the necessary financial resources are provided by the Ministry of Human Resources. In addition, it is possible to obtain a study scholarship, which the Ministry of Agriculture donates to students with an outstanding study average to help Hungarians living abroad stay abroad.

More than 20 university lecturers from the Faculty of Horticulture take part in cross-border education, and a sufficient number of Transcarpathian consultants are also involved. The two teachers work closely together in education: the subject teacher at the university prepares the subject program, the lecture material and travels to the College at least once a semester, where she performs teaching, consulting and examination tasks. In addition to constant contact, local counselors also supplement the teaching with local curriculum and knowledge. During the seven semesters spent in the training, students can complete 180-240 credits. It is usually possible to enroll 30 first-graders each year. In addition to constant contact, local counselors also supplement the teaching with local curriculum and knowledge. During the seven semesters spent in the training, students can complete 180-240 credits. It is usually possible to enroll 30 first-graders each year. In order to provide practical training for the outsourced trainings, the Agricultural Rural Development Innovation Center of the Hungarian University of Agricultural and Life Sciences in the Carpathian Basin, in cooperation with the Ferenc Rákóczi II. Hungarian College of Transcarpathia, visited companies and enterprises where students can acquire the necessary practical knowledge at the highest level. Permanent internships are mainly located in more easily accessible locations close to the center of outsourced training, Beregszász (Orosz I., 2011), which have been selected for individual and corporate horticultural farms. The internships are carried out by students on a dual basis, ie in Transcarpathia and in Hungary (1-1 one-week internship), while the subject exams take place in the local counseling centers. All cultivation subjects have the appropriate practical site. For

example, the practice of botany and herb growing takes place in the dr. József Szikura Botanical Garden, in Nagybereg. The staff of the Department of Biology and Chemistry of the college works closely with the Nagybaktai Research Station, which is also close to Beregszász, and also involves students in joint research (Pólin I., 2019).

Second- and third-year students take part in internships in Hungary, where they perform their duties together with students from other cross-border training centers. By this time, laboratory and professional internships and elective subject consultations will also be organized for students at the university. An additional condition for obtaining the degree is the completion of a four-week related internship, which can be completed either locally or in Hungary.

3. The training of horticultural engineers in Beregszász in the light of statistical data

Since its 20-year history of outsourced horticultural engineering, nearly 170 students have been able to graduate. Analyzing the data of the Study Department of the Buda Campus of the Hungarian Agricultural and Life Sciences, the fact can be supported that the training helps to increase the population retention power of the agricultural sector, and with it to stay in the Transcarpathian homeland (Figure 1). During the 20 years of training, nearly 95% of the graduates tried to establish themselves in their homeland. Only 5% of students chose the job opportunity in Hungary. However, working abroad is not typical at all.

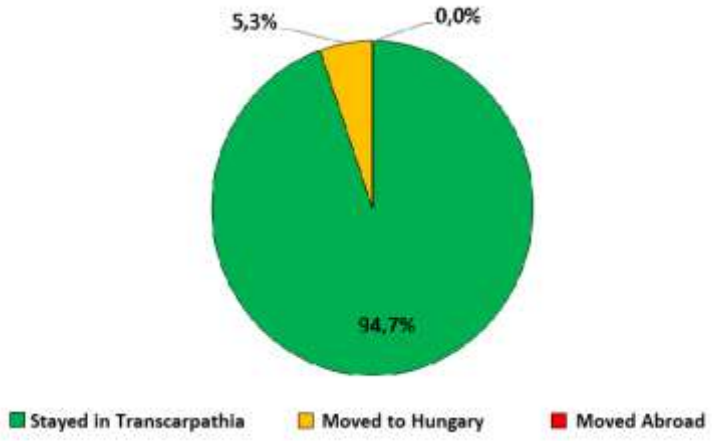

Figure 1.: *Distribution of graduates by place of residence*
Source: Based on SZIE study department statistics; own editing

Further analyzing the correlations of the spatial data of the graduates (Figure 2), it can also be observed that the district of Beregszász gives the dominant share, about 58%. This can be explained by the fact that the rural Hungarian-speaking population lives mainly here, and the Beregszász district can also be considered the base of the rural Hungarians operating in agriculture.

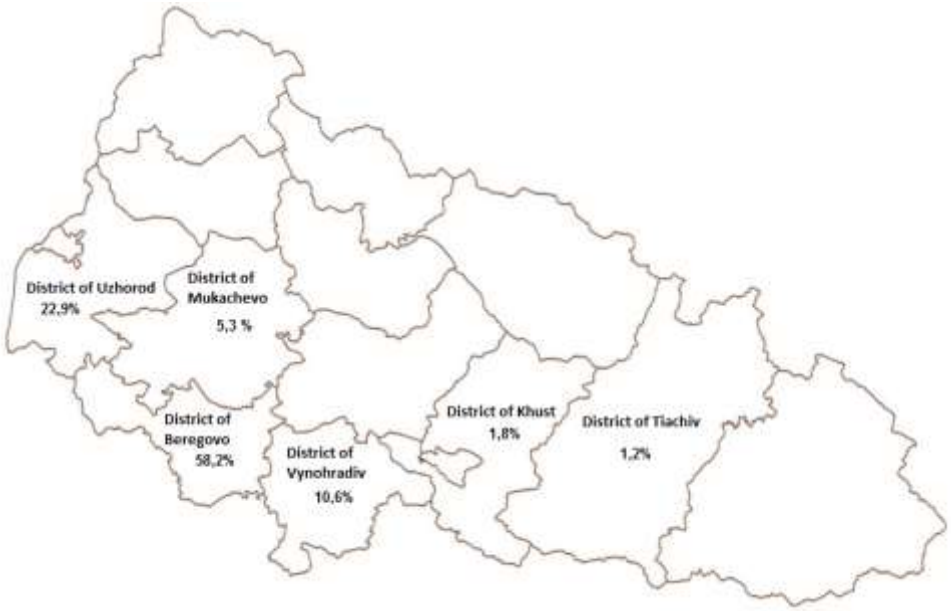

Figure 2: *Territorial distribution of graduates in Transcarpathia*
Source: based on the statistical data of the study department of II.RFKMF, own editing

The data also show a significant correlation with the territorial distribution of the winning applications of Egán Ede, which has been operating since 2016. This also supports the district dominance of the Hungarian-inhabited agricultural sector in Beregszász.

The Beregszász district is followed by the Ungvár district, with 23%, followed by the Nagyszőlős district, which accounts for more than 10.5% of the share of graduates. The share of the scattered region is small (there are some graduating students in the districts of Munkács, Huszti and Rahó, but the regions together do not reach 10%).

According to the statistics of the students admitted, the proportions by type of education (Figure 4) are shifted by a strong advantage (92% of all entrants) towards the undergraduate level. The share of those enrolled in old college education (considered BSc equivalent) operating until 2004 was 51.3% of the total undergraduate value, while 41% of students enrolled in the Bologna-based BSc undergraduate program since 2004. Examining the trend in the number of entrants, it can be observed that the number of entrants and students admitted until 2011 is characterized by a continuous decrease (Figure 3).

Of the breakdown of students admitted by type of training, the remaining 8% is almost entirely (6.86%) the proportion of students continuing their MSc training in Hungary, while the proportion of those enrolling in the MSc in Ukraine is only 0.65%. The latter can be mainly explained by the fact that the proportion of those who complete outsourced training and choose to continue their studies is low in the proportion of those who have acquired the Ukrainian state language at an appropriate level. Of the distribution of students admitted by type of training, the proportion of students admitted to PhD training is the lowest, only 1 person (0.16%), where the motivation of those interested in the PhD level is authoritative.

Over the years, the motivation of the students enrolled in the Transcarpathian horticultural engineer training is mostly in line with the local and native homeland and the establishment of their own agricultural enterprise and the development of their existing economy.

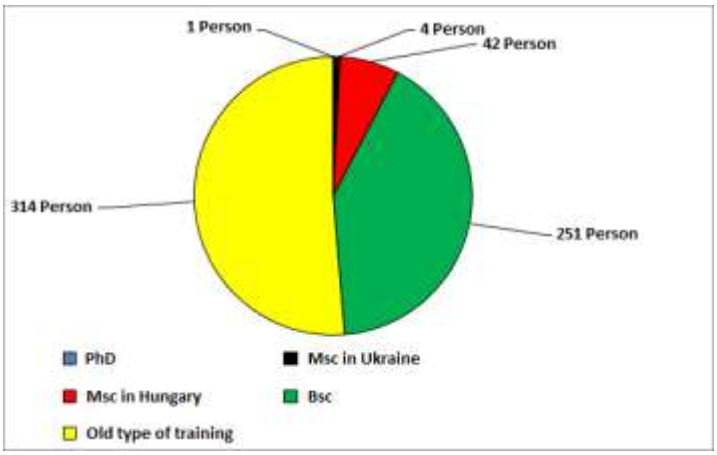

Figure 3: *Students admitted to horticultural engineering (persons) proportionality of each type of training*
Source: Statistics of the NEPTUN system and the SZIE BC Study Department based on its database; own editing

The enrolled students are mostly engaged in agricultural activities on a family or individual basis, so their motivation is very active in relation to the curriculum that can be acquired during the training.

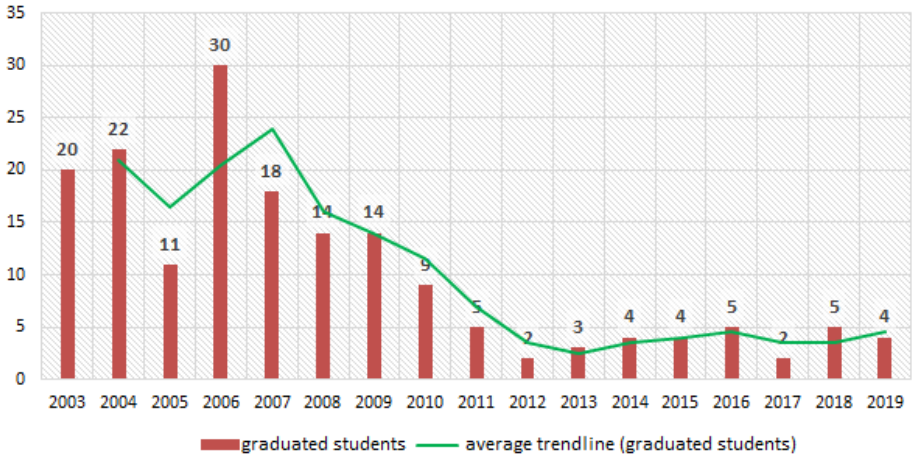

Figure 4: *Changes in the number of graduates by year*
Source: Based on the statistical data of the study department of the Hungarian University of Agricultural and Life Sciences, own editing

The majority of the graduates actively use the possibility of Egán Ede Economic Development tender grants, which has been operating in Transcarpathia since 2016, to start and develop their own agricultural enterprise. Local training at the College helps to do this to a significant extent, as not only

can they acquire the right expertise, but they also have a competitive advantage through their specialized qualifications. Local, Hungarian, and foreign-based agricultural companies are also showing significant interest in recent graduates. The majority of graduates can find employment according to the profession. Most of the graduates are now found as village farmers, educators, beekeepers, association leaders, farmers, winemakers, winemakers and sole proprietors. We can also meet graduate students who work as researchers (Nagybaktai Research Station), as well as cooperative or organizational staff, managers (Pro Agricultura Carpatica). There is also a significant number of graduates who are the managers, specialists and organizing staff of the outsourced branches of Hungarian or foreign companies. Difficulties in finding a job are only caused by the significant distances between inadequate language skills and workplace housing. After interviewing the graduates moving to Hungary, it can be said that this is why they choose to work away from their homeland.

4. Description of the situation of vocational training in Transcarpathia

In Transcarpathia, there has already been a demand to lay the foundations for Hungarian mother language vocational training. Thanks to the support of the Hungarian government in 2014, quality vocational training in mother language was launched in two places - when a vocational training institution was opened in Beregszász and Cluj-Napoca too. In Transcarpathia it was the Ferenc Rákóczi II. Institute of Higher Vocational Training of the Hungarian College of Transcarpathia, which changed its name in 2019 accordance to the new Law on Higher Education of Ukraine and continued the education under the name of the Ferenc Rákóczi II Transcarpathian Hungarian College of Higher Education. Formerly a "young professional" degree, while from the 2022/2023 academic year it changed into “young bachelor” level degree can give to graduated students. In Transcarpathia, this is the only Hungarian-language vocational grammar school that not only prepares for graduation, but also trains graduate professionals in line with labor market expectations.

In order to develop vocational education in Transcarpathia, the Egán Ede Vocational Training Center was established in 2019, with the first member institution of which became the Vocational Training Center in Nagydobrony. The task of the center was to be able to provide young people with high school, grammar school and high school education to obtain higher vocational education. The education takes place together with Hungarian partner institutions: two weeks in Hungary and two weeks in Transcarpathia. The education is practice-oriented and dual - they teach practical tasks in collaboration with local entrepreneurs.

Due to the great interest and in order to fully cover the Hungarian-inhabited areas of Transcarpathia the Egán Ede Vocational Training Center expanded its range and in 2020 the Beregszász Vocational Training Center and the Tiszapéterfalva Vocational Training Center also opened their doors. Currently, the vocational training centers are announcing the admission of nearly twelve courses for the academic year 2021/2022, according to the current needs. The Hungarian government is giving priority to developing the equipment of vocational training centers, and the creation of educational investments

(beauty, car mechanic and renewable energy workshops) in Transcarpathia. In the near future, a vocational training center will be launched in Visk, in order to effectively cover the scattered Hungarian minority in the Upper-Tisza countryside.

5. Summary

In Transcarpathia, the expansion of vocational and adult education in Hungarian mother language has become more valuable nowadays. Unfortunately, the social stratum that is unable or unable to continue learning due to lack of opportunities is becoming wider, therefore, they remain without a vocational qualification or diploma after primary or secondary education.

These people can only make a living from casual work, possibly forced to migrate for work abroad (Orosz I. et al., 2016). Expansion of the outsourced trainings and adult education courses of the Hungarian University of Agricultural and Life Sciences, and the development of Hungarian vocational training in Transcarpathia can be a solution to this challenge. Although the Hungarian minority in Transcarpathia shows a declining trend in terms of social indicators, even so the current training offer is already suitable for the comprehensive recognition of problems and their practical solution. In the future, we must continue to work to ensure that training supply covers and follows the demand side properly and effectively integrates labor market needs.

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2. Education

2b. Educating for sustainability

Abstracts

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Energy survey in Universities: a catalyst for an integrated and sustainable policy

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Abstract

As the second decade of the 21st century begins, universities are adopting an increasingly responsible attitude towards society, seeking a sustainable development agenda for the future, in line with an enhanced focus on the circular economy and the United Nations' SDGs. Given the proactive and problem-solving nature of entrepreneurial universities, it can be argued that they have a natural tendency to grapple with societal issues rather than merely engaging in activities that generate solely economic gain. Moreover, grappling with societal problems is a two-way alley: Apart from the obvious benefits societies garner from university engagement, universities make gains too. This paper sought to evaluate undergraduate students' attitude and behavioral factors and their relation to their energy use. The research analyzed on-line interviews with undergraduate students from Belgium and Brazil through quantitative techniques, such as factorial analysis, linear regression, and variance analysis. The sample consisted of 754 undergraduate students from Belgium (n = 377) and Brazil (n = 377). 66.2% (n = 499) of students are up to 25 years old and 8.8% (n = 66) are over 46 years old. The sample is balanced concerning gender: 50.7% (n = 382) are women. The research identified three dimensions of sustainable attitudes: citizens' role, scientists' role, and government's role, explaining 65.522% of students' sustainable attitudes. Concerning behaviors, the factorial analysis revealed three factors (total explained variance = 64.543%): Consumption of eco-friendly products, Financially-driven behavior, and Household energy saving. The linear regression model based on attitudinal and behavioral factors revealed that energy use could be explained based on three factors ($R2 = 0.203$, $p < 0.05$): Scientists' Role, Consumption of eco-friendly products, Economy driven behavior. The most important factor in assessing energy use was "Scientists' role" (beta = 0.381; sig. 0.0000), which means that reported energy use increases with the strong belief in scientists' role. The model also revealed that energy use decreases as people consume more eco-friendly products and adopt more economy driven behaviors. The respondents' overall perception showed that: (i) Brazilian students are more Economy-driven ($F=38.351$; sig. 0.000); (ii) Belgian students showed a greater propensity for consumption of eco-friendly products ($F=7.745$; sig. 0.000) and household energy saving ($F=273.939$; sig. 0.000); (iii) female students rely more on eco-friendly product consumption ($F=13.322$; sig. 0.000). From a sustainability perspective, the research concludes that: (i) universities should focus on individual behavioural changes alongside teaching sustainability science; (ii) governments should encourage public policies to raise awareness of the role of citizens in the sustainable use of energy; and (iii) universities should identify key elements for the construction of north-south cooperation proposals, such as capacity building programs for the dissemination of best sustainable practices. Finally, the study provides pertinent evidence for social researchers and university managers by identifying factors influencing students' perception of sustainability and providing elements for a sustainable university debate.

Keywords: Higher education institution, Energy efficiency, Sustainable Development Goals, Survey.

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Do Brazilian Business Schools prepare future financial executives to account for SDGs?

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Abstract

In September 2015, the 193 countries members of the United Nations (UN) signed the 2030 Agenda: a global plan composed of 17 Sustainable Development Goals (SDGs) with 169 goals for those countries to achieve sustainable development in all areas until 2030. The SDGs goals, such as number 4.Quality Education and 10.Reduction of Inequalities are fundamental, not only for business schools, but for any type of business education around the world. The goal number 12.6 of the SDGs, on the other hand, asks companies to start integrating information on sustainability in their usual financial reporting cycles. As a result, business schools play a key role in helping to achieve these UN goals by preparing business students to achieve this UN target number 12.6. In business schools, through undergraduate and graduate courses in areas of Accounting and Administration are taught ways of preparing financial reports, required by regulatory bodies in the countries in which the companies are established, or even management reports that assist in decision-making by the company's top management. The objective of this research is to investigate how, and if, Brazilian Universities, especially business schools, are preparing future executives for this reality, in compliance with the goal number 12.6 of the SDGs. The sample is composed by the 22 Brazilian Business Schools signatory to the Principles for Responsible of Management Education (PRME). PRME principles include the programme's objective of developing students' capacities to be future generators of sustainable value for companies and society at large and to work for an inclusive and sustainable global economy. To this end, educational institutions must incorporate into their academic activities and curricula the values of global social responsibility as portrayed in international initiatives such as the UN Global Compact Through the use of a semi-structured questionnaire based on the Auditing Instrument for Sustainability in Higher Education (AISHE), it will be investigated whether business schools adopt the teaching tools and sustainability frameworks, such as Integrated Reporting or other sustainability reports, such as Global Reporting Initiative (GRI). Learning these tools, the students and future executives are going to help organizations to be prepared to get through the challenges for sustainable development, particularly in reaching the goals of the SDGs. Given the importance of corporate involvement towards sustainability, it is relevant to question how future managers are being trained today, and whether the training they receive meets the needs and demands that the reality of the world of work imposes on them.

Keywords: Sustainable Development Goals (SDGs). Sustainability. Business Schools. Integrated Report.

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Bringing landscapes to school: experiences of developing a learning methodology for secondary school education

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Abstract

According to the European Landscape Convention (Council of Europe, 2000) “landscape” means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors. Focusing on the territory as a whole, not distinguishing between the ubran, peri-urban, rural and natural parts, landscapes are not limited to cultural, artificial and natural elements. This concept expresses the theme of the quality of the surroundings where people live. Taking into account the above definition, it is interesting to analyse what are young students’ and secondary school teachers’ beliefs, impressions and perceptions on landscapes. The presentation will focus on students’ and teachers’ attitudes and existing knowledge on landscapes, water surfaces. Above that, analyzing their environmental awareness is also a crucial factor in protecting landscapes and promoting sustainability. Furthermore, the role of landscape in formal education will also be examined. How is it possible to develop an innovative and integrated learning methodology, focusing on the European landscape and the role of water in shaping it? How can we bring landscapes to school education? Empirical data was collected through a questionnaire survey among secondary education teachers and students, as well as specific stakeholder organisations in four involved countries: Greece, Hungary, Italy and Turkey. The online questionnaires were available from May to June 2020, and they were completed altogether by 515 resondents. The presentation will address the main findings of the survery, focusing on the impression and perception of landscapes, the environmental consciousness of teachers and students, and their willingness to learn and teach about landscapes. The methodology to include landscapes into the curricula will also be discussed. Differences and similarities among participating countries will be highlighted, however, aggregated data was also analyzed, in order to measure current and general tendencies. The survey and the methodology was carried out in the frame of the Erasmus+ WaterSTEAM project (“Landscape, water and active citizenship: a nature-based STEAM teaching methodology”).

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Education and Volunteering to foster the societal sustainable transformation

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Abstract

The present paper analyzes the effects of an innovative higher education practice aimed to integrate volunteering initiatives in sustainability courses, with the purpose to strengthen students' sustainable awareness and foster the transformation of the society. In this regard, the transformative service research (TSR) recognizes that education, by nature, has an explicit transformative mission (Rosenbaum, 2011). Hence, it becomes a research priority to identify educational best practices that allow society members to contribute to the pursuit of individual and collective well-being. It is also highlighted by the target 4.7 of the Agenda 2030, which promotes an education capable of providing students with knowledge and skills concerning sustainable development and lifestyle, human rights and global citizenship. Moreover, as emphasized by Elkington (2018), it is time "to help individuals operating in the system to reconnect with their core values, renewing, their sense of purpose, meaning, and integrity"; accordingly, the volunteering can represent a practice that helps to create this re-connection.

In light of this, this study deals with the integration of volunteering practices in an Italian master degree program in Business and Management. Specifically, a volunteer initiative is proposed within the Business Ethics and Corporate Social Responsibility lectures. The lecture wants to sensitize and strengthen the students' awareness of the importance of behaving as societal sustainable citizens at individual and collective (i.e. as members of an organization) level. The research adopts a sequential mixed method design, based on a pragmatic approach. First, a quantitative study is carried out by administering a questionnaire inspired by the Theory of Planned Behavior (Ajzen, 1987) to investigate the students' attitude toward sustainable behaviours and volunteering. Second, after the volunteer lecture, a qualitative study is proposed combining two steps: i) the analysis of the student's projects aimed to embody volunteering within a real company's business practices; ii) the development of in-depth interviews with the students to investigate their feelings about the volunteer initiative, and collect their perceptions on the potential effects that it can produce on their future sustainable behaviours.

The research reveals the usefulness to integrate volunteering practices within the managerial master degree program, highlighting that it contributes to foster the primary university mission to develop sustainable and consciousness individuals before they become active members of business organizations. It represents a best practice that can be systematically adopted within university program, contributing to accelerating the societal sustainable transformation. The originality of the paper lies in the fact that, as far we know, it is the first study that attempts to establish a relation between higher education and volunteering to trigger and support the societal sustainable transformation.

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New directions for sustainable audio-visual culture

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Abstract

Abstract

The audio-visual industry is known for its grand façade of glamour. However, several problems are usually hiding behind-the-scenes such as the environmental, cultural and socio-economic impact the sector itself produces. Hence, the concept of sustainability is understood as the meeting of the economic, environmental and social needs of the present, also referred to as profits, planet, and people, without compromising future generations' ability.

Nonetheless, there are many aspects in which audio-visual practices fail to develop the Sustainable Development Goals (SDGs) suggested by UNESCO. From the misuse of natural resources, e.g., The Beach (Boyle, 2000), the permanent racism with certain ethnicities,

e.g., patanking, whitewashing, blackface to other issues like animal abuse or sexual harassment, among many others. The concept of media sustainability, is regarded as a counter-cultural initiative commonly known as Green Shooting, its compounded by policies and proposals for the media industry that align with the seventeen Sustainable Development Goals (SDGs) suggested by UNESCO, particularly SDGs 7 and 13, even though it could be applied to 4, 5, 9, 14, 15 and 16. Few cinematographic, television and advertising studios -with the help of companies and associations designated to this specific purpose such as EcoProd (France) BAFTA Albert (UK), Earth Angel NYC (USA), BC Creative (Canada), Fresco Films (Spain), among many others- have already accomplished great results by not only opting for sustainability practices in their audio-visual projects, but also for making available to other companies and creators carbon calculators and sustainable policies. Through a theoretical and case study, the current paper aims to explore the reasoning of the lack of demand and non-expansion of Green Shooting practices all over the sector. The results show that is due to (1) a lack of institutional support at a social and economic level, especially in the European context since most audio-visual productions depend on public finance; (2) misinformation on the meaning of the term sustainability; (3) a lack of social conscience, contrary to other sectors; (4) “the star system” blurry out the attention on those issues; and (5) many critics focus mostly on the quality of the plot instead of praising good practices. Instead of focusing on the nature of the material, critics emphasised the in-continuity within the plot.

In conclusion, the audio-visual sector should try to opt, when possible, for Green Shooting protocols or new media sustainability roles such as eco-consultant/supervisors to ensure that the SDGs are being accomplished. Hence, in a sense, change or rebuild the established system. Nevertheless, we can not forget the reality: most of the audio-visual sector relies on commercial interests, often having a creative and behaviour limitation. This paper provides newer literacy in the audio-visual sector to educate new generations to conceive and plan productions from a sustainable perspective. Hence, it relates intrinsically with the call because it targets professionals of the sector, academics, and students and proposes a dynamic course of use related to the environment and social justice.

Keywords: green shooting, sustainability, media, culture, environment, and audio-visual

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Non formal educational approach with poor communities about waste management: A case study in Belo Horizonte, Brazil

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Andre Mello

Abstract

The current issue about the lack of adequate and accessible dwellings, increase the number of people living in the slums for absence of a better option. The agglomerate of people living in poor conditions provides a series of social problems, most of them associating the damage to the environment and the loss of quality of life. Much is said about the harmful environment affects caused by bad living conditions of part of population in developing countries, that consume a lot of resources, with unmanageable urban waste and associated bad heath conditions.

Through awareness and educative campaigns to avoid cosmism and to show another significance for wellbeing without the need to adopt a lifestyle imposed by capitalism, we can minimize environmental impacts and combat pollution in developing countries.

Brazil has a propensity for urban problems. According to recent surveys carried out by institutes linked to the Brazilian government, almost 85% of the population is concentrated in less than 1% of the territory, causing a great density in certain areas that culminate in serious social and environmental problems. Due to this agglomeration close to large centers, the challenge to achieve sustainable urban planning faces barriers of time and resources, mainly in the waste collection and sewage treatment system. However, always aware that the environmental impact on river and forest springs is out of control.

This research shows the work that was accomplished with a poor community in Brazil, specifically in Belo Horizonte, capital of Minas Gerais about urban solid waste management. It was about an action-research that had been performing in an illegal settlement called *Rosa Leão* - metropolitan region of Belo Horizonte, where around 1500 families lived. With a Non-formal educational approach, we developed skills related with composting for urban agriculture, waste recycling, public health and how

these measures could also improve their quality of life. This approach targeted the Sustainable Development Goals n’s 1, 4 and 11.

With the help of government institutions close to the region, the researcher's work was able to advance towards the development of socioenvironmental skills in a long term and straight approach with 14 families (along the years of 2018 to 2020). Face-to-face and remote workshops were held addressing the various issues related to waste management.

The exploratory study aimed to get to know the reality of the researched context in depth, as well as to promote education aimed at improving the living conditions of the community through actions that reduce environmental impacts through the adoption of good practices.

A prior conclusion was reached, before all data were analyzed, that some families started to provide home gardens, recycling waste, reducing the amount of waste production, and contributing to the improvement of their quality of life.

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How the community of a University is addressing the sustainable Development Goals? The case of Universidad Autónoma de Madrid, Spain

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Abstract

The number of studies on SDGs and education in HEIs is increasing, even though studies about what business faculty members know about SDGs are less common. This study will focus on business faculty staff and students of Universidad Autónoma de Madrid), investigating their knowledge about SDG, their perception of the relationship between SDG and education, their lifestyle and profession. The most important contributions of this study are: 1. The identification of advances and limitations in one particular university faculty's implementation of SDG. 2. Proposed actions for each stakeholder in order to improve implementation. UAM is one of the biggest public universities in Spain that has worked with different stakeholders on implementing SDG (some initiatives are: ecocampus office and SDG Labs – where different UAM staff members, students and collaborators meet to develop strategies and plans in a SDG context). In particular the faculty of economic and business sciences is attempting to align with the 17 Sustainable Development Goals –SDGs- planned for the 2030 Agenda. The research is based on a descriptive analysis of an online survey conducted from October to December 2020, distributed to students (Bachelor (undergraduate) and postgraduate), administrative staff and teaching staff – all participants are from the faculty of Economic and Business Sciences at UAM. The students' questionnaire was divided into four parts: i) previous knowledge of SDGs; ii) development of the individual SDGs in the context of university studies; iii) SDGs and the participants' personal lives; iv) relationship between SDGs and the participants' profession at UAM. The teaching and administrative staff's questionnaire did not include the second part because it was not relevant for their profile. Preliminary results show the teaching staff are adequately trained in SDGs whereas the majority of administrative and service staff indicate that they have not received any formal SDGs training. Approximately half of the students who have completed the survey say they have no knowledge about SDG s– this finding has to be seen in the light of the fact that about a third of this group of students began their university studies less than six months before completing the survey. As for SDGs-related themes in business studies, students highlight the priority of decent work and economic growth, followed by gender equality, whereas the theme that receives the lowest priority is care for underwater life.

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Sustainability in Action: Lessons from the EUSTEPs Online Educators Training on Sustainability and Ecological Footprint

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Abstract

Higher Education Institutions (HEIs) are faced with increasing requests to disclose how sustainability values are being incorporated in all institutions' aspects. The interconnection of class practices with 'real world' experiences seems to be key for academic educators to effectively implement the sustainability concept and practices in their curricula. However, only few educators across different disciplines are properly equipped to teach sustainability in a fun and interactive manner within their courses.

Designed for all educators and students at HEIs, the ERASMUS+ EUSTEPs project - Enhancing Universities' Sustainability Teaching and Practices through Ecological Footprint- has been set up through a strategic partnership among four European universities and an international Non-Governmental Organization to make sustainability practical on campuses by engaging the whole academic community. This paper aims to present and evaluate a pilot course where the traditional "educator-to-student" flow of teaching is coupled with an "educating-the-educators" approach. The course was used to present and discuss the content of a developed EUSTEPs teaching module to educators from EU and non-EU Universities, thus helping to spread the module to a high number of students from diverse universities and fields of education.

The EUSTEPs module, made of 6-to-12 academic hours, can be inserted in any existing course and presents a novel and experiential approach to teaching sustainability foundations and concepts through Ecological Footprint (EF). Based on the outcomes of the pilot teaching in Spring 2020 in the four Universities involved in the project, a short-term joint training entitled "EUSTEPs Module: Educators' and PhD's Online Training" was carried out in September 2020, targeting both academic educators (trained on how to teach the EUSTEPs module in a cross-cutting and interactive way) and PhD students (trained on the EF accounting and how to build a calculator for their HEIs).

34 educators and 20 PhD students from 10 different countries, attended the training. A guideline containing background materials on how some concepts can be transferred by educators to students was developed, and the PhD students also contributed to identify the parameters for the EF calculator for future adaptation to the HEI organizational context. Two sets of questionnaires were developed to

evaluate the expectations before the training, as well as educators' and PhDs' perceptions on the training aspects, the EUSTEPs module, and intentions towards sustainability.

The Findings show that the training was overall satisfying and fully successful in meeting all attendees' expectations. Educators particularly appreciated the diverse materials the module consists of since they significantly increased their intention to teach sustainability and EF concepts based on EUSTEPs module within their courses. Also, PhD students indicated an intention to engage more actively in actions towards sustainability on campus after receiving the training.

The transferability potential of the module – also considering its online set-up – is high and it will contribute to increasing the teaching skills of involved educators. Also, its inclusion in the e-learning environment of the EUSTEPs web-platform allows accessibility by educators from all EU (and beyond) countries in time of COVID-19, hence contributing to continuous progress towards SDG 4, particularly target 4.7.

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Impact of Covid-times on subjective wellbeing of students – in the light of sustainable consumption

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Abstract

The pandemic crisis of 2020-2021 has had significant impacts on consumer behaviour and everyday life of people, affecting their subjective wellbeing seriously. Pandemic-related constraints are partly similar to those of an economic crisis but go well beyond its features, by restricting individual freedom, forcing lifestyle change and threatening well-established habits of consumption and social life. Society is facing a double challenge of changing habitual behaviour – shifting towards more sustainable consumption and adapting to the pandemic situation in a resilient way. Those challenges may support but also fight each other and the question remains: when the troubles are over, are we going to keep our new habits, or we cannot wait to return to our previous consumption habits?

Our research focuses on university master students who visited a course on sustainable consumption in the Fall semester of 2020, getting new insights, knowledge, attitudes and impulses for action towards sustainable consumer behaviour. On parallel, they have experienced the effects of the pandemic on their lives every day, leaving controversial impressions and feelings in them. In the study, we apply mixed qualitative methodology to show the Janus face of this situation. On the one hand, we used the reflective writing technique, to collect and assess students' reflections to their own consumption habits in the light to sustainability. The use of reflective writing in qualitative research lies in its contribution to the trustworthiness of a research study and in its feature to facilitate critical thinking, discover previously unrecognized linkages between theory and practice, actions and impacts, as well as to gain deeper understanding through bringing tacit knowledge to consciousness.

On the other hand, we used the method of participatory system mapping (PSM), to map the causal loops and interconnections between forced changes, triggered by the Covid-19 pandemic and subjective wellbeing. The central research question is how rigid the established habits are and how willing people are to change their consumer behaviour if circumstances dictate. The use of PSM helped focus groups explore the impact of shock events and the adaptation strategies they followed to cope with these effects. PSM was capable of exploring systemic effects while reflective writing showed individual-level emotions and narratives attached to wellbeing and sustainability impact of the Covid-19 pandemic situation.

Keywords: Covid-19 pandemic, subjective wellbeing, sustainable behaviour change, participatory system mapping, reflective writing

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The Representation of Sustainability in Turkish Universities

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Abstract

The purpose of the paper is to examine how Turkish universities represent sustainability in their mission, vision and value statements. The importance of sustainability has been discovered by the corporations and there are many serious and joint attempts to create generations who are sensitive to sustainability. In this wave, universities also have an important responsibility. For example, their curriculums are integrating sustainability focused courses, or sustainability related courses and new sustainability programs. Also students at different subjects are encouraged to work on sustainability projects. There is an attempt to create sustainability sensitive generations. The suggested study is going to analyze the vision, mission and value statements of the Turkish universities on their websites. Three research questions are going to guide the study: *RQ1*: Is sustainability represented in the mission, vision and values of the university? *RQ2:* How sustainability is mentioned in the vision, mission and value statements of the Turkish universities? *RQ3:* Is there a difference among foundation and state universities in terms of sustainability representation? Also differences among regions and the foundation of the universities will be taken into consideration in terms of sustainability representation. According to 2021 data of Higher Education Council of Turkey (YOK), there are altogether 207 universities in Turkey. Of these, 74 are foundation, 129 are state and 4 of these are foundation-vocational universities. The research will be done using content analysis. This analysis will provide us with qualitative and quantitative data. The study may be useful to sustainability research and it may encourage the universities to take sustainability more strategically. Sustainability being integrated into the mission and vision and value statements of Turkish universities is an important initiative.

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Sustainable Tourism for Generation Z: Communication Students' Understanding of Sustainability and Sustainable Tourism

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Abstract

In this study, the Generation Z undergraduate communication students' understanding of sustainability and sustainable tourism was analyzed. Those students that are part of Generation Z, also known as "post-millennials" or the "iGeneration," demonstrate certain characteristics, one of which is that they are comfortable with using technology and social media because they have been exposed to the Internet starting from a very young age. Generational segmentation suggests that what people experience in their early lives can affect their social values, attitudes, and behavior.

Generation Z people describe themselves as thoughtful, loyal, compassionate, and responsible. Previous studies add that these people are passionate about making the world a better place and acknowledge the importance of social issues. Given that sustainable development is considered an important goal for many countries, higher educational systems around the world should play a role in increasing the number of graduates with a thorough knowledge and understanding of sustainability.

Five focus groups were conducted with students from a university in Turkey (3) and the United Arab Emirates (2). This study reflected on these students' personal travel experiences and their observations of sustainable tourism from their domestic and international experiences. Issues in sustainable tourism and opportunities for achieving both sustainability and sustainable tourism were also discussed in these focus groups. The findings offer implications for teaching and learning about sustainability.

The participating students were generally aware of sustainability, but in a limited scope. In sum, Generation Z students, as future travelers, are sensitive to the concepts of sustainability and sustainable tourism, but have not yet internalized these concepts. These students are not entrepreneurs in this respect, that is, they do not waste the water and do not pollute the sea or the environment, but are neither involved in any sustainability campaign nor initiate anything that will influence others. They also expect that along with other major players in the society, governments will play a major role in educating them about sustainability issues in a way that is appealing to them.

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Madeiran public perceptions on marine litter: identifying gaps to design educational strategies

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Abstract

Marine litter, defined by the United Nations Environment Programme as 'any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment' is a worldwide problem with noteworthy environmental, social, economic, and aesthetic impacts. The recognition of the marine debris problem has been increasing over the years, being acclaimed as one of the most meaningful environmental crises of the 21st century. The management framework of the subject encompasses four categories: prevention, mitigation, removal, and behavior change measures. The behavior change actions are stated as the most challenging ones, as 'humanity will never achieve a truly clean marine environment unless there is a fundamental shift in human mindsets and behaviour' (Williams and Rangel-Buitrago, 2019, p. 657). Considering education's role in influencing individuals' behavior, a survey about marine litter knowledge, awareness, perceptions, personal experience, and behavioral intentions of Madeira island inhabitants (Portugal) will be launched.

The main aim is to identify where are the main gaps in order to design educational actions and strategies to promote citizens' attitudes and behaviors in favor of marine litter reduction. To date, a first pilot assessment survey (n=22) has been conducted (during January 2021 and using paper surveys). Most respondents (mean age=35.8 years) were aware of marine litter presence and perceived the sources, associated behaviors, and impacts of marine debris. Perceived responsibility and behavioral intentions were equally gathered, with most of the participants (95%) recognizing that their individual actions are required to tackle the marine pollution problem.

Altogether, the results indicated that the marine litter educational interventions that will be designed and implemented after the survey must focus on the perceptions that respondents have considering the sources of marine litter and in raising awareness about the extent of the problem. Nevertheless, these are preliminary results. The second phase of this study will consist of a large scale online questionnaire that will be generically widespread to the entire Madeiran population via electronic pathways (e-mail, Facebook, Instagram, LinkedIn). After the responses' analysis, future work will consist of the development of educational actions, that will be pointed at different target audiences and evaluated through a methodological triangulation.

Acknowledgments:

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Reference:

Williams, A., Rangel-Buitrago, N., 2019. Marine Litter: Solutions for a Major Environmental Problem. J. Coast. Res. 35, 648–663.

Additional information:

SDG 4 (Target 4.6) + SDG 14 (Targets 14.1 and 14.2)

With the pandemic situation caused by the coronavirus SARS-CoV-2 the focus of marine litter studies will probably suffer a slight alteration, as new items will appear in the ocean and beaches and more single-use plastics and personal-protective-equipment will become to be used and discarded. This change, together with the current state of pollution of the ocean, highlights the necessity of placing marine litter on the podium of the issues that need an urgent and immediate educative approach to raise awareness and promote behavior change action.

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From Waste Management Education to Waste Reduction Effectiveness: A Novel Pedagogical Practice

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Abstract

The amount of human-made mass has surpassed that of biomass on the planet. Excluding few exceptions, the vast majority of this stuff will eventually become waste. Therefore, waste management education has a central role in educating the next generation of sustainability scientists and, unsurprisingly, this topic is generally taught in most circular economy and sustainability-focussed programmes.

However, waste management education does not always translate into waste reduction effectiveness, with assessments varying from exams to coursework, either individual or collaborative. In this paper we present a novel approach to pedagogical practice that combines the theoretical understanding and evaluation of learning objectives with positive environmental benefits. The learners are tasked to pick one action from within each layer of the waste pyramid and implement it in their own lives over a four-week period, monitoring any waste reduction incurred.

In so doing, they learn first-hand the barriers that specific actions pose (e.g. home composting) as well as the opportunities offered by less-thought-of undertakings (e.g. upcycling and re-purposing). Additionally, in having to monitor and report on the environmental benefits of their waste reduction efforts students also familiarise (i) with the latest findings on environmental impacts of products, processing and packaging – thereby supporting their learning with novel scientific evidence; and (ii) with the environmental footprints of different products and materials – thus increasing their sustainability awareness as citizens. Results highlight the overall reductions in waste generation and environmental impacts achieved by the students, the actions chosen by each, and a synopsis of personal reflections on the barriers and enablers that each of them identified.

Uniquely, the prospect of a conference paper has been embedded since the beginning in the pedagogical approach to further strengthen the importance of the work done and the value of its findings. The result is that this paper is co-authored by the professor and some of the students to truly close the loop in the research-teaching continuum. At a time where waste flows steadily grow in every country of the globe (further exacerbated by the single-use products required by the Covid-19 pandemic) this paper contributes to accelerating progress towards waste reduction, and specifically addresses a number of Sustainable Development Goals (SDGs) and their targets: SDG12.3, SDG12.5, SDG13.3, and SDG14.1.

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Lifting children's preference to use bikes for sustainable school commuting: A practice-based approach along different levels of education

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Abstract

Introduction

Sustainable means of mobility are significant for a city's image, spatial order and for creating good quality of life and harmony with the environment (Macioszek et al., 2020). The current COVID-19-related momentum of a changing mobility awareness and behavior among adults concerning the bicycle could serve as a starting point for other societal groups and their everyday mobility patterns, namely children and their way to school. Due to barriers, false myths and path dependencies, however, this requires specific measures and approaches that meet the needs of children and their parents and that focus on changing frames and conditions for the daily use of bikes. In fact, the percentage of children who actively cycle to school has been decreasing in recent years, with negative effects on children's health and development (BUND n.d.; Canters et al., 2010). Our study builds on this by elaborating aspects that promote or hamper children to use bikes for commuting to school.

Method

The study grounds on a practice- and needs-based approach in the further education of children's mobility (Scheurenbrand et al., 2018). Key participants are students aged 10 to 12 years in grades 4 to 6 and different school types (primary and secondary school). We use different theory-based indicators and criteria, data and media formats (on-site, digital) for data collection and evaluation. Multiple methods and approaches are applied based on an empirical-qualitative case study with a pilot school and according to specific groups of participants in the study. This includes fieldwork activities and participant observations, surveys and qualitative interviews with children, parents and other stakeholders.

Preliminary results & discussion

Preliminary results include the participatory implementation of a bike course in the school yard of the pilot school, the elaboration of bike maps, the implementation of teaching units and the associated multi-perspectival knowledge transfer between the topics mobility, environmental and climate protection and health education. The children consolidate their knowledge of the bicycle as a technical, cultural and aesthetic object and extend skills and competencies concerning motor activity, sustainable mobility and social aptitudes.

We expand existing research on mode choice related to primary school commuting (Kelly & Fu, 2014), by testing it against the peculiarities of the German school system and extending it to the specific context of secondary schools. The student-centered approach allows to derive (success) factors and

measures that determine the perception and the decision in favor of cycling as a means of transport for everyday school commuting.

Contributions to SDGs/Targets

The research contributes to **SDG**/*Target* **3**.*D*, **4**.*1*, **4**.*7*, **4**.*A*, **9**.*1*, **11**.*2*, **11**.*3*, **11**.*7*, **12**.*8*, **13**.*2*, **13**.*3*, **17**.*14*, **17**.*16* and **17**.*17*.

Contribution to the overall conference topic

One of the most vulnerable groups in society is addressed, namely children and young people, who during COVID-19 have been severely exposed to fragile conditions in their daily routines. Focusing on strengthening children's sustainability competencies in a participatory way could elevate the negative impacts of the crisis.

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Education for Sustainable Development in Germany: Aims and Scope of the "ESD Competence Centre"

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Abstract

Education is considered to be a key element in shaping a sustainable world. This assumption is especially formulated in the multilateral political program on sustainable development that began with the Agenda 21 and continued with the adoption of the Agenda 2030. In connection with the current Agenda the program "ESD for 2030" aims at the realisation of the 17 SDGs and emphasizes the key role of Education for Sustainable Development (ESD) in that process. In order to implement sustainable development as a guiding principle one main objective of those programs was and still is the promotion and structural anchoring of ESD in local educational landscapes.

Against this background the project "ESD Competence Centre Education – Sustainability – Municipalities" (original name: "BNE-Kompetenzzentrum Bildung – Nachhaltigkeit – Kommune") funded by the Federal Ministry of Education and Research aims at identifying and embedding contributions towards ESD at a regional and local level in Germany. For this purpose, about fifty model municipalities with different levels of ESD related efforts, i.e., municipalities i) that rather have implemented ESD into their local structures, ii) that rather have implemented SD into their local structures, and iii) in which rather individual stakeholders have launched isolated (E)SD initiatives, will be identified and won for cooperation. In parallel, various empirical approaches will be pursued, including quantitative methodologies for the detection of supply structures and structural conditions in the municipalities, and qualitative case studies. The empirical part of the project will build on different theoretical considerations, for example on educational governance theory and network theory. These empirical findings are supposed to serve to support the municipalities in building, implementing and systematically developing further local and regional ESD structures. Furthermore, the process support will draw on existing structures, processes, measures and products provided by the municipal educational landscapes and adjust the offers accordingly. Hence, in order to optimize local processes regarding ESD different formats will be used and combined.

In this contribution particularly related to SDG+Target: 4.7 we would like to present the status of the project and its approaches. Moreover, we will especially consider the question of how the implementation of ESD is affected by the recent COVID-19 crisis, for instance in terms of economic and temporal considerations in local contexts or networking within and between actors of different branches and municipalities. Therefore, we will discuss potential effects of for example the restructuring of workforce, the closure of (non) formal educational institutions or the limitation to virtual communication that may amend the political priority of ESD or hinder its implementation in general.

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Immersive learning as an answer of teaching sustainable development goals in relation to the sustainable paradigm of education in higher education

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Abstract

Postulating a balanced paradigm of education in universities is an attempt to adapt the teaching model to new requirements shaped by the changing reality. We live in a time where distractions are ubiquitous, so experience learning and personalized learning are ways to support adult education. The COVID 19 pandemic requires universities to answer the question of how, in a constantly changing educational landscape, existing human and material resources can contribute to the effective transformation of classical education into online education using virtual classes and other key tools.

The previous educational paradigm of the instruction paradigm, whose aim was to transfer knowledge from the teacher to the student, is slowly being replaced by the learning paradigm, which places emphasis on stimulating the discovery and construction of knowledge by the student himself in accordance with the idea of centered learning, SCL. The student-centered learning concept (SCL) can be particularly relevant to the development of soft skills. Orienting the didactic process to the individual needs and capabilities of students in order to activate them, through involvement in building their own knowledge, will contribute to the development of the learning paradigm and the holistic preparation of the student to enter the labor market. Based on the conducted literature and empirical research, the authors state that the use of hard and soft skills along with the implementation of immersive learning in teaching sustainable development goals allows for achieving the desired attitudes among students (Hornik S., Thornburg S., 2010; Yusof AA, Adnan AHM, Kamal NNM, Kamal MAM, Ahmad MK, 2019; Mishra L., Gupta T., Shree A., 2020; European higher education in the Covid-19 crisis, 2020; Barbier EB, Burgess JC, 2020; Chłapek K ., Krajewska S., Jonas K., 2019)

The aim of this study is to show the advantages and disadvantages of immersive learning as a method of teaching the goals of sustainable development in the perspective of the sustainable paradigm of higher education education. The basic research methods used to achieve the research goal are surveys and literature studies. Based on the statistical analysis, deductive and synthesis methods were used to formulate conclusions. The conducted research shows the necessity to modify the SDGs education model in order to adapt it to the requirements of an electronically equipped society. At the same time, the need to accelerate the implementation of the SDGs was identified. COVID-19 has been a huge challenge for higher education. Universities should learn from this challenge to improve learning and teaching for the future.

2b Educating for sustainability

Full papers

Mapping sustainable development goals on university events

New data sources for the analysis of university sustainability

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Abstract

The Sustainable Development Goals (SDGs) of the United Nations have emerged as an index of an organization's commitment to sustainable growth. A need to measure the outcomes related to SDGs in businesses, countries or citizens' initiatives has also been growing in recent years. Universities' teaching is not limited to lectures from different subjects of a specific degree. Universities also organize many events that can be considered part of the learning experience: workshops, debates, meetings, expositions, performances, etc. A very interesting way of approaching the real commitment of universities to the SDGs is, precisely, the analysis of the events that are really happening on campus. Their study and classification are also an excellent way to prove publicly, especially for university rankings, the real commitment to sustainable development. In this proposal we explain how to map SDG related events in the universities with the use of Big Data techniques. To prove the interest and measure its efficiency, the method has been applied to five top world universities according to QS and THE Rankings. 20.825 events were analyzed, and 1,418 events considered as connected with SDGs.

Keywords: university sustainability, sustain development goals, rankings, big data analysis, universities websites.

1. Introduction

In recent years, a flourishing field of research has emerged in Higher Education, focused on how universities contribute to sustainability and how to measure this impact. As De la Poza et al. (2021) have explained, more and more universities need key performance indicators to measure their sustainable impact and complement others such as those in the marketing area. Besides the rich contribution from Academia in this field, several initiatives to foster and measure sustainability in the University have emerged -like the *STAR* rating-, especially after the proposal, in 2015, of the Sustainable Development Goals (SDG) from the United Nations. SDGs have been openly proposed as

data-driven and data-based projects, in which, for every objective, a set of specific indicators is proposed.

Other initiatives have also arisen, born outside the academic research field and with a highly applied approach. An example is the document "Getting Started with The SDGs in Universities: a Guide for Universities, Higher Education Institutions, and the Academic Sector", produced by the *Sustainable Development Solutions Network* (SDSN) – Australia/Pacific in collaboration with the *Australasian Campuses Towards Sustainability* (ACTS). The text has offered a clear way forward for the sustainable development of any university. Previously, more than 300 universities constituted the Higher Education Sustainability Initiative network, and the International Sustainable Campus Network has published annually a report about the best practices in sustainability, De la Poza et al. (2021). Other more regional proposals have been added to this type of initiatives. In Spain, the *Sustainable Development Spanish Network* (*Red Española para el Desarrollo Sostenible*) has published the report "Cómo evaluar los ODS en las Universidades" (How to evaluate SDGs in the Universities) -REDS (2020)- which offers a framework of indicators to measure the sustainable performance of any university. The network has also published reports about teaching and how to improve the presence of sustainability in study plans, Miñano, García Haro (2020).

This concern for sustainability in High Education implies a change of the current university model of excellence. According to the traditional model, a good university must perform essentially two tasks: it teaches its students well and conducts research with international impact and through collaboration. A new paradigm arises from the social demand for sustainability: one that adds the dimension of sustainability to teaching and research excellence already present in the traditional one. It is understandable that rankings providers and other institutions, which in last decades have been measuring excellence in Higher Education, have reacted to this new trend. The first initiative came from the University of Indonesia as the *GreenMetric Ranking*. The ranking has four groups of indicators: three areas dedicated to a more operational campus management dimension, and the last one to sustainable research and education. The ranking does not measure SDGs.

However, the main revolution in the ranking panorama has been the *Times Higher Education Impact Rankings*, published for the first time in 2019 and positioned as reference in the measure of sustainable impact in the university. The ranking, developed with Vertigo Ventures, focuses on the analysis of the contribution of the universities to the SDGs. Maybe because its methodological complexity and its new focus, the ranking obtained low university participation in the first two editions. But, in the last edition released, in 2021, the ranking has surpassed these difficulties and it has obtained as many participants as other global rankings.

One of the fundamental principles of this impact ranking is the connection between institutional commitment and transparency, also a key element of the SDGs. This link responds to the new conditions

of the digital ecosystem: publishing a project in a website is considered a guaranty of the institution's commitment to it. Once published on the corporate website, the project is open to the public scrutiny. Now citizens have tools not only to examine the description of the projects, but also to compare with other from institutions and protest publicly if the projects are not developed as they think they should. Governments, future students, or any citizen can now easily demand that a university delivers on the promises made on its websites, causing a reputational crisis if their opinion is not heard. Furthermore, the increased transparency demanded by society obliges universities to offer, whenever possible, open data about the activity and people affected by the sustainable projects. This idea drives the evidence scoring system in the *THE Impact Ranking*, Times Higher Education (2021).

Therefore, universities' websites play a crucial role to show how universities are approaching sustainability, as Dade, Hassenzahl (2013) and Ott et al. (2016) have underlined. University corporate websites are being used "to share information and engage the campus community in sustainability efforts", Amey et al. (2020). In this task, the websites have a lot of content to demonstrate their commitment to sustainability, such as blogs, user feedback, sustainability reports, surveys, volunteer opportunities, newsletters, social media references, etc.

However, there is a content that has been neglected: the calendars of events published in the university's websites. Among all contents published on the university's websites, the events published have an important role in the websites, appearing on 42% of the main page of the universities and being one of the ten types of contents more visited on them, Groneman Hite, Railsback (2010).

This is not the first time that events have been proposed to evaluate a dimension of HE. QS uses university events held between universities and companies to assess the employability of participants in its *QS Employability Rankings*. *UI GreenMetric*, in the Education and Research area, weighs sustainable events to assess a compromise with the issue, although they don't offer a clear criterion for distinguishing a sustainable event from one that is not, UI GreenMetric (2021). Finally, THE asks the universities to prove, as a measure of their work on the SDGs, that they have organized events related to them. In these three cases the university must accredit the events it has organized, sending evidence, but they are not collected from public sources by the ranking.

We believe that the university events offer relevant information about the actual activity (not only the promised or commercially planned one) of the university. A guarantee of the reliability and correctness of the website's events to represent the real activity of the campus is that university's internal stakeholders are attentive to them. They use them to keep up to date with what it is happening on campus. On the other hand, events are collected in the events calendar, leveraging the barriers imposed by university decentralization, one of the biggest issues according to Dade, Hassenzahl (2013), to communicate and develop sustainability in the university context.

Therefore, this paper discusses the use of events calendars of university websites to analyze sustainability on universities. It proposes a new data source to study this dimension in the Higher Education scheme. The objective is to show techniques for the data extraction, analysis, and critical thinking about them.

We also intend to connect events with SDGS. The classification of texts related to the SDGs has interesting previous attempts but, until now, the efforts in HE has focused on classifying academic research texts according to their connection with the SDGs. Thus Körfgen et al. (2018), with similar techniques, used keywords to classify Austrian research papers. More relevant have been Scopus' work to identify SDG related research. As published by Jayabalasingham et al. (2019), Scopus's system is far more complex, using their own dictionary of words, combined as positive and negative filters. Times Higher Education would adopt this methodology to evaluate research for its Impact Rankings.

2. Methods

As proof of concept, it was proposed to apply the event extraction and classification methodology to all three-year events (2017-2019) of the first five top universities of the THE University World Rankings (University of Oxford, California Institute of Technology, University of Cambridge, Stanford University and Massachusetts Institute of Technology). The decision to stop collecting data in 2020 is justified by the alteration of COVID: many universities have closed their campus and cancelled face to face events. This proposed temporal limit prevented obtaining information in one case, as will be considered later. The selection of these five universities is especially relevant because none of them, except for MIT is in the *THE Impact Rankings*, and none, apart from Oxford, participates in the *UI GreenMetric Rankings.*

It was necessary to overcome two major challenges to analyze university events. First, there is no public data frame, no repository, that offers this information. An extraction system was needed. Second, the events are not *pre classified* as "sustainable" or connected with SDG, so a classification system had to be built. As we will see, the large number of events considered made a manual classification of the data impossible.

Two procedures were developed to surpass these difficulties:

A.) Scraping university events

The procedure to obtain the information was scraping, that can be defined as:

> "Scraping, to state this quite formally, is a prominent technique for the automated collection of online data. It is one of the most distinctive practices associated with current forms of digital social research, those that are marked by the rise of the Internet and the new ubiquity of digital data in social life". Marres, Weltevrede (2013)

For the extraction, the language code used was Python, with the help of *Beautifulsoap* and *Selenium* modules. Almost all universities have an "Events Calendar" on the university website that offers all the events organized by day, week, or month. From the calendar, the user can access the events pages, where a detailed description is displayed (title, description, place of the event, time, etc.). The extraction procedure was divided in two parts: first, the calendar had to be scrolled down through the days and, on each page, the events' titles and the URL were extracted. In the second part, with the list of URLs from the first process, the relevant information for the analysis (title, subtitle if present, description and date) was retrieved. It was necessary to program a script for each of the five universities: the event calendar and the event pages information structure were different in each case, see an example of the code in De Lorenzo (2021).

Harvard University presented a special case. Its calendar does not collect events prior to February 2019 (they recently migrated their system to a new one managed with Trumba). We recovered all events from that date to 2021, assuming that it is a very different reality because COVID19. We will mark this data as 19-21 to express the difference.

The result was a data frame with all the events of the universities, 64.702. A reduction process was needed to obtain only unique events: because the access to the events is from the calendar, many of them are repeated (the same event can occur more than once). Though it could be interesting considering the repetition of events as a sign of their relevance, the results would be distorted by some events repeated weekly or daily. Hence, of events drawn, the number was dropped to 25.943.

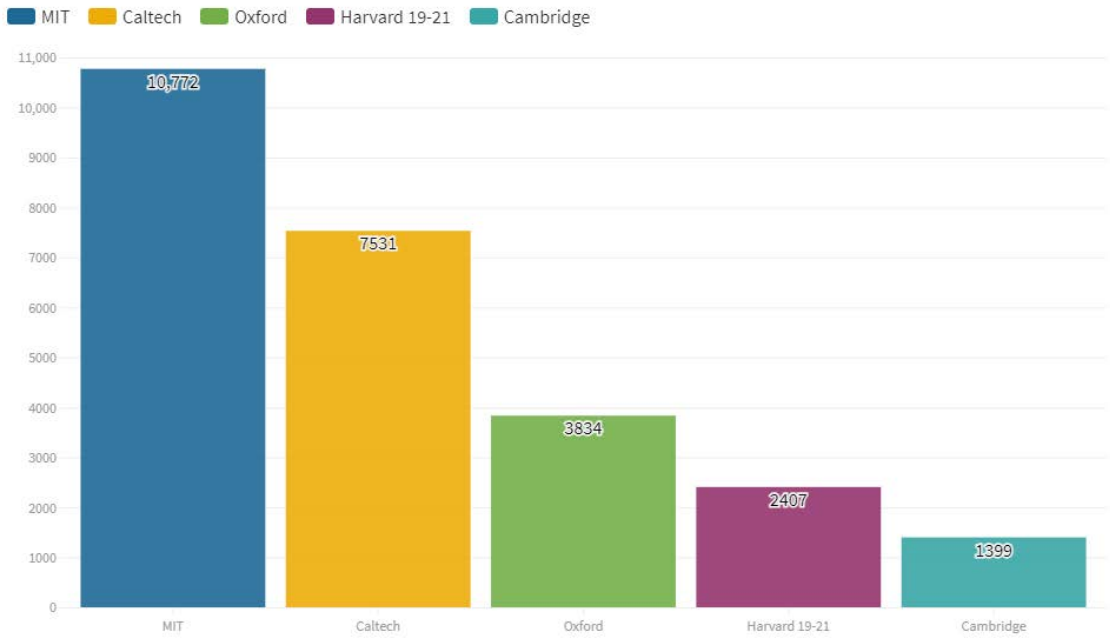

***Figure 1**. Distribution of the events by University*

B.) Classifying the events

Universities do not classify their events as "sustainable" and, if they did, the procedure and limits of the definitions used would be a matter of discussion. In addition, the objective was to classify the events by their link with the SDGs. The technique used by Körfgen et al. (2018) was adapted by using a bag of words to classify, identifying the frequency of selected words from a list in every event. In this phase, only the "Description" field was used for the word frequency analysis. The words used, that make it possible to detect an ODS, were extracted from the "Compile Keywords for SDG Mapping" from the document "Getting Started with SDG in the universities", SDSN Australia/Pacific (2017). Some other words were added (like the acronym SDG or other variations), so the list increased to 892 words. The list from the Australian universities does not consider the SDG 17, so this goal was not examined for this work.

A Python script allowed to search for the presence of the keywords selected in the description of the event -see GitHub in De Lorenzo (2021)-. The 892 keywords were found in the event's descriptions 66,234 times.

***Figure 2**. Words that appeared more than 100 times (total=74)*

In the procedure, for every SDG, the description of every event would be searched for the list of keywords of the SDG. The total positive findings would be counted and stored. The number of events and the frequency of words found in total are presented in Table 1.

***Table 1.** Events by the number of words presents in their description.*

Number of present words	Events
1	12,118
2	3,662
3	1,314
4	515
5	163
6	61
7	22
8	9
9	4
13	1

It was necessary to decide the minimum threshold beyond which an event would be considered SDG related. A list of 50 events were examined and the minimum of three words was decided: the events with two words had many false positives and events with three words did not have too many false negatives. The results can be consulted in the *Google Data Studio* provided in http://bit.ly/top5sustainablevents, where different threshold can be used to filter the data.

3. Results and Discussion

For the threshold of three or more word coincidences for the SDG's keywords, only 1,632 events were considered as connected with SDGs.

Table 2. *Sustainable events from the top five global universities*

	Sustainable events	Total events	% of events
Caltech	270	7,531	3.59%
Cambridge	111	1,399	7.93%
Harvard 19-21	279	2,407	11.59%
MIT	747	10,772	6.93%
Oxford	225	3,834	5.87%

Based on the results shown in Table 2, around 6,29% of all events in the top five global universities relate to the SDGs.

Table 3. *Sustainable events from the top five global universities, by SDG and University*

SDG	Caltech	Cambridge	Harvard 19-21	MIT	Oxford	Cases	% of total
SDG 01	1	3	14	14	7	39	1,52%
SDG 02	4	10	9	25	10	58	2,26%
SDG 03	32	15	40	41	24	152	5,91%
SDG 04	12	2	15	35	11	75	2,92%
SDG 05	4	10	24	22	18	78	3,03%
SDG 06	15	1	7	34	3	60	2,33%
SDG 07	47	2	10	93	10	162	6,30%
SDG 08	26	29	21	104	50	230	8,95%
SDG 09	111	28	23	272	51	485	18,86%
SDG 10	26	40	124	165	75	430	16,73%
SDG 11	31	11	36	144	22	244	9,49%
SDG 12	37	5	11	82	7	142	5,52%
SDG 13	32	5	22	89	17	165	6,42%
SDG 14	7	1	0	36	3	47	1,83%
SDG 15	11	8	5	20	12	56	2,18%
SDG 16	9	12	49	47	31	148	5,76%

An event can qualify for more than one SDGs, so the sum of the columns of the Table 3 ("Cases") are greater that the Table 2. In any case, even considering other different thresholds that would increase the number of events, sustainable events in these universities are a small part of all events organized in their campus. Some SDGs have a higher presence in events, like SDG 09: Industry, Innovation &

Infrastructure, with 18% of all events detected or SDG 10: Reduced inequalities, with 16% of all of them.

4. Conclusions

The methodology described in this paper offers a way of retrieving and mapping university events. We consider that it could be a relevant tool for exploratory analysis on sustainability or other university dimensions if other bags of words are developed. Events are an interesting, meaningful, open and accessible data source.

One relevant benefit of the methodology is the time needed to retrieve and analyze the data. Once prepared (depending on the structure of the website and its CSS, the preparation time is not more than 20 minutes), for one university the process took less than 60 minutes of running code. In a short time, any university can obtain an exploratory but useful analysis of its activity, without the need of the intervention of IT Services to retrieve the data. It is a process that greatly reduces time but is not definitive: there is a need to apply critical thinking to the results and review events to detect errors, delete repetitions and remove false positives. The process could be used to collect and present evidence with the support by a clear methodology, for the UI Green Metric Ranking or the THE Impact Rankings.

Of course, while useful for exploratory studies, the methodology can be improved in several ways. First, keywords can be normalized using techniques of *stemming* and *lemmatization* (adding to the keywords other options, like, if we had the word computer, comput -stemming- or computation/computing/compute -lemmatization-). This technique could be very useful in languages like Spanish, that have masculine and feminine forms in adjectives or nouns.

Secondly, the methodology could gain more sensitivity -avoiding false negatives- (maybe losing part of its specificity -avoiding false positives-) if the keywords were given a value according to their importance in detecting an SDG. To develop this idea, a selection of events would have to be taken apart (maybe one thousand), classified according to the SDG and then frequency of words should be measured in their descriptions. New keywords could appear in this analysis. In the end, this process could allow the elaboration of some machine learning algorithms to classify events according to each SDG. This procedure would be similar to the one used by Scopus to develop their methodology to detect SDGs in research papers, see Jayabalasingham et al (2019).

Third, a common threshold for all SDGs was selected for this study. However, selecting an SDG-specific minimum word limit would likely improve detection accuracy. Finally, the last way to improve

the event classification could be increasing de bag of words used for the analysis (now more than 800), perhaps by adding the words used by Scopus.

This research opens new perspectives, with both horizontal and vertical possibilities. Horizontally, it would be interesting to extend to other universities the methodology and make comparative studies, by country or region. Also, a temporal study could be very interesting to evaluate, for example, the effect of a sustainability plan that intends to impact the cultural and social aspects of a university. Another possible study is, when face to face activities return to our campus, to compare the pre-COVID and post-COVID degree of sustainability.

Vertically, it could be very interesting to compare this information with other data sets. The information from the THE Impact Ranking could be contrasted with the result of this methodology. Also, using the methodology of Scopus to identify research related to the SDGs, the correlation between the two data sets could be compared. Finally, the classification method can be extended to other types of data, like courses descriptions or news from the university websites, and make possible the building of new information sources for the sustainability analysis of Higher Education.

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Training in purpose: a route to Corporate Sustainability

Evidence from a multinational service company

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Abstract

Today, society demands that companies go beyond economic development and contributes also to the social and environmental sustainability. To achieve these objectives, academics, consultants, and companies have called for a focus on the organizational purpose. To be fully effective, this organizational purpose must be shared and lived by workers. However, workers only live the organizational purpose when there is a connection between the organizational purpose and their personal purpose. This is why some companies are developing purpose trainings. These trainings facilitates that employees reflect on their personal purpose and thing how they can connect it with the organizational purpose. The aim of this article is to identify the key aspects that makes a purpose-based training program successful. Through a concept mapping technique with trainers and participants of a multinational service company, we identified 59 actions that lead to the course success. The concept mapping also grouped the actions into three groups: Course Didactics, Emotional Atmosphere, and Finding your Purpose. The results were validated with an expert panel than debug and prioritized the actions. We discuss the final selected actions in the framework of other purpose courses for managers and we provide theoretical and practical improvements.

Keywords: Purpose Training, Corporate Purpose, Corporate Sustainability, Purpose Implementation, Concept Mapping

1. Introduction

Even before the Covid-19 crisis, purpose was one of the topics of the moment both in research and inside companies (Hollensbe et al., 2014; Levillain & Segrestin, 2019; Mayer, 2020). Experts also acknowledge purpose as one of the assets to care in companies in the pandemic economics (Fink, 2021;

Paine, 2020). This is because several benefits come from the living of purpose inside companies (Alegre et al., 2018). For example, research shows that having a corporate purpose has a beneficial impact on strategy and leadership (Rey et al., 2019), creates a shared identity inside the organization (Quinn & Thakor, 2018), and enhances the adaptation capacities of leaders (Cross et al., 2019) among other benefits.

Moreover, and because of the prosocial aspect of corporate purpose that goes beyond the economic benefit (Hsieh et al., 2018), it seems that corporate purpose also enables corporate sustainability (Henderson, 2020). This has been shown in the previous years with appeals from economic forums and corporate lobbyists to shift the business paradigm from shareholder-oriented to purpose-driven stakeholders-oriented firms (Business Roundtable, 2019; World Economic Forum, 2020). In addition, several companies are changing their purpose statements to include sustainability issues (Ahuja et al., 2019; Laszlo et al., 2020). Purpose is therefore an interesting enabler of corporate sustainability (Bastons et al., 2020).

We have seen that corporate purpose has certain advantages. However, a purpose statement alone is not enough to achieve results (Bartkus & Glassman, 2008), as it has to move from a mere declaration to the whole company being articulated around purpose (Cross et al., 2019). Purpose must be found in strategies, performance measurement systems, leadership decisions and in stakeholder relations (Rey et al., 2019). The role of employees is particularly relevant, since the success of purpose-driven organizations depends on them and their identification with purpose (Quinn & Thakor, 2018).

The process by which corporate purpose ceases to be a motivational statement posted on the wall and becomes lived by employees is known as purpose implementation (Lleo et al., 2021). Previous research has shown that this implementation depends on three issues: the knowledge of purpose that allows for better decision making (Gartenberg et al., 2019), the internalization of purpose as one of the greatest motivations (George, 2004), and the contribution employees make with their work to that organizational purpose (Quinn & Thakor, 2018). Therefore, the implemented purpose is more powerful than the stated one because it involves the reasoning, emotion and action of employees (Lleo et al., 2021).

A fundamental aspect for the correct implementation is the example and the words of the leaders at all levels of the company (Carton, 2018; Quinn & Thakor, 2018). They are the ones who must enable their employees to contribute to the organizational purpose (Carson et al., 2007; Cross et al., 2019), and it is usually with them that the transformation process towards purpose-driven organization begins (Craig, 2018). There is extensive literature and courses on how to train managers in purpose. In these courses, it is first proposed to find the personal purpose and then join it with the organizational purpose (George et al., 2008). Several specialized consulting firms offer courses to find this personal purpose among managers (George et al., 2008; Kofman, 2018; Leider, 2008; McLeod, 2016).

However, recent studies show that this tendency to focus on managers has led to a disparity between the purpose implementation among managers and the rest of the workforce (Dhingra et al., 2021). It is important, therefore, that companies connect the personal purpose of all their employees with the organizational purpose in the way they train their managers (Malbašić et al., 2018; McLeod, 2016). Some authors state that this is the main function of the purpose-driven leaders (Kofman, 2018), but they do not present how to do it. Indeed, there is not much published evidence on purpose at work training courses for employees.

Given the lack of research, we decided to look for companies that had training programs for employees. This inductive approach is nothing new, since in the most cutting-edge topics it is often the case that practitioners are sometimes more advanced than researchers and the latter are the ones who have to gather this experience and propose new knowledge from this experience (Trochim, 1989). To do this, we first selected a company that has been providing training courses on purpose to its employees for more than three years. After a detailed study of the training course, we selected a varied group of participants to carry out a concept mapping with them. This method, explained in section 2, allows an individual to give his or her vision within a group (Windsor, 2013). When all the group's visions are collected through quantitative and qualitative methods, new knowledge is generated (Berg et al., 2018). In our case, we aim to find the most important factors of a training course in purpose.

2. Methods

Concept Mapping is a mixed method that generates frameworks based on group participation (Berg et al., 2018). Developed by Trochim (1989), concept mapping is capable of eliciting common knowledge (Windsor, 2013). As the topic of training in purpose is vastly unexplored, we have considered that Concept Mapping would be the appropriate method. This method relies on five steps, which we will follow in this section to finish with the presentation of the Concept Mapping results.

The first step is the *Participant Selection and Preparation* of the study (Windsor, 2013). Once we had the company's approval, we created a steering committee consisting of the research team and the two people responsible for the company's training as recommended in this method (Berg et al., 2018). This committee made the selection of participants, seeking the widest possible perspectives on the training course (Windsor, 2013). The committee chose eight people who ranged in their responsibilities from General Manager (1), area manager (2), trainers (3), and front-line employees who had received training (2). For the preparation of the study, the steering committee proposed to focus on answering a single question to stimulate the first brainstorming session (Windsor, 2013). The question that was going to be asked in the second phase to the participants was: *which aspects of the training course in purpose have the most impact?*

The second phase is the *Generation of Statement Pool*, which is done through personal brainstorming. (Windsor, 2013). We presented the pre-established question to the participants and asked if they understood and knew what the objective of the brainstorming was (Trochim, 1989). Blank sheets of paper were then handed out for them to write down actions they thought answered the question. We indicated that there was no limit to the answers and that they did not have to judge whether those actions had a major impact or not (Lleo et al., 2017). The total number of sentences generated by the eight participants exceeded one hundred responses. We proceeded to a participant-by-participant reading aloud, being able to decide if any action had already been mentioned previously and could therefore be eliminated. Other participants could make suggestions, but the decision whether or not to include the phrase in the final pool was entirely up to the writer (Berg et al., 2018). On later stages the actions could be removed but this first brainstorming session involved less discussion. The final set consisted of 63 proposed actions, which we numbered for better identification in the quantitative analyses. The totality of the actions can be found in the results section.

The third step is *Statement Structuring*. It seeks to establish a relationship between the sentences generated in the previous step, as well as to rate the importance of each of the sentences (Trochim, 1989). For this purpose, we printed 63 cards for each participant with the sentences and distributed them so that the participants could assign each sentence an importance from 0 to 10 and group the cards according to their own consideration (Windsor, 2013). We explained that two conditions had to be met: that a sentence could only be in one group, and that the minimum number of groups was 2 and the

maximum was 62. We then perform the combination of results through two steps (Trochim, 1989). We made eight square matrices of 63 rows and 63 columns in which we marked with '1' those sentences that the participant in question had grouped together and with '0' those that he or she had not put in the same group. Second, we combined the eight matrices into a single combined group similarity matrix (Trochim, 1989). This matrix counted how many people considered these two phrases to be grouped together. Therefore, the values within the similarity matrix ranged from 0 (if no participant had grouped those two sentences) to 8 (if all participants had grouped them). For each sentence we also extracted the mean importance by taking the arithmetic mean of the eight participants' scores (Trochim, 1989).

The fourth step is the *Multidimensional Scaling and Statement Presentation*. For this step you can use statistical software such as SPSS, which we used (Windsor, 2013). First, we perform multidimensional scaling (Davison & Sireci, 2000), which has as outcome a map in which it presents the phrases as points with greater proximity when the value in the similarity matrix was higher (Trochim, 1989). We also performed a hierarchical cluster to determine the number of groups in which to group the sentences (Romesburg, 1984; Trochim, 1989). We use a dendrogram in order to better identify the number of groups. We presented this dendrogram to the participants and reached a consensus solution on how many groups there should be.

Finally, the last step is the *Interpretation* of the groups that have appeared through the previous steps (Trochim, 1989). We did this in a new session with the participants in which we gave them each a list of the phrases and their final grouping. We asked them to individually assign a name to the groups and then the eight participants discussed which name was the most appropriate for each group (Lleo et al., 2017). They were also allowed, as an exceptional measure, to change a phrase that they felt did not belong in their group (Lleo et al., 2017).

In addition to the concept mapping, we conducted a panel of experts for validating, debugging and reducing the results. We contacted seven experts from the business world (3), consulting (2) and academia (2), all of whom were familiar with this specific training program. We sent them the actions and groups of the concept mapping and asked them four questions for each action: if the action was well written, if they would eliminate it because it was duplicated, if they would change the group where the action was; and, finally, the action importance from 0 to 10.

3. Results and Discussion

We wanted the eight participants of the concept mapping to answer the following question: *which aspects of the training course in purpose have the most impact?* After a brainstorming session, participants came up with 63 different actions. The participants grouped these actions according to their criteria and these groupings were joined together in a similarity matrix.

To know the number of groups into which to divide the actions we performed a hierarchical cluster statistical analysis (Figure 1), which yielded three groups of actions.

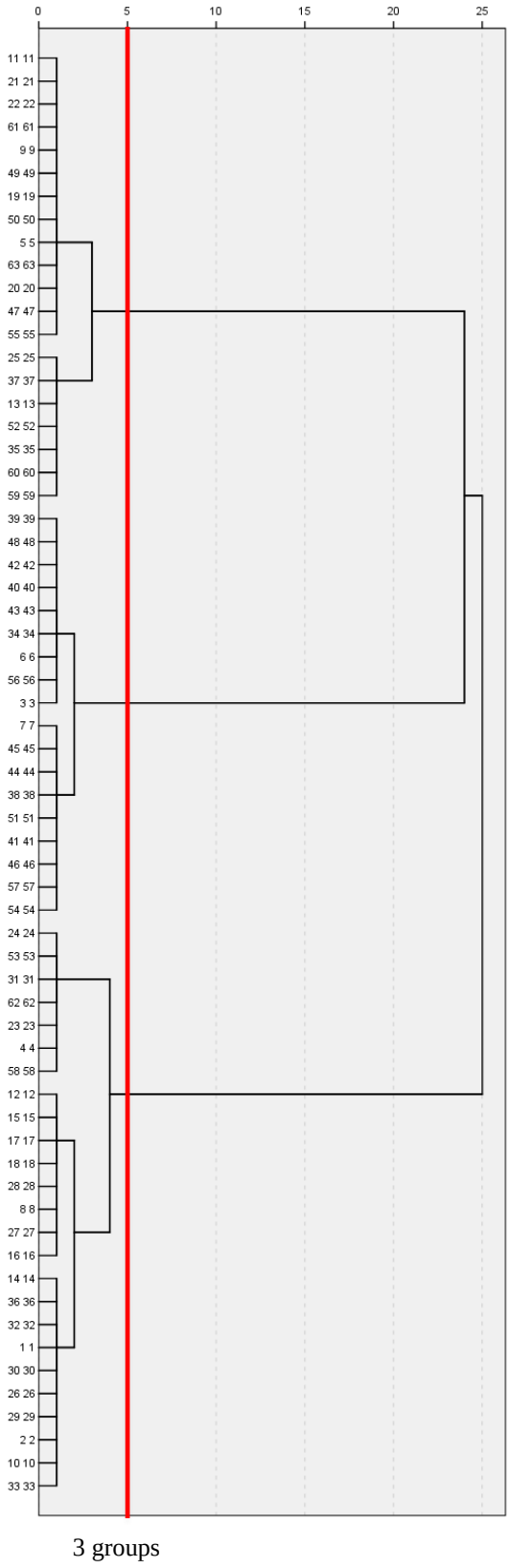

Figure 1. *Dendrogram outcome of the hierarchical cluster operation.*

We used multidimensional scaling to create a map of points. In that dot map (Figure 2), each dot represents a statement, and closer proximity between dots indicates that more participants thought those

two statements were related (Windsor, 2013). Therefore, we presented the dendrogram (Figure 1) and the dot map (Figure 2) to the concept mapping participants for their interpretation.

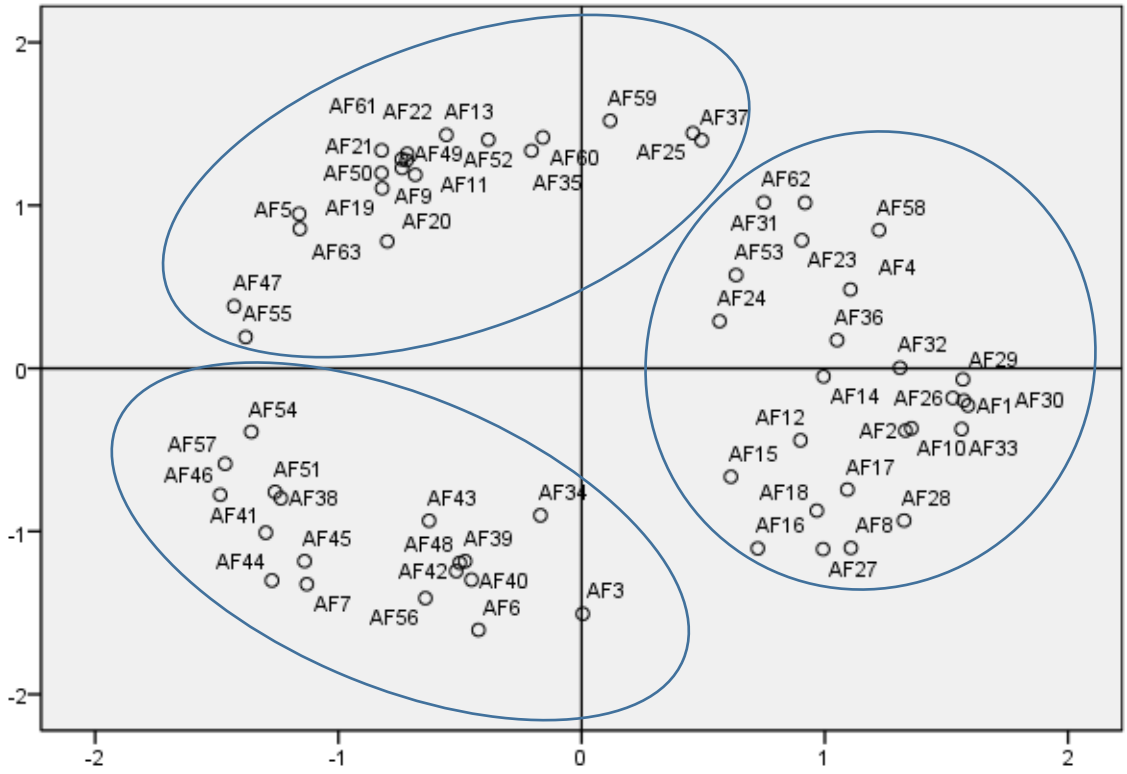

Figure 2*. Concept map of actions (Euclidean distance) that enhance the training in purpose. The circles represent each one of the dendrogram groups.*

The participants chose the names and definitions of the three groups:

- Group 1 – Course Didactics. Care for the contents, of the setting, and of the facilitator with the aim of making the attendees feel like the protagonists.
- Group 2 – Emotional Atmosphere. Openness and trust in the room that facilitates the exchange of feelings.
- Group 3 – Finding the Purpose. For attendees to discover their purpose and contribution within the company.

We then asked seven corporate purpose experts to participate in an expert panel to evaluate these results. The experts ratified the groups and definitions and also made minor changes to the actions such as rephrasing them or changing the group of few actions. Four actions were eliminated due to similarities with others, leaving a total of 59 actions, which are listed in Tables 1, 2 and 3.

We start with the actions of the first group, Course Didactics (Table 1). This group presents a total of 24 actions and refers mainly to aspects of the course that are provided by the organization.

The figure of the facilitator takes on special prominence, both in terms of the facilitator training capacity (A1), and the facilitator communication skills that adapt to a wide variety of audiences (A32, A28, A62, A33). Likewise, the participants mentioned the facilitator listening skills (A15, A30). This corresponds with the indication of some authors that personal purpose emerges from a conversation rather than a lecture, and that this conversation is a demanding one (Craig, 2018). George et al. (2008) comment that, while the listening skills are essential, it is also necessary to transcend the conversation of everyday issues. This may limit the number of participants, as the facilitator must be able to speak to each of the attendees, and it also shows that the facilitator must have experience and knowledge of the company. The ability to explain the corporate purpose is also important to provide the necessary clarity that leads to purpose knowledge, one of the three dimensions of purpose implementation (Gartenberg et al., 2019; Lleo et al., 2021).

It is also important in this training that participants see that the company's management is committed because executives attend the course (A26, A29). The commitment of managers, especially the C-board, to training on purpose has very positive effects on purpose implementation (McLeod, 2016), and authors point out that these levels are the ones that need to show the most coherence (George, 2004). Another actions are that the company generates a trusting environment through details such as free food available (A8, A27). Food is not explicitly mentioned in the literature, but it is important as a sign of the company's commitment to the course, which is more important (Kofman, 2018).

The concept mapping participants highlighted that the course is participatory and dynamic (A17, A12, A4, A16), and that it presents a novelty because of its location and the variety of attendees (A3, A18, A10). Variety is important because, once the personal purpose is discovered, seeing that people from different locations and functions can contribute to it leads to a powerful effect (Leider, 2008; McLeod, 2016). In fact, Kofman's (2018) consulting work is based on making the point that the main job of each worker is to contribute to the company, and how this is best observed is with the comparison of different positions (p. 16).

Finally, we also found that attendees want to share their feelings, experiences and have a voice in the conclusions of the course (A14, A16, A58). In short, they want to be the protagonists of the training course (A12, A53), which is a sign of the psychological courage that comes with the discovery of the purpose (Craig, 2018).

Table 1. *Final items of the Course Didactics actions. The items are sorted by the importance given by experts.*

Code	Action (24 items)	Expert Panel Importance	Concept Mapping Importance
A1	The facilitator quality	9.14	9.125
A17	The course should be enjoyable, have activities and not be boring	8.71	9.125
A36	The course should be about attitudes and not on skills	8.57	9.25
A14	The course should generate dialogue	8.57	8.62
A2	Messages in the course are relevant	8.43	8.62
A32	The facilitator gives real day-to-day examples to speak 'the same language' as attendees	8.29	9.125
A12	The course encourages participation among the attendees so that they become protagonists in the course	8.29	8.875
A28	The facilitator should be close to attendees	8.14	9
A15	The facilitator listens to the participants	7.86	9.375
A53	Attendees feel identified with the organization	7.86	8.875
A26	A company manager is involved in the training	7.71	9
A62	The facilitator presents the course in advance as a path to be traveled until the discovery of the purpose	7.71	8.625
A23	The facilitator recognizes the work of attendees	7.71	8.875
A4	The course has exercises that are related to the day-to-day life of attendees	7.57	8.25
A33	The facilitator writes individualized messages to each attendee	7.14	8.875
A30	The facilitator is involved in the problems of the attendees that arise in the course	6.71	9.375
A29	The facilitator is an executive of the company	6.71	8.875
A16	There is a sharing of personal experiences in groups	6.57	7.625
A3	Variety of roles, positions and functions among the attendees	6	8.625
A8	The course has mini-catering available	6	8.625
A18	The attendees are from different work centers	5.86	8.125
A10	The course takes place away from the usual place of work	5.71	8.375
A58	A visual item where attendees share their discovered personal purpose	4	9.125
A27	The course has sweets available	2.86	7.25
	Average	7.17	8.73

Note: two items of the original list were re-sorted by the expert panel to other groups.

It is interesting to note the difference in perceived importance between the concept mapping attendees and the experts consulted. For example, attendees rated 19 of the 24 actions higher than 8.5, while the experts only rated 4 of the 24 actions higher than that score. Indeed, taking the average importance of the actions, for the participants this dimension is the most important, while for the experts it is the least important. It should be remembered that the concept mapping participants evaluated the actions before the final grouping, while the experts evaluated them when the groups were already defined.

We continue with the Emotional Atmosphere dimension, which encompasses 15 actions (Table 2). This makes this dimension with the lowest number of items, although it has four actions eliminated by the experts. This group is also the least discussed by the authors cited above.

Table 2. *Final items of the Emotional Atmosphere actions. The items are sorted by the importance given by experts.*

Code	Action (15 items)	Expert Panel Importance	Concept Mapping Importance
A41	Human warmth	9.14	7.75
A57	The course generates pride of belonging to the company	9.14	7.375
A44	All attendees and the facilitator have humility	9.0	8.0
A46	To exit the course with peace of mind	9.0	8.25
A42	The course is full of joy	8.86	8.125
A49	The facilitator recognizes the good that everyone is doing	8.86	9.125
A43	The commitment of attendees	8.71	7.5
A38	There is a climate of companionship among attendees	8.57	8.125
A39	The course is a ‘beautiful’ event	8.57	7.75
A54	The course generates in the attendees a feeling of being at home	8.43	8.625
A45	Attendees open up	8.43	7.875
A34	The facilitator provides the option to talk about everything	8.29	8.5
A40	The course is surprising	8.29	7.75
A6	There is closeness among the attendees	8.0	8.0
A48	Attendees have personal satisfaction because they feel that the organization has counted on them	7.71	8.25
	Average	8.6	8.06

Note: the experts added two items from other groups. The experts also eliminated four items of the list.

The actions refer to personal feelings such as leaving the course in peace (A46), or satisfaction with the course (A48), or feeling 'at home' in it (A54). These are aspects that would make sense once the course is over, as they are a consequence of finding meaning (Kofman, 2018), but according to the comments

of the participants in the concept mapping this situation occurred before talking about personal purpose. This could indicate that the aforementioned conditions give the necessary serenity to reflect on the purpose (Leider, 2008).

Other actions in this group refer to shared feelings such as human warmth, joy, pride of belonging to the company and closeness between attendees (A41, A57, A42, A45, A6). These shared feelings are also mentioned in previous literature but as an outcome of the finding of purpose (George et al., 2008; Kofman, 2018). Allowing employees to show these feelings is important because it enhances the feeling of belonging and is one of the generators of a company culture (Leider, 2008; McLeod, 2016). In addition, peer identification with purpose can lead to self-internalization of purpose as indicated by previous studies (George, 2004; Lleo et al., 2021).

Finally, the concept mapping also pointed out the figure of the facilitator and the 'design' of the course also appear in this group (A49, A39, A34, A40). We see that the participants of the concept mapping emphasized the task of allowing everyone to express their opinion, which ties in with a theme that did not appear in the concept mapping: the cynics and disbelievers. Authors claim that it is good to give these cynics space, as they take time to get used to the new mentality of purpose (McLeod, 2016); others add that the cynics need to see that the contribution they are making is valuable (Leider, 2008). But this concept mapping has not explicitly shown a way to manage the course well when faced with these skeptics.

Again, there is a difference between the importance assigned by the concept mapping participants and the one given by the experts. For the experts, this group is the most important and 9 actions exceed 8.5 importance. For the concept mapping participants, however, only 2 actions exceed this score and the Emotional Atmosphere is the least important group on average.

The third group, "Finding the Purpose", has 20 actions can be seen in Table 3. This group refers to what the course has meant for discovering each personal purpose and how it connects with the corporate purpose.

Since this training is about purpose, it is not surprising that many of these actions are rated as important by both participants and experts. It is in fact the group where the difference in opinion is the smallest.

Some actions that appear in this group refer to some definitions of purpose as ‘why are you in the world for’ or ‘to be protagonist of change’ (A9, A31, A13), and the prosocial purpose of serving others (A63, A50). According to Leider's (2008) definition, purpose above all has a stewardship component. Kofman (2018) also points in that direction when he comments that purpose transcends personal interests. It is the concept mapping participants themselves who have used the word 'contribution', which also reminds us of the last dimension of purpose implementation stated by Lleo et al. (2021).

Table 3. *Final items of the 'Finding the Purpose' actions. The items are sorted by the importance given by experts*

Code	Action (20 items)	Expert Panel Importance	Concept Mapping Importance
A60	The course gives meaning to work	9,57	9.0
A9	The course makes attendees think about what are they in the world for	9,43	9.0
A59	The course connects personal purpose to organizational purpose	9,29	8.75
A11	The course makes attendees aware of the impact of their work	9,14	8.75
A31	The course helps attendees to discover their purpose	9,00	9.0
A19	Attendees feel important within the organization	9,00	8.75
A63	Attendees have the satisfaction of serving others	9,00	8.75
A55	The course confirms the importance of what everyone does every day	9,00	7.375
A52	The course shows the contribution that everyone makes with their work	8,86	9.125
A61	The attendees feel that their job transcend the everyday activities	8,86	9.0
A50	The course makes attendees see that they can help others	8,86	8.875
A21	The course helps recognize each other's work	8,71	9.0
A13	The course makes them realize that they can be protagonists of change	8,57	8.375
A35	The course shows employees the impact they can have on the customer with their work	8,29	9.0
A5	The course helps attendees to put themselves in the place of others	8,29	8.875
A25	The course helps disclose company facts and information	7,86	8.125
A37	The course explains the impact of personal work within the size of the organization	7,86	7.75
A20	The facilitator thanks the attendees their assistance	7,29	9.25
A22	The course explains how the business is driven by everyone	7,29	9.25
A47	The course generates a feeling that 'we are the best'	6,57	7.625
	Average	8.37	8.64

Note: one item of the original list was re-sorted by the expert panel to other group.

However, the largest number of actions are found in the discovery that they can live this personal purpose within the company (A60, A59, A19). As Craig (2018) comments, the relationship of unity that occurs when a common purpose is shared is much stronger than the mere hierarchical relationship, and attendees have figured it out (A21, A5, A22). Being connected by purpose is a very efficient way

to generate a culture that is able to overcome difficulties with effort and innovation (George et al., 2008; McLeod, 2016).

This unity generates a contribution to the company's economic and social results (Dhingra et al., 2021; Kofman, 2018; McLeod, 2016), also pointed out by the participants of the concept mapping (A11, A55, A52, A35, A37). It seems that both theory and practice agree that a shared purpose that enhance every personal purpose has great impact in the sustainable value generated by the company (George et al., 2008).

4. Conclusions

This study is, to our knowledge, one of the first to identify important aspects of purpose training courses for employees. We have done this identification through a concept mapping with employees of a multinational company that has one successful purpose training course. In the concept mapping, participants identified three groups of actions: Course Didactics, Emotional Atmosphere, and Finding your Purpose. We also consulted a panel of experts to validate, debug and evaluate the importance of each of the actions and their belonging to the group.

For Course Didactics the results show that are fundamental both the figure of the facilitator and the commitment of the organization through the assistance of managers and small tokens of commitment on the part of the company. In the case of Emotional Atmosphere, not only personal feelings are involved, but also the group expression of these feelings. If the course creates this atmosphere, it makes it easier to reach the last group of actions: finding your purpose. Understandably, each person finds his or her own personal purpose throughout observing his or her life (Leider, 2008), so the 'Finding your Purpose' actions refer to what attendees do once they have found it. We summarize these actions in two main groups: connection of personal purpose with the purposes of peers, and connection of personal purpose with the work performed and job outcomes.

These results show that the course requires special preparation, and that the facilitator has to have expertise and authority to be able to drive the course toward the purpose (Kofman, 2018; McLeod, 2016). Someone from outside the company may have to be hired first to match the course characteristics to the organizational purpose; but certainly, after that the facilitator must be a member of the company.

Concerning the different ratings on the importance of actions, we remember that the path to purpose is arduous and each person requires a different amount of time (Craig, 2018). Perhaps this is why the course attendees evaluated Course Didactics better than Finding your Purpose, just the opposite of the experts consulted. Although Finding your Purpose is the real objective of the course, it cannot be reached without generating an Emotional Atmosphere through the Didactics.

This study, although interesting for the knowledge generated and for its novelty, suffers from certain flaws. Some of them are inherent to the methodology, such as the fact that all the concept mapping participants came from the same company. This had to be the case if we wanted to extract information from this specific successful course. We also have the limitation of not having verified the real effect of these actions with empirical studies after the course and we only have the importance perceived by the participants of the concept mapping and by the panel of experts.

But these limitations open up the possiblity of future research. The ability of employees to live their purpose in the company is key to generating sustainable value (George et al., 2008). As we have observed in this study, employees themselves value that finding their purpose leads to a greater connection with their peers and a service mindset. Therefore, it would be interesting to study which of

the selected course actions have a greater impact on employees' future behaviors. From an organizational sustainability perspective, it is also relevant to study the impact of these courses on purpose implementation and sustainability metrics.

As they are drawn from the experience of participants in a training course on purpose, the theoretical contributions mentioned above also have practical implications. Companies that want to implement a course on purpose or already have one, can find in this article some actions and conclusions that can help them. And a reminder that the most important part of purpose implementation is the living of each personal purpose in the daily tasks.

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Tourist entrepreneurs´ experiences of co-operation with university students for Sustainable Destination Development

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Abstract

Purpose: The Purpose of this study is to describe tourist entrepreneurs' experiences of co-operation with university students solving the entrepreneurs' practical challenges for Sustainable Development. *Methods:* A qualitative approach is used in this study. Eleven destination entrepreneurs on the island of Gotland, Sweden, responded to an online survey. The survey guide contained questions about entrepreneurs' backgrounds, the business's art, the challenge offered to the students, experiences over the co-operation with the students, and solutions to the students' challenges. Besides, the questionnaire included questions on how entrepreneurs experienced the suggestions and how they were planning their implementation. Also, questions over sustainability issues were brought up in the questionnaire. Analyse of these responses were made by using theoretical concepts such as learning, problem-solving, meaning- and sense-making. *Results and Discussion:* The study's significant implication is that destination entrepreneurs are optimistic about using university students in organisational change approaches. Also, the students fill the gap for the needs of theoretical and practical knowledge of the challenges. The exchange of knowledge, not least in sustainability matters, is of great importance to both parties and promotes learning. Entrepreneurs need reciprocity in relationships and collaboration with university. They need to be confirmed as essential and valuable resources and committed as actors in developing destinations. *Implications:* The study results show the importance of paying more attention to the role of small entrepreneurs in the development of destinations and their work of sustainability. Co-operation

between universities and entrepreneurs should be nuanced by highlighting these entrepreneurs' practical needs.

Keywords: co-operation, destination development, small entrepreneurs, sustainability, value creation

1. Introduction

In today's knowledge societies, entrepreneurs are constantly confronted with complex problems that involve the design of innovative solutions toward sustainable development. There is a need to create contextualised knowledge for all entrepreneurs' challenging situations, not at least within the tourist sector. Education and co-operation towards creative problem solving and learning are needed. According to the latest data from the World Tourism Organization (UNWTO), the downfall of global tourism was dropping by 74 percent caused by the Covid-19 pandemic. Due to an unprecedented fall in demand and widespread travel restrictions, destinations worldwide welcomed one billion fewer international arrivals in 2020 than in the previous year (UNWTO, 2021). The tourism industry has run into financial difficulties. Many of them fight for their survival (Gössling, Scott, and Hall, (2020). Innovative solutions are needed not only for survival but also for sustainability. At the national level and locally, the tourism industry has received financial support during the pandemic worldwide. However, minor tourist entrepreneurs have received little or no support (UNWTO, 2021). This situation is even the case in Sweden and on the island of Gotland, which is one of the major tourist destinations in Scandinavia, having a large number of small entrepreneurs working with the tourist industry. Uppsala University at the Campus Gotland gives an international master's Destination Development program. One of the courses in this program is called Teams in Multidisciplinary projects. Within this course, students are offered the possibility of getting practical experience by co-operating with tourist entrepreneurs on the island and trying to solve the challenges offered by them. This research paper aims to study how some destination entrepreneurs experience co-operation offered by students studying destination development. In addition to this introductory section, this article is structured in four more sections: Theoretical perspectives, Methods, Results, and Analyse and Discussion.

2. Theoretical perspectives

The study is based on the following theoretical processes, essential for collaboration and problem solving: communication, learning (both individual and group learning), and meaning- and sense-making to understand the collaboration between student teams and entrepreneurs.

Co-operation

The universities operate in the middle of the societies they are part of. The demands from society for increased co-operation have led to the university's mission transformation. Academic knowledge can be considered to impact and benefit societies and, at the same time, inspire the renewal of education and research (UFV, 2019).

In recent years, many universities have intensified their collaboration with the rest of society and created models for collaboration between higher education institutions and students. This is the case also at the Uppsala University, where education have, to a large extent, expanded internships close to the business for the students. Several studies witness the importance of an interdisciplinary approach when involving students in co-operation with external partners. The real-life co-operation is developing for both the students and their partners. (Oxenswärdh, 2020; Oxenswärdh and Persson-Fischier, 2020). As a way, teamwork and a co-operating tools have been studied by scholars extensively from a range of perspectives.

Educational institutions also have a responsibility to guide students to work effectively in teams because organisational performance depends on group synergies rather than individual contributions (Rousseau, Aube, and Savoie, 2006). There are a set of skills and competencies needed to be a team worker. Three areas of knowledge are essential: affective, cognitive, and behavioural. The affective dimension comprises satisfaction with the team, viability, cohesion, and identification with the team. The cognitive dimension includes learning and innovation. The behavioural dimension captures concepts of quality and quantity of work and the achievement of objectives (Humphrey, Karam, and Morgeson, 2010). Learning is a natural part of teamwork also within a practical setting. Learning and group processes are interdependent and interwoven. Nevertheless, teamwork is a complex multidimensional competency (Oxenswärdh and Persson-Fischier, 2020). Communication skills in any group constellation are of importance. The basic features of teamwork are goal setting, problem-solving, and conflict resolution. The diversity of the group members or team members is widely recognised as a success factor.

The heterogeneous groups with various skills promote creativity in problem-solving; each group/team member influences the group process and vice versa. There are numerous ways by which group composition might be customised to benefit members in the group/team with particular needs or to emphasise particular outcomes (Haslett, and Ruebush, 1999; Schultz, 1999; Sunwolf and Seibold, 1999).

Learning

Learning is the process of acquiring new understanding, knowledge, behaviours, skills, values, attitudes, and preferences. The nature and processes involved in learning have been studied in many fields. Research in different disciplines has led to identifying various sorts of learning. Roughly, learning is often described as both an individual and a collective process, preferably in balance. There are different types of joint learning. Collective, collaborative and co-operative learning are terms often used in the context of joint learning processes. Collaborative learning can be considered a form of joint learning, where the starting point is that all learning is based on social activities. Collaborative learning is when at least two people learn something together (Bruffee, 1993; Dillenbourg et al. 1999).

Collaborative learning activities can include collaborative writing, group projects, joint problem-solving, debates, study teams, and other activities. The approach is closely related to co-operative learning, which is the instructional use of small groups so that individuals work together to maximise their own and each other's learning (Johnson et al., 2008). Collective learning again presupposes the interactive and communicative actions through which members of a team identify and understand the team's tasks and develop action options for how they should be performed. Ohlsson (1996) notes that collective learning shapes how the individual perceives their practical work and thereby shapes the potential of individual experience. It is crucial for collective learning that the experiences are described in the collective so that the community can jointly problematise and reflect on the experience (Dixon, 1994; Ohlsson 1996; Wilhelmson, 1998). Ohlsson (1996) points out the dynamic learning character and the ongoing co-constructing of borders, such as the permissible and the impermissible, can be perceived as a condition for learning processes. There is a critical, emancipatory dimension of awareness rising of these unconscious learning conditions. If the individual is unaware of its potential and limitations, the individual cannot respond fully to promote learning. The difference between collaborative and collective learning is still vague.

Nevertheless, according to Granberg and Ohlsson, (2016), this difference can consist of that in collaborative learning, a group of individuals is trying to learn something together but without to specify or clarify the social context. However, in collective learning, it is decisive to try to achieve a common understanding. Sustainability competencies by Brundiers and Wiek, (2011) and collective learning seem to be compatible. Collective learning can then be seen as one of the tools and an arena for acquiring this knowledge and skills.

Co-creation of values

Sustainability can be seen as a value we co-create in groups and teams. The creation or co-creation of values are two concepts that are often used in business and management literature and research. Today's consumers can be regarded as co-producers, creating meaning for the products, and at the same time, their consumption can be seen as an identification marker. Furthermore, this process adds sense to the product and makes the active customers participants in the product experience. This, again, transforms consumers into co-creators of values. (Bergman and Klefsjö, 2020). The relationship between the customer and the product provider can also be transferred to describe the relationship between entrepreneurs and students in this study. In this relationship, the project owner, the entrepreneur, invites the students into the learning process, offering them real-life challenges and continuously following up on the process. This co-creation of values emerges in practice, including processes of both individual and collective art. Both meaning-making and sense-making are seen as processes involved within the interaction between members of the team/group.

Meaning-making is described in psychology as a process through which people construe, understand, or make sense of life events, relationships, and themselves (Ignelzi, 2000; Mortimer and Scott, 2003). The process of meaning-making helps retain, reaffirm, revise or replace elements of a person's orienting system towards more nuanced, complex, and valuable (e.g., Gillies, Neimeyer and Milman, 2014). The term is widely used in constructivist approaches and educational psychology (Ingelzi, 2000; Mortimer and Scott, 2003). One way value can be created between entrepreneurs and students is in the pursuit of sustainability. Value creation can lead to more viable solutions and practices in tourism, thus contributing to the development of a sustainable society. This does not happen without participation in collective and collaborative learning, where both meaning-making and sense-making occur and where knowledge sharing and learning takes place.

3. Methods

The context investigated

This article discusses the entrepreneurs' experiences over the co-operation with student teams in the course "Projects in multidisciplinary teams" that is part of an international master programme in Sustainable destination development at Uppsala University, campus Gotland, and took place in the spring semesters of 2020 and 2021. The programme uses a pedagogy of ESD, Education for Sustainable Development, in which learning by doing together is emphasised (Wiek et al., 2011; Lotz-Sisitka et al., 2015). The co-operation is crucial, as sustainable solutions are a collective effort. The United Nations Sustainable Development Goal, number 17, Partnership for sustainable development, indicates the importance of different stakeholders and sectors of society working together (UNSDG, 2015) The study programme has three specialisations: Entrepreneurship, Nature-based tourism, and Heritage politics. Apart from these different specialisations, the course Projects in Multidisciplinary teams mixed the students from these different tracks into teams.

In this course, students worked with sustainability challenges that local actors within destination development at Gotland face, offered by companies, organisations, and public authorities. The students solved these challenges in groups of 3 to 5 within 11 groups/teams, using their different competencies and creating heterogeneous teams. One of the expected learning outcomes was to use heterogeneity in the group when solving the problem. The students in this study had their origin in 28 different countries.

The course was structured around the Design Thinking model, which ultimately served as a methodological tool for the students dealing with the challenges of entrepreneurs (Kurokawa, 2013; Kimbell, 2011; Brown, 2009). Design thinking as a method and a model has lately spread into many disciplines. Design thinking begins with principles that frame a way to see the problem or challenge. It has a multi- or interdisciplinary character through problem-solving and demands synthesising knowledge from various sources (Cross, 2007; Pink, 2006; Simon, 2016; Kurokawa, 2013).

Data collection

This qualitative study focuses on some entrepreneurs and their experiences with co-operation with university students. Entrepreneurs were chosen among the participants involved in the course at Uppsala University, Campus Gotland, called Projects in Multidisciplinary Teams, in spring semester, 2020 and 2021. All entrepreneurs are practising their businesses at Gotland in Sweden. The course aims at promoting problem-solving, innovation approach, and collaboration by students working in teams and using design thinking as a method.

The number of entrepreneurs invited to the study was 17. The results of this study consist of responses from eleven entrepreneurs. In table 1., the entrepreneurs and their assignments/challenges/problems offered to the students are presented.

Table 1. The entrepreneurs and their assignments/challenges/problems.

Entrepreneur	The Challenge
Farmer, tourist entrepreneur	To get help with creating a package for visits to the farm with sustainability theme
Advisor, project manager, consultant	To get help with finding development potential and to internationalise the business with the help of social media
Business manager and property developer	Transform motorhome camping into sustainable clamping
Priest, Church of Sweden	To develop the pilgrimage route
Representative for local community	How to create commitment among the villagers and develop tourism
County Administrative Board	Development of a new national park
Digital developer	Develop a mobile tool (CRM) for lifestyle entrepreneurs
Tourist and event entrepreneur	Production of compostable disposable material for restaurant operations
BnB entrepreneur	Develop courses for other BnB entrepreneurs in sustainable housing
Event developer (historical event)	To expand the event outside the capital of the island
Organizer for Harvest festival	To provide more knowledge to consumers of Gotlandic farmers and their products, sustainable food production

Primary data collection for this study took place between Feb-March 2021. The secondary data collections consist of documents over the course. An interquest (a hybrid over the interview and inquiry) was sent digitally to participants.

The interquest was composed of four sections, each containing related questions: 1. The background, consisting of, in total, five questions. 2. Collaboration with the students, sex questions. 3.The challenge offered to the students, consisting of sixteen questions. 4. Questions about sustainability (general questions about sustainability and how participants have been implementing sustainable solutions in their businesses, sustainability and the future (what owners wish to develop in the future regarding sustainability in their businesses, etc.), in total five questions.

Data analysis, was made by using the theoretical concepts, presented in the section of Theoretical perspectives. In the following, the results and analysis are presented using the inquiry structure. The study is limited to a small number of respondents and their reflections on their experiences over the co-operation with the students and does not claim statistically significant results.

3. Results and Discussion

Background and motivation

The responses show that most entrepreneurs in this study are women and have a university degree; the majority of them have a bachelor's degree. The majority of them are in the age range of 40 to 60 years old. Many contractors seem to have several jobs and entrepreneurship that are tourist-related. They can be called bricoleurs. Bricoleurs are innovative entrepreneurs who create value in environments with scarce resources (Baker and Nelson, 2005). The concept of entrepreneurial bricolage was introduced by Lévi-Strauss (1966) and can be defined as "making do by applying combinations of the resources at hand to new problems and opportunities" (Baker and Nelson, 2005). Also, Oxenswärdh (2020) highlights these entrepreneurs and their ways of combining several professions and activities to support themselves. Since they are often micro-entrepreneurs, they need to seek knowledge from the outside. This may explain their willingness to participate in collaborative projects with the university. Entrepreneurs explain the choice of these challenges as they need to get others' eyes on their problems or opportunities. All challenges were linked to developing sustainable solutions in these companies. Entrepreneurs in the study regard that the students at the university have the latest knowledge in the field, and several of them have been involved during both years of the course and have good experiences of this collaboration with the students. They experience the students as innovative and creative.

¨It is in our interest to find products that are good for the environment in the long term and can also be included in our supply chain from serving to the soil. Therefore, we wanted expert help to find the right kind of material that works for our business.¨

Collaboration with the students during the project

Due to the ongoing pandemic (Covid 19), contact between entrepreneurs and students, during the course 2020, just before the pandemic broke out, made communication between the parties in projects significantly different from year 2021. At that time, communication was primarily handled through physical visits. The pandemic has caused that several different ways of communicating have been applied in the projects. It has often been a combination of the use of digital media and on-site visits without direct contact with the contractors.

Entrepreneurs have experienced collaboration as very satisfactory. Here are some of the statements:

¨Very inspiring. Knowledgeable, responsive, committed people. Easy to work with.¨

¨Very efficient and clear communication from start to finish.¨

¨An incredible commitment in the group. Also, they all seemed to work well together as a group.¨

¨The collaboration went very well, thanks to the regular meetings. The students could agree on ideas, and we could correct misunderstandings.¨

As it can be deduced from the respondents' statements, the students' collaboration has been perceived as very satisfactory. The communication seems to have worked well despite the ongoing pandemic. Entrepreneurs experience no problems communicating, primarily digitally, with the students. From the contractors' statements, it is also possible to read how student teams have succeeded in their work. Teamwork performance depends on group synergies rather than individual contributions (Rousseau, Aube, and Savoie, 2006) including competencies needed to work well together. All these competencies: the affective, cognitive, and behavioural dimensions, seem to be functioning well within these teams (Humphrey, Karam, and Morgeson, 2010). The diversity of the members of the team promote creativity in problem-solving. (Haslett, and Ruebush, 1999; Schultz, 1999; Sunwolf and Seibold, 1999). Entrepreneurs themselves can also be considered members of these teams in continual contact with the teams by communicating and functioning as active counterparts, giving further information, and putting new questions.

¨We want to collaborate more where we can, become a lab for Uppsala university with the opportunity for experimental development and test a lot, in different projects, with customers and users in sustainable development and tourism and where we can have students as part of the projects.

¨The student team has been very friendly and professional!¨

Entrepreneurs are willing to collaborate with Uppsala university, preferably in several courses and areas of expertise. They express their willingness and need to help develop their businesses and, not least, in improving sustainable solutions.

Challenges offered and solutions suggested

Challenges offered to the students by the entrepreneurs varied a lot (see table 1 for details). The common denominator for them was that they all dealt with the hospitality industry and strived for sustainability solutions in their companies. Entrepreneurs seem to need new ideas, new solutions to practical problems in their businesses. They stated that they trusted students to offer the latest knowledge on sustainable issues by being creative and inventive within problem-solving. The solutions varied in nature and were perceived as very interesting and rewarding by the problem owners; in the following, some entrepreneurs' reflections on experiences over the suggested solutions with student co-operation are presented.

¨I found co-operation as a very positive experience. Already the way to reformulate the questions/challenges provided valuable insights.¨

¨There was a long list of both concrete solutions and concept structures. The design and matrix thinking was advantageous. The input was given both current working methods for developing the trail, possible concerns, and prototype proposals for inspirational material.¨

¨It has been a very positive experience and lot of information in a short time. They gave us time that we do not have ourselves, so it helpt incredibly to get help to do such marketing research.¨

¨We have not had time to delve into the issue; that is why we thought that students with fresh ideas could give us new perspectives, which they did. They also linked to the 17 sustainability goals that we have not thought of highlighting and linking to the project.¨

It was often practical things and a lack of time that stood in entrepreneurs' development initiatives. As bricoleurs with several different ways of earning a living, they seem to have a shortage of time and effort in developing their businesses. This makes it also difficult for these entrepreneurs to create networks. Collaboration with the students can be a source of knowledge for these entrepreneurs. Learning takes place here on several levels. Collaboration with the students enables individual and joint learning. Different parts of the collaboration process seem to require different kinds of learning. The students used, as their tool, a model of Design Thinking, which includes various phases where information is obtained from the contractors in round turns to ensure sufficient background facts and additional facts during the process to be able to provide a solution to the problem. This type of learning is similar to that of collaborative learning, where both parties are learning together: students by getting new knowledge and problem owners by reshaping their experiences over their practice (Bruffee 1993; Dillenbourg et al. 1999).

Collective learning occurs as well in collaboration between the student teams and problem owners. It is decisive for collective learning that parties' can form a consensus on future solutions and strategies to achieve them (Granberg and Ohlsson 2016). At the same time, parties do create value for each other. Process of meaning-making and sense-making, connected with learning processes, help the parties retain, reaffirm, revise or replace elements of their orienting system towards more nuanced, complex, and valuable knowledge and practice (Gillies, Neimeyer, and Milman, 2014).

Most of the contractors who participated in the course year 2020 have already implemented proposed solutions in their operations, others are about to do so, and only one of 11 contractors has not intended to do so. The manner of implementation of these proposed solutions varies between contractors. Some of them intend to introduce the changes step by step based on needs and financial resources. The most important lessons for entrepreneurs, from the students' solution proposals and collaboration process, were as follows:

¨The students gave me a different perspective, especially based on foreign visitors' expectations.¨

¨I found that it is difficult to design new things alone. These student groups surprised me with their creativity.¨

¨I learned that there are other solutions than the obvious ones.¨

Sustainability and entrepreneurs in the study

Entrepreneurs in this study seem to be aware of sustainability and define the concept as aspects of ecological, economic, social, and cultural aspiration to act within our planet's framework. They have, though, applied mainly solutions to varying degrees in their companies, primarily due to their different organisational nature. Some of them talk about different certifications they are already applying in their companies; others refer to the global environmental goals they want to break down on a practical level. Some describe the practical measures they have already taken in their operations. Again, some others link sustainability goals to their business goals to strengthen competitiveness. A part of the measures is quite concrete.

¨We are re-cycling. We inform our guests about sustainable living and behaviours. We have a charging hybrid car and plans to invest in solar cells.¨

¨We have environmental hosts, projects for waste management and water saving, we are nudging towards visitor groups.¨

¨I eat locally produced food.¨

Increasing sustainability thinking on the island, the following measures are proposed by contractors:

¨Offer much more personal service, accommodation, guidance, food culture, etc., spread it over the whole island.¨

¨Simplify and work for climate-smart transports.¨

¨Happy positive people want to share themselves and their environment. Protect the fragile places that exist and create oases for those who want modern, hip environments. Development and new fashions are created, and even those who like this must have their needs met.¨

¨Learn from each other, collaborate more and use our local raw materials. Create relationships between us as hosts and visitors.¨

¨Live as you learn!¨

These answers show that entrepreneurs have a positive spirit of progress. They are committed to the environment and want to take care of their island. According to the respondents, the visiting guests can also be trained in sustainability issues. These entrepreneurs' knowledge deficiencies are mostly in need of continued competence development. They consider themselves being quite aware of sustainable issues but want to learn more and be updated on sustainability issues. Some others recall the importance of updating their knowledge of the public, municipal and regional rules and regulations that are constantly changing.

¨There are many rules for building standards, nature conservation, etc. that you would need ongoing information about when rules are constantly changing.¨

4. Conclusions

This study aimed to investigate how some small destination entrepreneurs experienced co-operation with the student teams studying destination development at Uppsala University, campus Gotland. The questionnaire was sent to l7 entrepreneurs who had offered their challenges to the students during the years 2020 and 2021. Eleven entrepreneurs answered the questionnaire. This may mean that some of the entrepreneurs invited to the study were not satisfied with the university course's collaboration. However, there may, of course, be other reasons for them not participating in the survey.

According to the results of this study, the students' involvement in this co-operation can be considered beneficial both to students and entrepreneurs. Both parties had the chance to be engaged in the co-creation process, enacting the collaborative (social) dimensions of new knowledge construction. Entrepreneurs and respondents in this study can be classified as so-called life-stylers and bricoleurs. Their commitment, not only as a participant in this study, but also participation in the course of Projects in Multidisciplinary Teams; but most of all, their commitment to solving sustainable problems by offering challenges to the student teams in their businesses, has been investigated in this study.

Collaboration between local societies and higher education institutions is something societies have been striving for, to a greater extent, in the last decades. These collaboration demands at the universities are also expressed in different policy documents. Nevertheless, collaboration has often worked only on university terms unilaterally. Besides, it has often been a matter of using different companies and business organisations to collect data for students in different subjects and as sources for researchers in their research. Seemingly, there has not been much genuine co-operation with equal conditions, giving and taking, i.e., reciprocity between the parties. The study shows that this type of collaboration is vital for entrepreneurs and can be achieved through careful planning in dialogue with universities. Destination entrepreneurs need new knowledge and support, not least in sustainability issues.

Nevertheless, there is also a great need among university students to apply their theoretical knowledge in practice. Starting co-operation with companies, having their practical problems and challenges in focus, can open the door to favourable co-operation between the parties. This also enables research initiatives for university teachers. This presupposes a dialogue in which both parties meet on equal terms. The condition here is reciprocity.

By entrepreneurs offering their challenges for students to solve, collaboration takes place. Then different value-creating processes emerge. Understanding- and learning processes, both the individual and the collective, becomes activated by all parties. Thus, the challenge functions as an engine that drives the process by creating new questions and solutions. This, in turn, seems to increase the entrepreneurs' understanding of the value of change. At the same time, they become confirmed as active actors in destination development. This creates value also for their businesses. These destination entrepreneurs, bricoleurs and life-stylers, will be a fundamental group for the entire development of destinations as they, with their different areas of activity and dedication, can spread knowledge about sustainability further in the local society. The critical issue here is confirmation of their important role in destination development.

These small entrepreneurs, life-stylers, and bricoleurs seem to understand the importance of sustainability issues. Their ability to spread knowledge and about sustainability should not be underestimated. This power or ability should be better noticed and further developed. Entrepreneurs testify to their loneliness as small entrepreneurs without large companies with resources for consulting assistance, etc., for solving sustainability challenges. They need training in the form of networking with other entrepreneurs to be able to find practical solutions to their problems. The great asset here is their commitment.

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Challenges Of Educating The Youth On Sustainable Development

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Abstract

The ways the society develops and progresses are determined by the people who live in it, who have the vision of its future and set the goals for its development. Educating young people about Sustainable Development is of great importance as they are to become the driving force of our society in the nearest future. The paper demonstrates the level of awareness of the concept of Sustainable Development and its Goals among the students of Saint-Petersburg branch of the Financial University under the Government of the Russian Federation and the ITMO University of Saint-Petersburg identified with the help of the existing data research method and the method of survey and describes ways of raising their awareness of the global and local perspectives of Sustainable Development through various means such as evaluating the relevance and importance of SDGs for a particular country, region or industry, considering local business and social initiatives as contributions to the success of the global Sustainable Development, identifying problem areas and developing projects for local businesses, non-for-profit and government organizations to help them follow the principles of Sustainable Development in their work. The paper touches upon the effect of COVID-19 on the indicators of Sustainable Development in the region statistically and as seen by the students and describes the students' attitudes and the proposed ways to improve the current situtation. The paper also suggests the framework for the design and development of the educational course on Sustainable Development both for university and college students and members of the local community.

Keywords: Sustainable Development, higher education, content integration, educational course, relevance

1. Introduction

The ways the society develops and progresses are determined by the people who live in it, who have the vision of its future and set the goals for its development. The world is becoming more and more

globalized every day which is manifested not only by the fact that one can communicate in different ways and by using different means with anyone, anywhere and at any time, share ideas professionally and socially, travel across borders easily, find employment anywhere his / her skills are required. Globalization also means that local actions can have a global effect and a global perspective. So, one of the main challenges of the 21st century is to learn to strike the balance between different spheres members of our global society are trying to develop so that the development of one sphere would not negatively influence any other spheres at present and our current actions and activities would not have any negative effect on our future.

The concept of sustainability implies that economic, social and enviromental spheres are interdependent and interconnected (Lozano, 2008). Climate change (like droughts in Middle Asia and Africa) and the reduction in the availability of natural resources (for example, lack of water in Northern Africa or decreasing gas and oil reserves) cause negative economic and social consequences (increases in fuel and food prices, increased poverty and even hunger). Unwise economic activities of some countries or companies (like the construction of a pulp and paper mill on the shore of Lake Baikal in 1966 without the simultaneous construction of water purification plants or the diesel fuel spill near Norilsk (the Arctic zone) in May 2020 caused by the improper maintanence of fuel tanks by the public company Nornikel) are followed by increased pollution, exctinction of certain species and other natural disasters. The pandemic of COVID-2019 has shown us once again that enviromental factors can slow down the world economy dramatically, undermine the many economic and social gains that have been made to date on both national and local levels and cause a lot of damage to health and lifestyles of each individual.

Sustainable Development has become a burning issue for governments, various public organizations and institutions as well as for private companies and citizens. The educational system, being a sub-social system, reflects all the social processes taking place in the society (Muravyeva and Oleynikova, 2016a). So, nowadays the issues of Sustainable Development have to be paid great attention to by educational institutions of all levels. Besides, the society on the whole, international and national organizations have recognized the role of education in the socio-economic development of countries, improving the quality of people's lives and establishing values important for achieving global and local goals. Educational institutions of all levels, especially higher educational institutions, prepare citizens and professionals who are to become the driving force of our society in the near future. Many researchers acknowledge that universities must play an important role in dissemenating the ideas of sustainability among students. In this way higher education for sustainable development (ESD) aims to enable people to acquire knowledge and reflect on the effects of their actions and behaviours from a global, responsible and future-oriented perspective (Barth et al, 2007a).

2. Methods

The concept of Sustainable Development being a complex issue, researchers are still arguing what the term “Sustainable Development” is and what its main components are (Eizaguirre et al, 2019a). Some researchers reduce its meaning to the ecological issues only, emphasizing their importance and, thus, prevalence over any other possible issues (Muravyeva and Oleynikova, 2016b). Some researchers resort to a purely economic view on the concept of Sustainable Development adopting the ideas of the World Bank and considering sustainability as maintaining assets of different types, namely production / economic assest, human assets or natural assets (Shtakk, 2019). We agree with the researchers that point out that the existence of multiple definitions and concepts should not be a problem if it is clearly identified what concept or definitions the authors refer to for the purpose of their research and, consequently, their article (Eizaguirre et al, 2019b). In our educational research project we refer to the definition of Sustainable Development given by the World Commission on Enviroment and Development which states that Sustainable Development is “development that meets the needs of current generations without compromising the ability of future generations to meet their needs and aspirations” (Report of the World Commission on Enviroment and Development, p.43, (1987)). We consider all the three dimensions of this definition - ecological, economic and social - of equal importance and believe that none of them can be recognized as irrelevant or the importance of any of them can be reduced. For the purpose of our research we also consider the scope of Sustainable Development Goals (Sustainable Development Goals) to be the framework for issues under consideration for the participants of our project.

Education plays a very important role in implementing policies developed by national governments and international organizations. That is why government and public organizations and institutions elaborate educational policies and formulate implementation schemes to promote new ideas and concepts, to create awareness of them and, if necessary, to alter public perception of them. UNESCO proposed the term “Education for Sustainable Development” which means “including key sustainable development issues into teaching and learning; for example, climate change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption. It also requires participatory teaching and learning methods that motivate and empower learners to change their behaviour and act for sustainable development. Education for sustainable development consequently promotes competencies like critical thinking, imagining future scenarios and making decisions in a collaborative way” (UNESCO, 2012).

Universities are considered one of the main providers of education, so ways to incorporate ideas of sustainable development into university curricula must be found. Researchers point out that this task requires a shift both in the social paradigm and in the educational paradigm (Muravyeva and Oleynikova, 2016c). A shift in the educational paradigm would mean finding new approaches and formats for teaching and learning. Also it is of vital importance to find ways of integrating content related to sustainable development issues into the curricula and outline competencies linked to

sustainability as the learning outcomes. There are two methods of intergrating content into any curricula: horizontal integration which involves integrating the content into different existing courses throughout the existing curriculum; and vertical integration which involves adding new courses to the existing ones (Barth et al, 2007b). For Bachelor's degree programmes we consider horizontal integration to be the most suitable for a number of reasons. Firstly, the content linked to the issues of sustainability is considered broad-based and multi-disciplinary (Aktas et al, 2014), so issues of sustainability should be presented from a different perspective within the framework of different courses. Secondly, the issues of sustainability should be recognized in every sphere of life and science, so the contents of various courses should be linked to the concept of sustainability. Thirdly, researchers point out that the issues of sustainability require the development of soft skills (Lozano et al, 2015) which are to be developed through different activities and assignments provided within the framework of existing courses.

Some researchers also raise a question of whether to teach sustainable development formally or informally (Barth et al, 2007c). By formal teaching they mean teaching and learning that takes place during classes and by informal teaching they mean teaching and learning that occur in the students' free time through various activities not directly related to classroom teaching. We believe that both formal and informal teaching and learning should take place. Formal teaching is the most suitable when awareness of sustainability issues is created and examples of positive actions and behaviours are considered and discussed as case studies. Informal learning takes place when students work on their research projects, do internships or participate in other activities organized by universities or local communities.

In the Russian Federation the competency-based approach to education is adopted. The requirements to develop and include competencies as clear, measurable and transparent learning outcomes into university course programmes are formulated in the Federal State Educational Standards (Federal State Educational Standards). The concept of competency includes such aspects as cognitive, operational, motivational, ethical, social and behavioural (Borisova and Voronov, 2016a, Tubeeva, 2015a). Therefore, competencies can be defined as knowledge, values, skills and attitudes needed to address and solve complex problems students will encounter in their professional careers and personal lives (Borisova and Voronov, 2016b, Tubeeva, 2015b). So, if sustainable development issues are integrated into university curricula, the issue of developing a set of sustainability competencies also becomes relevant. Researchers have not come to the conclusion what these sustainability core compentencies are (Eizaguirre et al, 2019c). However, it is admitted that all competency schemes already adopted in different countries contain some elements of sustainability development or are often implicitly present in competency frameworks. UNESCO in the document “Education for Sustainable Development Goals” states that key competencies for sustainability are 1) systems thinking competency, 2) anticipatory competency, 3) normative competency, 4) strategic competency,

5) collaboration competency, 6) critical thinking competency, 7) self-awareness competency and 8) integrated problem-solving competency (UNESCO, 2017). Researchers have found out that the detailed sets of sustainability competencies may differ from region to region on the global scale or different stakeholders in the process may give more or less emphasis to a certain competency. However, they conclude that several generic competencies closely related to each other form a single factor, so working on one of them means working for the whole (Eizaguirre et al, 2019d). This conclusion implies that general competencies outlined in the Federal State Educational Standards can be considered correspondent to the sustainability competencies outlined by UNESCO and some slight differences in their range or number may be attributed to regional differences.

The educational research project developed by members of "The cross-cultural communications and humanities" department of the Financial University under the Government of the Russian Federation aimed to find out the level of awareness of the concept of Sustainable Development and its Goals among the students of Saint-Petersburg branch of the Financial University under the Government of the Russian Federation and the ITMO University of Saint-Petersburg with the help of the existing data research method and the method of survey. It also aimed to describe ways of raising the students' awareness of the global and local perspectives of Sustainable Development through various means of formal and informal teaching and learning. Another goal was to show the effects of the pandemic of COVID-19 on the indicators of Sustainable Development in the region statistically and as seen by students. And finally, it aimed to propose the framework for the design and development of the educational course on Sustainable Development both for university and college students and members of the local community.

3. Results and Discussion

At the initial stage of the research project a survey consisting of two stages was held. The survey at the first stage aimed to find out the level of awareness of the concept of Sustainable Development and its Goals. For the survey random groups of university or college students of the first or second year of studies specializing in different majors were chosen. The survey showed that the level of awareness of the concept of Sustainable Development is extremely low - less than 10%: in an average group comprising 20 students there were 1 or 2 students who have heard the term "Sustainable Development"; there were groups where no students showed any knowledge of this term. Those who knew the term were also asked to describe the scope of this term. 60% of the respondents said this term was related to ecological issues, 25% of the respondents said they were not sure about the meaning of the term, 15% of the respondents related this term to promoting equal rights and tolerance. The other goal at this stage was to find out whether the students understood the interdependence of ecological, economical and social factors. The students were given time to look up the meaning of the term "Sustainable Development" in the Internet on UNESCO websites, and to get information on the Sustainable Development Indicators and Goals. After that the task was to group the issues within the

framework of SDGs into ecological, economic and social 1) by origin, 2) by possible solution, 3) by possible outcomes. Multiple double or triple overlappings between groups “By origin”, “By solution”, “By outcomes” were supposed to show that the interdependence and interconnection between the issues within the framework of SDGs were clearly recognized by the students. The analysis of the data showed that 100% of triple overlappings and 57% of double overlappings were registered only for issues related to ecology, such as “Climate change”, “Life under water”, “Life on land', “Affordable and clean energy”. 18% of double overlappings were registered for “Decent Work and Economic Growth” (solution => outcomes), 10% of double overlappings were registered for “No poverty” (origin => solution), another 10% of double overlappings were registered for “Zero hunger” (origin => solution), and 5% of double overlappings were registered for “Responsible Consumption and Production” (solution => outcomes). Thus, the overall results show a high level of awareness of ecological issues and of their relation to social and economic consequences. They can be explained by increased public attention to these issues and widespread media coverage. Other issues have not gained so much public attention for a number of objective or subjective reasons, so their interdependence is not recognized.

At the second stage the focus was on creating the Perception Index of the relevance of SDGs for people of 18-20 years of age, from low / mid income families, full-time university / college students from different urban and rural regions of the Russian Federation (according to the statistics, 70% of students in universities of Saint-Petersburg come from other regions). The survey aimed at finding out the relevance and importance of Sustainable Development Goals for our country in general and for our region in particular. The students were requested to rank the goals according to their perceived importance / relevance and then to group the Goals according to the ranking results as “very important / very relevant”, “important / relevant” and “unimportant / irrelevant” and, if possible, give short explanations to their classification. The “unimportant / irrelevant” group included Goal 1 “No Poverty”, Goal 2 “Zero Hunger”, Goal 5 “Gender Equality”, Goal 6 “Clean Water and Sanitation”, Goal 16 “Peace, Justice and Strong Institutions”, Goal 17 “Partnership for the Goals”. The explanations given to justify the inclusion of Goal 1, Goal 2, Goal 5, Goal 6 into the group “unimportant / irrelevant” could be summarized as follows :”On a global scale these goals are important, but in our country these goals have been achieved so, at present, they are seen as irrelevant”. Goals 16 and 17 are considered unachievable and, consequently, irrelevant for the present day situation. The “important / relevant” group included Goal 7 “Affordable and Clean Energy”, Goal 9 “Industry, Innovation and Infrastructure”, Goal 10 “Reduced Inequalities”, Goal 11 “Sustainable Cities and Communities”, Goal 12 “Responsible Consumption and Production”. Goals in this group are important to ”make life comfortable both at present and in the future”, but they are not “of vital importance”; also, they are either considered to have been partly achieved, or work on achieving these goals is being done, although it is recognized that more effort should have been taken to achieve them.

The “very important / very relevant” group included Goals 13, 14, 15 united as “Ecological”, Goal 3 “Good Health and Well-being”, Goal 4 “Quality Education”, Goal 8 “Decent Work and Economic Growth”. Goals in this group are considered to be “of vital importance” and “there is a lot to be done to achieve them”.

The next stage of the project involved integrating content related to sustainability into the curricula. Being members of the “Cross-cultural communications and humanities” department, we were able and, thus, decided to integrate the contents into the following courses: “General English”, “Business English”, “Professional English”. Topics like “Doing business internationally”, “Economic trends of the 21st century”, “Educational issues” included into the basic curriculum were enriched with the contents related to Sustainable Development issues (for example, within “Economic trends of the 21st century” we considered “Fair Trade”, “Ethical consumerism” etc). We also added topics to the “Business English” and “Professional English” curricula (”Social responsibility of business”, “Issues at the workplace - gender equality, diversity”, “What makes a good company” etc). In the course of studies materials on these topics from textbooks by Oxford University Press, Cambridge University Press, Macmillan, National Geographic Learning were considered both from the linguistic point of view and from the informative and sense-bearing point of view. Students also did case-study assignments and prepared presentations on the best practices and procedures adopted in foreign and Russian companies.

The final stage of the project involved participation in a students' research conference. Research conferences have been recognized as a means of developing and facilitating a set of competencies that can be related to sustainability competencies - a competency in interdisciplinary work, a competency in transcultural understanding and cooperation, a competency in planning and implementation, a competency in self-motivation, a competency in setting professional goals and finding ways of implementing them. Each university department has to hold a research conference (or participate in a research conference organized by another department) at least once a year. Students are encouraged to take part in the conferences and present their research papers or projects at them. In the years of 2019 and 2020 there were 1 and 2 reports respectively on sustainability related issues. This year on May 19 the conference “The role of physical education in the modern world” was held. Our department of “Cross-cultural communications and humanities” held its own section “Good health and well-being as one of the Sustainable Development Goals” and 13 research projects and papers prepared by individual students and teams were accepted for participation. In their papers the students addressed important issues of their own choice, provided some research to prove their point of view and offered possible solutions that could be implemented at different levels - from national to local. Each paper showed that social initiatives and actions taken by businesses or by public organization could bring very important economic benefits. The conclusions drawn by the students reflected the shift in their perception of social initiatives and actions - social initiatives in private companies and public

organizations used to be considered manifestations of good will of individual employers and, therefore, unprofitable and unique. At the conference, best practices and procedures existing in different foreign and Russian companies were interpreted as benchmarks for every private company or public organization to establish and achieve.

The pandemic of COVID-19 was touched upon directly or indirectly in the students' research papers. This enviromental factor has so significantly affected both the economic and the social spheres of lives that it could not have been ignored. According to business analysts, in general, in 2020 the crisis affected 67% of companies, 1/3 of Russian companies worked at a loss in the spring of 2020 and about 1 million companies closed down. Among them there were travel agencies which made losses of RR500 billion, food catering companies whose turnover went down by 2 times compared to the same period in the year of 2019, retail outlets whose turnover went down by 36,7% in April 2020 and by 19,2% in May 2020 compared to the same period of 2019. 65% of Russian retail chains are planning to close about 15 outlets on average, and only 18% of retail companies are not planning to close any of them. In order to survive, entrepreneurs tried to optimize their costs by making their staff redundant (34% of companies), by reducing the pay level (26% of companies), by reducing non-financial benefits for employees (10% of companies). The most frequently reduced non-financial benefits were in-company training programmes and health-and-fitness programmes (Poteri rossijskogo biznesa ot coronavirusa, 2021). The general decrease in profits for medium and big businesses in the year of 2020 is estimated to be 23,5%, besides the experts believe this decrease would have been more significant if the government had not supported these businesses financially (Vinogradova, 2021). For small businesses it was more difficult to get financial support, so they suffered much more. Economic difficulties have resulted in increasing competition in the labour market for young people in general and for recent graduates in particular (Glavnye posledstvija pandemii dlja rynka truda, 2020). The students feel the need to increase their own employability and become more competitive in the labour market by gaining new knowledge and developing new skills. Obviously, these ideas are shared by many more people belonging to different social and age groups, as the demand for on-line educational courses increased dramatically in the spring of 2020 and the profits of Russian companies offering such courses soared (Ryzhkova and Vysokich, 2021). The students also noted that health issues are being paid more and more attention - they have mentioned the increase in sales of health-and-fitness products, the increase in sales of healthy foods and the growing interest to healthy life style habits (Prodazhi sporttovarov v Rossii v 2020 godu vyrosli pochti v tri raza, 2021). However, the students expressed their own health concerns related to the development of bad habits among some people during the so-called self-isolation period in the spring of 2020 and the increasing number of mental health problems occuring in people at the same period. According to their research, unhealthy habits and mental problems of employees bring significant losses to companies and to the society at large. So, the students call for action at all levels - from

prohibiting selling alcohol to people before the age of 21 (now alcohol can be sold to people of 18 years of age), increasing penalties for those who break the rules to introducing measures on improving mental health of students and company employees. The students also believe that the authorities at all levels should pay more attention to developing healthy habits in people and to teaching them responsibility for their own health and well-being.

4. Conclusions

Our educational research project has shown that issues related to sustainability can be integrated into any course contents, and awareness of the concept of Sustainable Development and its Goals can be created within any educational framework. As relevance of SDGs can differ from region to region, it seems most effective to estimate various issues within the framework of SDGs for a given target audience first, and educate the target audience by using relevant examples with the help of formal and informal teaching means and methods. Case studies and research assignments help to develop the set of sustainability competencies and soft skills.

Educating on sustainability issues is important at different levels, and universities can design and develop educational courses on Sustainable Development for the business and local communities. To be able to do this work successfully, it is important to raise the awareness of Sustainable Development issues among the teaching staff. Further research work has to be done on the ways of implementation of sustainability issues into business and educational practices in Russia.

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Combatting Climate Change: The Roles of National Culture and Education

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Abstract

This multinational study examines the role of national culture, education, and GDP on the progress 70 countries made to combat climate change. Climate change refers to the progress of a country to reduce emission rates of greenhouse gases and black carbon which is measured through eight indicators. Education and Hofstede's cultural dimensions are used as independent variables in the study. GDP is used as a control variable and did not have any significant impact on the variables. The results suggest that culture and education play important roles in the progress to combat global climate change and the findings provide insight on the direct and indirect impacts of culture on climate change. Individualism has an indirect and direct impact on climate change while uncertainty avoidance has only a direct impact. Education has a direct impact on climate change and both individualism and long-term orientation have a direct impact on education.

Keywords: climate change, national culture, education, environmental performance, cross-cultural study

1. Introduction

The topic of climate change has quickly become a focal point for many controversial political and social discussions and has led to countries being at different stages of sustainability and environmental performance (Monroe et al., 2017; Tranter & Skribis, 2014). Climate tends to be expressed as the average weather patterns of a region which varies with the season (Kwaśniewska, 2020). Factors such as industrialization, uneven regional population growth, and globalization have all contributed to the way the global climate has been changing (Bu et al., 2016; Jiang & Hardee, 2011; Vavrus et al., 2008). Temperatures around the world have been on the rise and typical weather patterns are becoming more stagnant which is damaging sensitive ecosystems (Gutt, 2017; Shaw, et al., 2011). Despite the differing economic and political views on climate change (Helm & Hepburn, 2010), it is clear that the changing global climate needs to be addressed.

Understanding factors that positively and negatively impact the reduction of climate change are essential for governments and businesses to implement policies to accomplish the desired sustainability goals as the public is increasingly demanding more environmentally sustainable practices, products, and services (Kumar et al., 2021). However, many corporations and government officials worry about how these changes will affect business practices and the state of the economy (Bowen & Stern, 2010; Evangelinoset al., 2015; Norton, 2018). The legislature must find a way to implement policy changes to reduce greenhouse emission rates without being detrimental to the economy (Kumar et al., 2020). A balance between government and business practices is dependent on the understanding of elements that have a significant influence on a country's ability to limit its role in global climate change (Kumar et al., 2019). For governments to understand the issue at hand, more research needs to be done due to the limited number of studies on the topic, specifically on education and national culture's role on climate change (Lahuerta-Otero & González-Bravo, 2018).

The findings of Husted (2005) suggest that national cultural values play a significant role in the environmental practices of a country and it is important for those in charge to have a strong understanding of those roles. As national cultural values remain rather steady, Peng and Lin (2009) suggest that higher education holds a strong position to influence environmental performance. Their study suggests education plays a mediating role between national culture and environmental sustainability, which was measured by the Environmental Sustainability Index used by Peng and Lin (2009). Although both studies' findings are

suggestive, the results tend to be based on limited data which indicates more research needs to be conducted to confirm these findings. Therefore, the purpose of this multi-national study is to further explore the role of national culture and education on the progress to mitigate climate change. Practical implications of the results are proposed to further enhance environmental performance.

2. Background/Literature Review

Climate Change:

In this study, climate change is the indicator being further analyzed from the EPI and is referred to as the "progress to combat global climate change, which exacerbates all other environmental threats and imperils human health and safety" (Wendling et al., 2020). Climate change consists of eight indicators: "adjusted emission growth rates for four greenhouse gases (CO_2, CH_4, F-gases, and N_2O) and one climate pollutant (black carbon); growth rate in CO_2 emissions from land cover; greenhouse gas intensity growth rate; and greenhouse gas emissions per capita" (Wendling et al., 2020). Greenhouse gases drive climate change as they trap heat in the atmosphere to trigger global temperatures to rise, causing crucial shifts in the global environment (Meinshausen, et al., 2017). Countries with a higher climate change score demonstrate a stronger environmental performance through their reduction of greenhouse gases (Wendling et al., 2020).

The Environmental Performance Index (EPI) was chosen as the source of progress against climate change in this study for two main reasons. Firstly, the EPI, published by Yale Center for Environmental Law & Policy, has spent the past two decades establishing its data collection, reporting, and verification methods to reflect the most recent advances or regressions in environmental performance. (Wendling et al., 2020), The 32 performance indicators of the EPI can be individually analyzed to gauge country performance and is the most exhaustive index. The overall EPI score is beneficial to get an overall sense of a country's performance, but breaking the score down by indicator provides deeper insights into specific areas and actions a country is doing well in. We can also gain a deeper understanding of specific areas that have stronger impacts on the overall EPI score. Secondly, EPI was chosen because previous research has predominantly focused on other measures of sustainability, such as the Environmental Sustainability Index (ESI). The ESI has an established role in the research world but the data has become outdated. The organizer has stopped the continuation of the ESI and has now moved towards the EPI approach after recognizing the wider applicability of the EPI (Environmental Sustainability Index (ESI), n.d.). To create more accurate and applicable results, the EPI was decided to be the strongest source for environmental performance. This study wants to further explore the EPI, national culture, and education due to the limited research that has been conducted, despite the significant value the EPI provides.

In a previous study, national culture, GDP, and R&D performance were studied to understand the EPI of 31 European countries (Lahuerta-Otero & González-Bravo, 2018). It was found by Lahuerta-Otero and González-Bravo (2018) that cultural values had an important role on certain indicators of the EPI, such as air quality, but for other indicators, national culture lost its significance when GDP and R&D performance were considered together. An important fault Lahuerta-Otero and González-Bravo (2018) acknowledge is that they only focused on European countries, which have somewhat aligned environmental strategies. Environmental policy and performance vary depending on Hofstede's cultural dimensions, even though European countries have similar environmental objectives (Lahuerta-Otero & González-Bravo, 2018). Using correlation matrix and cluster analysis, it has been suggested that more individualistic, uncertainty avoiding, and long-term oriented countries have higher EPI scores, therefore having a strong environmental performance (Kumar et al., 2019). Kumar et al. (2019) argue that due to the adaptive nature of culture, improving environmental performance shapes national culture. Cox et al. (2011) found that individualistic and lower power distance cultures, where egalitarianism, freedom of expression, and individual initiative are greatly valued, were more concerned with environmental sustainability. It is suggested that as developing countries become more economically stable, their cultural values may shift which results in a focus on balances economic growth with environmental sustainability (Cox et al., 2011).

National Culture:

Culture in this study is defined as "the collective programming of the mind distinguishing the members of one group or category of people from others" (Hofstede et al., 2010, p. 6). Throughout his years of research, Hofstede was able to break down culture into the following six cultural value dimensions: power distance index, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence (Hofstede, 1980; Hofstede, 2001; Hofstede et al., 2010). Mi, et al., (2020) found that on an individual level, long-term oriented and collectivistic tendencies play an important role in the private and public sphere of pro-environmental behaviors (PEB), which are actions that significantly contribute to mitigating environmental pollution. Power distance was shown to not have any significant impact on either a private-sphere or public-sphere PEB whereas masculinity only affected public-sphere PEB. Social-demographic characteristics such as gender, age, and educational level have been shown to moderate the effect of cultural values on both PEB spheres (Mi, et al., 2020). Husted (2005) suggests that collectivist societies view environmental stability as being in the best interests of everyone.

Cultural values have been found to have a significant impact on corporate social responsibility (CSR), which consisted of four components, including an environmental category. Higher masculinity and uncertainty avoidance played a significant direct role in the environmental efforts done by companies across the world (Ho et al., 2012). However, another study further exploring the role of national culture in CSR found masculinity has a negative impact on corporate social responsibility whereas individualism and uncertainty avoidance have positive effects (Peng et al., 2014). Although this discrepancy between the significance of variables Ho (2012) and Pang (2014) can be due to a slightly different methodology, the inconsistency demonstrates a need to further examine the role of national culture and CSR.

A higher power distance index and a higher masculinity index have been shown to negatively impact the ESI, which is a composite number represented from five major components made up of 67 variables. Risk avoidance and individualism were not found significant factors on sustainable development during the research (Park et al., 2007). However, in another study that measured the significance of national culture, economic development, and population growth on a country's environmental performance, it was found that each cultural variable has a significant effect. The least effective variable was uncertainty avoidance (Peng & Lin, 2009). When these studies took place, however, there were only four cultural values established by Hofstede, whereas there are now six. Indulgence and long-term orientation have now been established as separate cultural values. Since the new variables were established, there has been minimal research done exploring how a country's culture influences its environmental progress. On the other hand, an area that has more extensive research with potentially important results is education.

Education:

In this study, education is referred to as the average years of all schooling across all education levels for the population aged 25 and over (Mean Years of Schooling, 2017). Peng and Lin's (2009) research suggests that education plays a significant direct role on environmental performance, in addition to providing a link for culture to environmental performance. Alkhateeb et al. (2020) found that with more education, society members awareness increases, and they may be more likely to act to combat climate change. The amount of primary education has a rather insignificant impact on CO_2 emission, but higher secondary schooling years have been shown to directly decrease CO_2 emission (Alkhateeb et al., 2020). An Australian study conducted by Balaguer and Cantavella (2018) has shown that increasing higher education student rates play a direct role on the CO_2 emissions per capita. Economic growth in combination with improving education rates has a significant role to improve environmental conditions (Balaguer & Cantavella, 2018). In general, higher years of schooling on average have been connected to economic growth rates, which may influence other measurements as well (Breton, 2015).

In a study of Brazil and El Salvador, Wamsler et al. (2012) found that a higher average level of formal education had a direct effect on factors that reduced the risk of climate change and mitigated factors that further damage global climate. They also found higher education levels increased one's awareness and understanding of climate change and also reduced behaviors contributing to climate change (Wamsler et al., 2012). In different studies of the Nordic countries, it was suggested that higher levels of education had

more environmental awareness and are more likely to be interested in buying an all-electric vehicle or already are driving an electric vehicle (Sovacool et al., 2018). Consumer knowledge in the Nordic countries is one of the top four barriers for electric vehicles to dominate the market. Stronger knowledge of environmental issues and electric vehicles leads to consumers being more likely to purchase an electric vehicle (Noel et al., 2020).

GDP (Control Index):

It is well known that international trade and foreign direct investment are driving factors of economic development and national wealth (Akalpler & Hemn, 2017); however, both of these economic practices have a direct and indirect impact on CO_2 emissions (Huang et al., 2019; Zhang & Zhang, 2018). With further global economic activity, however, it is expected that more advanced green and cleaner technology will arise (Davidson & Sirotkina, 2020). Green investments have also been founded to promote GDP per capita growth (Lyeonov et al., 2019). GDP per capita, along with population and technology growth, were found significant factors affecting the carbon emissions from energy consumption in China. Forecasting China's future energy consumption in various scenarios showed that a high GDP per capita growth rate had carbon emissions at their highest (Li et al., 2019).

3. Hypotheses and Research Questions

Based on previous research exploring progress for environmental protection relating to Hofstede's cultural dimensions, this study explores the following hypotheses:

H1: The higher the degree of Uncertainty Avoidance, the higher climate change progress

H2: The higher the degree of Individualism, the higher the climate change progress

H3: The higher the degree of Long-Term Orientation, the higher the climate change progress

H4: The higher mean years of schooling, the higher the climate change progress

Due to the limited research of education's role regarding environmental progress and Hofstede's cultural dimensions, the study also explores the following research questions:

RQ1: To what degree do cultural values impact education?

RQ2: To what degree does education mediate cultural values and climate change progress?

4. METHODOLOGY

Based on the previous literature, this study explores the interactions between national culture and education on climate change. The dependent variable, climate change, was gathered from the *Environmental Performance Index* (EPI) which is developed by Yale Center for Environmental Law & Policy. The EPI ranks 180 countries based on 32 performance indicators under 11 issue categories to convey how established a country's environmental policy is (Wendling et al., 2020). Climate Change was one of the issue categories under the Ecosystem Vitality policy objective section. Based on a scale of 0-100, the higher the climate change score, the more progress a country has made to reduce its emission rates.

Hofstede's cultural value dimension data used in this study came from Hofstede Insights Country Comparison which is based on Hofstede et al. (2010) and is the commonly accepted national culture framework. Consequent studies have validated Hofstede's results. For the purposes of this study, uncertainty avoidance, individualism, and long-term orientation are the three dimensions focused on, but all six dimensions were looked at. Uncertainty avoidance measures how comfortable society is with uncertainty and ambiguity on a scale of 1-112. Nations with a higher score in this index do not stray from their firm beliefs. On a scale of 1-100, individualism measures "the degree of interdependence a society maintains among its members" (Hofstede et al., 2010). Countries with scores lower than 50 in this dimension are considered collectivist where society members take care of each other. Long-term orientation

is the way societies link their past to present and future challenges and is measured on a scale of 1-100. Those who score high in this area "encourage thrift and efforts in modern education" (Hofstede et al., 2010) to plan for the future.

Our World in Data provided the data for the average number of years of schooling. The *Our World in Data* dataset combines three published datasets to present the average years of schooling for 189 countries for each year from 1870-2017. Education data from the year 2014 was used in this study as it takes several years to see the effect of education in society.

Although GDP per capita is not discussed in the hypotheses or research questions, the variable GDP was included in the data analysis to act as a control variable due to previous research suggesting GDP can play a role in the education obtained in a country and environmental performance. To act as a control variable and to ensure the correct variables were being measured, GDP was included in the regression analysis. (Real GDP (purchasing power parity), 2020).

The World Factbook provided GDP per capita at purchasing power parity (PPP) which utilized each country's purchasing power parity for each country at prices present in the United States. The larger the GDP per capita (PPP) suggests higher living standards and stronger economic performance (Ericsson & Molinder, 2020). Power distance index and masculinity were also included in the regression analysis despite not being in the hypotheses or research questions as previous research (Peng & Lin, 2009) suggested the two cultural values may play a significant role in the environmental performance of a country.

A total of 70 countries had data for each of the variables used in the data analyses. SPSS was utilized to run descriptive statistics, correlations, and hierarchical regressions of the data. Variance Inflationary Factor (VIF) analysis was used as well to assess multi-collinearity. To explore and measure the mediation of education, Bayesian tests of indirect effect confidence interval and p-value were run. The Hierarchical Bayesian method is better suited for smaller samples and has outperformed other methods, such as the BCa Bootstrap method (Biesanz et al 2010). These qualities combined made the Hierarchical Bayesian method ideal for this study.

The confidence interval calculator utilizes regression coefficients, standard errors, degrees of freedom, and t-statistics which are calculated in the regression models. The calculated confidence interval demonstrates the reliability of the data (Falk & Biesanz, 2016). The Partial Posterior P-value calculator uses the t-statistic for the two paths in the mediation model along with the degrees of freedom and sufficiently controls Type 1 error rates (Falk & Biesanz, 2016). To calculate the most accurate results, computational accuracy and speed were set to excellent for both calculators.

5. Results and Discussion

Table 1: Descriptive Statistics

	Mean	Std. Dev.	N
Climate Change (Clim-Chg)	59.05	15.95	70
Power Distance (PDI)	60.83	21.75	70
Individualism (IND)	43.37	23.26	70
Masculinity (MAS)	48.51	19.11	70
Uncertainty Avoidance (UAI)	66.66	22.41	70
Long-Term Orientation (LTO)	42.64	21.97	70
Indulgence (IVR)	48.96	22.56	70
Education (EDU)	9.83	2.73	70

The basic descriptive statistics and correlations are displayed in Tables 1 and 2 and Table 3 presents the results of the hierarchical regressions. Model 1a of Table 3 begins to address **RQ1** as it demonstrates individualism and long-term orientation are significant predictors of the variance of Education (R^2.609). Model 1b goes on to suggest the significance of individualism and long-term orientation being significant predictors of the variance of Education (R^2.573). In the same model, GDP was added to the regression to

measure its possible role and GDP does not have a significant impact on mean years of schooling. Model 2 and its sub-models address the four hypotheses. Model 2a, supports that Individuality, Uncertainty Avoidance, Long-Term Orientation, and Indulgence play a significant role in predicting the variance of Climate Change (R^2.521). Model 2b supports **H4** as it suggests Individualism, Uncertainty Avoidance, and Education play a significant role in predicting the variance of Climate Change (R^2.570). Model 2c further supports the non-significant role of GDP impacting Climate Change as it did not have a significant p-value. Model 2c supports that Individualism, Uncertainty Avoidance, and Education each had a significant role in directly predicting the variance of Climate Change (R^2 .550). Model 2a supports **H1** and **H4** as they suggested the direct impact of Uncertainty Avoidance and Education on the progress to combat climate change. Model 2c supports Individualism having a significant impact however it is not an inverse relationship, as hypothesized in **H2**.

Table 2: Correlations

	Clim-Chg	PDI	IND	MAS	UAI	LTO	IVR	EDU-2014	GDP (Mil)
Clim-Chg	1								
PDI	**-0.49**	1							
IND	**0.62**	**-0.66**	1						
MAS	0.03	0.13	0.14	1					
UAI	0.13	0.15	**-0.20**	0.04	1				
LTO	**0.26**	-0.09	**0.27**	**0.21**	-0.01	1			
IVR	**0.21**	**-0.26**	0.17	-0.07	-0.14	**-0.42**	1		
EDU-2014	**0.68**	**-0.50**	**0.70**	0.09	-0.02	**0.44**	0.11	1	
GDP (Mil)	0.01	0.04	0.11	**0.24**	**-0.22**	**0.24**	-0.08	0.02	1

For abbreviations see Table 1

Table 3: Regression Models

	Model 1a Std. Beta	Model 1b Std. Beta	Model 2a Std. Beta	Model 2b Std. Beta	Model 2c Std. Beta
PDI	-0.124		-.126		
IND	**0.517[3]**	**.631[3]**	**.505[3]**	**.343[2]**	**.357[2]**
MAS	-0.043		-.070		
UAI	0.137		**.291[2]**	**.232[2]**	**.213[1]**
LTO	**0.388[3]**	**.305[3]**	**.241[1]**	.065	
IVR	0.175		**.229[1]**	.165	
EDU	**Dep.**	**Dep.**		**.402[2]**	**.439[3]**
GDP		-.127			.008
Clim-Chg			**Dep.**	**Dep.**	**Dep.**
R^2	0.609	.573	.521	.570	.550
Adj. R^2	.571	.554	.475	.536	.523
ΔR^2	.609	.015	.521	.065	.000
F Value	**16.322[3]**	**29.852[3]**	**11.412[3]**	**16.941[3]**	**19.884[3]**

[1]p<.05, [2]p<.01, [3]p≤.001, For abbreviations see Table 1

As mentioned before, to measure the degree of multicollinearity between variables to avoid inaccurately interpreting the results, variance inflationary factor (VIF) was used with each regression model. Across the five models, the VIF score ranged from 1.0 to 2.4 which is below the suggested score of 5. These results suggest that multicollinearity should not play a role in possible misinterpretations.

For **RQ2**, Hierarchical Bayesian Analysis was used to understand the role education had in mediating national cultural values and climate change progress. Rather than assuming normal sampling distributions,

the Bayesian approach draws from the posterior distribution of each regression coefficient. It is also suggested that this method is more appropriate for small samples that are less than 100 (Biesanz, Savalei, & Savalei, 2010).

Falk & Biesanz (2016) developed both a confidence interval calculator and an indirect effect p-value calculator which were utilized for the results displayed in Table 4. The results support that both Individuality and Long-Term Orientation impact Climate Change through Education at a significant level. From looking at Tables 3 and 4, **H3** is supported as Long-Term Orientation has a significant direct impact on Education which then Education has a direct impact on Climate Change. Therefore, Long-Term Orientation is having an indirect impact on Climate Change in addition to the direct impact on Climate Change explained above.

Table 4: Hierarchical Bayesian Test

Settings and Results	IND>EDU>Clim-Chg	LTO>EDU>Clim-Chg
Computational Accuracy Settings	Excellent	Excellent
Confidence Interval Setting (%)	0.95	0.95
Confidence Interval	**.0809, .3227**	**.0267, .1741**
Partial Posterior p-value	**0.0003**	**0.0018**

For abbreviations see Table 1

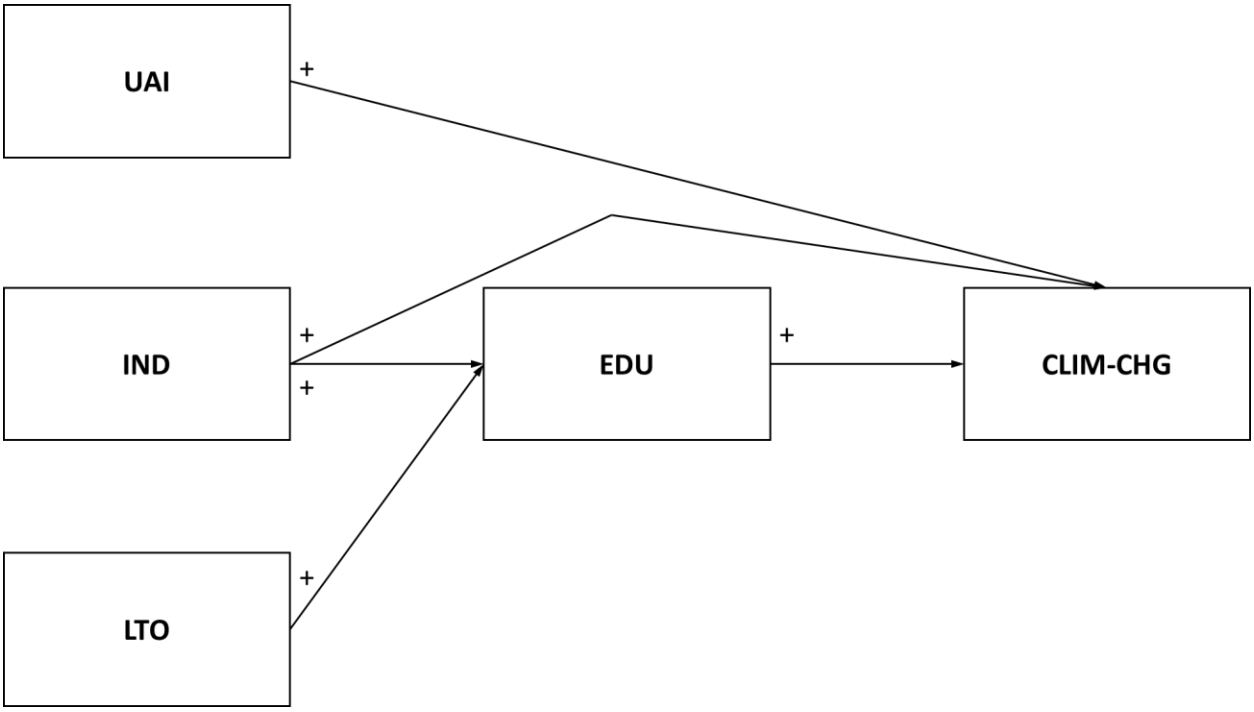

Figure 1: Climate Change Model Significant Results

The purpose of the study is to examine the potential impacts of education and national culture on the progress of a country to combat global climate change. The findings from the study support a mediated model that both culture and education play vital roles in the progress a country is making to reduce its contribution to climate change. Based on the results, it is supported that uncertainty avoidance, individualism, and education play a direct role in climate change. It is also supported that individualism and long-term orientation have an indirect impact on climate change through a direct impact on education. Figure 1 visualizes these direct and mediated relationships between the variables. These results further support findings mentioned previously that national culture and education play a role in the environmental

performance of a country. Gaps in research on the role of national culture on environmental behaviors were also addressed in this study.

Unlike Peng and Lin (2009), this study has found that power distance and masculinity do not play a significant role in a country's progress to reduce their greenhouse gas emissions, whereas it had been previously suggested that each cultural value plays a significant role. Additionally, a relationship between indulgence and the progress against climate change was not found which differs from Peng and Lin (2009). This could be due to the environmental performance variable used in previous studies measuring the sustainable development of a country whereas climate change measured the progress to reduce greenhouse gas emissions.

6. Discussion

Under normal circumstances, national culture is very stable and to effectively impact a nation's culture is through policy. Policymakers and officials need to understand the reasons why these specific cultural values are having an impact on climate change. Government officials can pass laws or policies to combat climate change even if it does not necessarily fall within their country's national cultural values. To successfully pass these kinds of laws, legislatures can involve their citizens in the process, especially if the policy would be promoting actions not typically accepted. Policies are only effective if they are followed through by the people and having their opinions incorporated into the laws will encourage their support. Promoting transparency on sustainability has been proven effective in European nations and has been suggested to also be effective in Latin American countries (Guerrero-Gómez et al., 2021). Reforming transparency laws to require environmental sustainability information to be easily accessible by the public will help governments accomplish full transparency and encourage uncertainty-avoidant behaviors.

In general, every country stands to gain more and further develop from a better and stronger education, which includes prolonging how long students are in school. If not for the suggested environmental impact longer education has, it would be in each country's interest to invest in and develop their education programs. Policies to encourage students to stay in school longer such as lowering the cost of schooling or investing in technology to make schooling more interactive and flexible would be ideal. To further enhance the environmental aspect education has, those in charge of establishing learning standards- government or board of education- are recommended to require environmental education. Focusing on environmental issues from a young age will promote action in the future because as the students grow older, they will already have a strong foundation on how to ethically and critically evaluate a broad range of environmental issues. Public knowledge and awareness will be enhanced and as a result, people will make more informed and sustainable decisions. Education is an investment so although there will be some quick advances, the effects will continue to increase for years to come.

Corporations are finding environmentally friendly systems to be appealing as well. With an increasing demand from consumers for organizations to employ green practices, it is in the best interests of businesses to implement environmentally sustainable policies. Expanding into countries that harbor these significant cultural values will give companies a competitive advantage because there has been an increasing demand from consumers for eco-friendly products and environment-oriented organizations (Cassely et al., 2020). Companies can also utilize a strategic management perspective to encourage a long-term-oriented belief in the workplace. Some goals can include reducing carbon emissions by 60% in the next 10 years or eliminating all waste in the manufacturing process. Companies have already begun establishing environmental sustainability plans, such as Audi, a car manufacturing company. Using 2015 as a reference year, Audi intends to reduce CO_2 emissions by 30 percent across the vehicle lifecycle by 2025, and by 2050, Audi intends to be climate-neutral in all aspects of the company (Kolb, 2019).

7. Limitations and Future Research

With only 70 countries in the sample, there is a higher variability which can be seen by the larger standard deviations. Larger standard deviations indicate that the data is spread out over a wider range of values. Additionally, the high variability may lead to bias which can deem the results to be less conclusive since

the margin of error increases. Due to this, results from the study should be construed conservatively. The study also only investigates the role of education and national culture and does not address other factors that have been suggested to have an impact on environmental progress. The study suggests that 55% of the variance of climate change is attributed to education and national culture, but the remaining 45% of the variance is not explained. This demonstrates that other statistically significant factors play a role on the progress of a country to reduce climate change.

For future research conducted, it is suggested to further expand this model with a larger sample size. There are many opportunities to further research the role of cultural values in the actions a country is taking to reduce its impact on the environment. It is suggested that future studies investigate other variables and factors that play a role in a country's efforts to strengthen its environmental practices. The variable education measured the average number of years of schooling but that does not necessarily mean the population has a better education. Future studies should examine whether the quality of education is a better measurement over the average number of schooling years. With many factors playing a role in the environmental performance of a country, more studies, in general, need to be conducted for government officials, management, and the general public to become more aware and understanding of the global issue.

8. Conclusions

The study concludes that national culture and education have significant relationships with the progress a country has made to reduce its emission rates of greenhouse gases and black carbon. Specifically, it was found that uncertainty avoidance and individualism have significant direct impacts on the progress to reduce climate change. Education had a direct role on climate change and had a mediating role. Individualism and long-term orientation had an indirect impact on climate change through their significant direct impact on the average schooling years of a country. The study did not establish a relationship for the cultural values of indulgence, masculinity, or power distance index with the reduction of emission rates.

A country's history, religion, language, and political attitudes play important roles on each country's culture and identity. With environmental sustainability becoming a progressively more valuable and critical issue to address, governments and corporations need to identify cultural values that positively impact the condition of the global climate to create and implement effective policies to promote these cultural behaviors. It is also in a country's best interest to improve its education programs to facilitate economic growth but to also improve the condition of the planet. Establishing educational programs which will keep students in school longer will allow countries to enhance environmental performance in the long run.

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Education for Sustainable Development in time of crises

Possibilities for learning concerning an unknown future

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Abstract

A new pedagogy that can manage an unknown future is needed in time of crises. Especially the western world needs a change in attitudes, behaviors, and lifestyles. The world has changed, with destructive consequences for many, will continue to change and will not return to the situation 'normal'. That is, it will not return to "normal" global temperatures or species abundance and fluctuations experienced by earlier generations of humans. The epoch has been labeled 'The Anthropocene'. With the pandemic, also our daily social life has changed and have an impact on us as human beings and our relation to nature. The planet is facing problems that are of such a kind that they cannot be looked upon as only technical problems. The pedagogy of today partly confirms and gives support to a kind of *status quo* in society - or business as usual. This paper aims to illuminate and discuss how a pedagogical model for education and teaching could be formulated that manages the challenges for education and pedagogy concerning an unknown future. For our discussion, keeping the Anthropocene in mind, we present the main ideas of *Wild pedagogies* [WP]. WP began as a graduate course at Lakehead University (Canada) and was later developed through an international network. WP tries to rethink education and re-examine relationships with places, landscapes, nature, more-than-human beings, and the wild. WP also tries to challenge recent trends towards increased control over pedagogy and education, and how this control is constraining and domesticating educators, teachers, and students. In WP six 'Touchstones' are intended to be reminders of what educators could do in teaching. We have used an abductive approach for the analysis and content analysis as method. We used constructive critical didactics as a theoretical framework. This gave possibilities to illuminate what perspectives and strategies educators and teachers can be aware of and how that could have an impact on theories, practices, and approaches in education. Our results show that educators can problematize the dominant versions of education that are enacted in powerful ways and turn to a practice that challenges a human-centered view and unecological *status quo*. Given the dominant current human relationship with the earth cannot be sustained we posit that any critique suggested must be paired with a vision - and corresponding educational tools. We discuss this through possible didactical concepts. A conclusion is how it allows for the possibility to enact a new relationship through education that also has an inexorable impact on how to understand learning and teaching.

Keywords: Abduction, Content Analysis, Education, Didactics, Sustainable Development, Wild Pedagogies

1. Introduction

Our point of view is that we are heading towards an unknown future with accelerating progress. The world has changed, with destructive consequences for many, will continue to change and will probably not return to the situation 'normal'. That is, it will not return to global temperatures or species abundance and fluctuations that fall within the kinds of background levels experienced by generations of humans. (ipcc.ch, 2014). The pandemic has changed our daily life and has an impact on our relationship with nature. We think that the problems the planet is facing are of such a kind that they cannot be looked upon as only technical problems. Generalists who can combine many different forms of knowledge need to be educated (Bhaskar et al., 2012). Today's problems cannot be handled by continuing on the same path we have chosen. We need other innovative ways of living and the joy of a more nature-friendly life.

The time we live in has been labelled 'The Anthropocene' (Jickling et al., 2018). It is used to describe how human activity has an impact on the physical processes of the earth and puts man in the center. This worldview has been heavily criticized by using a concept as Anti-Anthropocene. Anti-Anthropocene illuminates man’s responsibility for the situation and at the same time the impossibility to control how things develop. Learning to live within an unknown future then becomes important. Another important point is that the challenges we face require a critical approach to question the priority of knowledge on behalf of democratic values. The knowledge issue is instrumentalized and when what can be measured has become most significant (Englund et al., 2012). Economic interests and the labor market are at the forefront, where the benefits of education are valued concerning educating technocrats more than educating citizens for a democratic society (Forsberg & Wallin, 2006). The demands for clarity and an evidence base for how the school's objectives are achieved, which is often based on New Public Management [NPM] as logic, is a threat to moral considerations (Green, 2011). It is even more important than ever before to focus on values and the question of why in education (Biesta, 2009). There is a need to change attitudes and behaviors that can manage an unknown future. This is a pedagogical problem and important in education. But the dominant pedagogy of today confirms and gives support to a kind of status quo in society (Jickling et al., 2018). A time of crisis might need a radical new pedagogy.

Our interest touches on issues of democratic education in particular, as well as issues of knowledge and learning. We need new perspectives in education and teaching that give space for man's relationship to the environment and values, attitudes, and readiness for action. These notions need theoretical concepts that could help us to understand and examine this in a pedagogical and didactical context. This paper aims to illuminate and discuss how a pedagogical model for education and teaching could be formulated that manages the challenges for education and pedagogy concerning an unknown future.

Our argumentation about societal development has a background in critical realism and a Nordic eco-philosophical tradition (Bhaskar et al., 2012). According to Bhaskar critical realism distances itself from postmodern discourse and also questions the dualism between facts and values and emphasizes that values can be rationally reasoned. It questions the Western worldview that maintains regularity, predictability, and control (Jickling et al., 2018; Morse et al., 2021). In this paper, these perspectives give a possibility to critical interest and to focus on both questions of why, of values and practice (see e.g. Biesta, 2009).

We present the main ideas in the concept of Wild pedagogies [WP]. WP began as a graduate course at Lakehead University (Canada) and then later developed through an international network of engaged pedagogues. WP tries to rethink education and re-examine relationships with places, landscapes, nature, more-than-human beings, and the wild. WP also challenges recent trends towards increased control over pedagogy and education, and how this control is constraining and domesticating educators, teacher's engagement, and curiosity. We consider WP as an interesting alternative for shedding light on issues mainly discussed within education for sustainable development [ESD] and in outdoor education. In WP six 'Touchstones': Nature as a Co-Teacher, Complexity, the Unknown, and Spontaneity; Locating the Wild; Time and Practice; Socio-Cultural Change; Building Alliances and the Human Community, are formulated as reminders to help pedagogues what to do in teaching. To illuminate what perspectives and strategies teachers can be aware of and then discuss how it could have an impact on theories, practices, and approaches in ESD, we reconstruct WP within a didactical framework.

2. Method

Methodologically the study is based on an abductive approach and content analysis as method. The core of abduction is that a notion of something can be interpreted within the framework of other perspectives and theoretical frameworks to reach a more developed and in-depth understanding (Danermark et al., 2018). In an analysis, there are similarities with hermeneutics when it comes to the commute between part and whole. Creativity is emphasized and the ability to associate is central to how theoretical and empirical statements are related to each other as an ongoing process. Empirical data are used as an argument in a debate and in that case, need to be obvious rather than proven (Alvesson & Sköldberg, 2017). This requires a consistent and conscious interpretation. Furthermore, concept formation and theorizing are considered essential in abduction (Danermark et al., 2018). This opens up to discuss how a pedagogical model for education and teaching for sustainable development [SD] can be formulated to manage the challenges for education and pedagogy concerning an unknown future. In didactic research, practice is seen both as a starting point and a reference framework for didactic theory (Künzli, 2010).

We used qualitative content analysis for interpreting the six touchstones. Although content analysis can be both quantitative and qualitative (Krippendorff, 2019). Qualitative interpretative content analysis has roots in critical scholarship (Krippendorff, 2019; Neuendorf, 2017). The method used meant close reading and rearticulating interpretations of texts into new narratives (Krippendorff, 2019). The three stages, selection of text, coding text, and interpretations of the results were implemented (Krippendorff, 2019; Neuendorf, 2017). We reconstructed the six touchstones described in WP Jickling et. al (2018) by using five questions from constructive critical didactics as a theoretical framework (Klafki, 1995;2010a). As in hermeneutics, the relation to social and conditioned understandings was used to get a holistic impression of what the text was about.

Although science strives to be as value-free as possible and hardly can guide us on how we should act concerning nature, values and norms can be subject to rational justification or criticism (Bhaskar et al., 2012). We also posit that a continental didactical tradition and the assumptions found in critical constructive didactics [CCD] (Klafki, 2010b) are fruitful since it emphasizes that teaching practice is always subject to change and that it is dependent on societal changes. What happens in teaching always needs to be traced back to questions about the purpose and content of the education. Even in critical constructive didactics, an integration between hermeneutic, ideology-critical social science methods and empirical studies is advocated (Arfwedson, 1998; Klafki, 1997).

According to Klafki (1995), three questions illuminate the theoretically based norms: What is characteristic of the content and how is it related to the curriculum? What content can arouse students' commitment and learning? How can it contribute to their personal development and the future as citizens of society? Klafki (1995, 2010a) also formulates a didactical analysis for the preparation of teaching, a reflection about the content. The questions of why and what are in the foreground and particular methods to be chosen in teaching are guided by consideration of practical aspects. Planning for teaching is looked upon as a meeting between theoretical and practical perspectives (Künzli, 2010). It is an interpretive activity, not a technical one (Hudson, 2007). The five questions are mutually dependent, they do not have to be answered in order and the answers to each question are only understandable in the light of the other five answers (Klafki, 1995). The questions are:

What wider or general sense of reality do these contents exemplify and open up to the learner? What basic phenomenon or fundamental principle, what law, criterion, problem, method, technique, or attitude can be grasped by dealing with these contents as 'examples?

What significance does the content in question or the experience, knowledge, ability or skill to be acquired through this topic already possess in the minds of the children in my class? What significance should it have from a pedagogical point of view?

What constitutes the topic's significance for the children's future?

How is the content structured? (which has been placed in a specific, pedagogical perspective by questions I, II, and III)?

What is the body of knowledge which must be retained ('minimum knowledge') if the content determined by these questions is to be considered 'acquired', as a 'vital', 'working' human possession?

The process of interpreting and our analysis occurred in steps: First, we read through the text that describes the six touchstones (Jickling et al., 2018), to get a sense of the content. Then we discussed Klafkis questions and slightly adapted them to be used in the analysis of touchstones. The questions were adjusted to be about a general student, rather than a specific group of students in mind. The questions based on Klafki (1995) was formulated as:

> What key elements can be grasped by dealing with this content?
>
> What significance does the content already possess in the minds of the children?
>
> What constitutes the topic's significance for the children's future?
>
> How is the content structured and how could it be situated in a pedagogical context?
>
> What is the body of knowledge to be retained?

We used those questions as analytic tools and condensed the answers for the six touchstones on our own and then met to discuss the result of our analysis. This process ended with a consensus and further refinement of the result as a thematization based on the six touchstones. The reliability and validity of the analysis were confirmed by: a) comparisons of analyses and interpretations of the same data with each other (internal reliability), and b) in collaboration we discussed collected data against relevance for the aim of the paper (internal validity) (Krippendorff, 2019). Within abduction, the interpretations made should be corresponding to the empirical data and with the purpose of the study, this posits that they need to be tested through the conclusions made (Alvesson & Sköldberg, 2008). This is how the theoretical concepts, principles we formulated, give meaning to the empirical data according to our interest. The analysis corresponds with and gives essential meaning to the three suggested principles as theoretical concepts. Overall credibility has been strengthened by communicative validity (Kvale, 1997).

3. Results and Discussion of Didactical concepts

In the didactic analysis that Klafki (1995) proposes, the first question is about key elements. When analysing the touchstones (Jickling et al., 2018), nature is described to be everywhere, and is characterized by an unpredictable process, and is always changing. Furthermore, nature is complex and includes qualities that cannot be quantified. Key elements are how to understand nature as a co-teacher

and the importance for students to be present in nature to listen to voices other than the human ones. Another key element is that the rhythm of nature challenges a mechanistic view of time and space. Accepting and being able to grasp the moments are essential. Teachers' control over how the teaching proceeds is challenged. Teaching needs to be dynamic where the teacher's role is primarily to help the students focus their attention on the relationships between man and nature, as well as between people.

The second question for analysis is about the students 'prior knowledge'. An obvious result is that nature and the environment at the moment should be in the foreground. Here, the focus is on experience followed by reflection over what is experienced. Thereby meaningful moments could be created. Attention should be paid to the fact that nature has intrinsic value, is changeable, and offer surprises. It is emphasized that nature always is present and cannot be understood solely through human culture. Experiencing the rhythm of nature can contribute to another understanding of time and space than a mechanistic view.

The third question focus on what significance the content may have for the student's future. The importance of allowing the content to emerge and develop based on experiences at the moment is particular. Nature provides an opportunity as it is characterized by an ongoing process without any end. Life is characterized by coincidences and creativity. Sometimes small changes take place, sometimes more dramatic changes. The ability to see nuances and dimensions appears to be central and the possibility to see the unknown in the known, the known in the unknown. The students should develop the ability to ask questions from several different perspectives regarding one single experience.

The fourth question about structuring the content shows in the analysis to be closely related to the view of nature as changeable and with different rhythms compared to what usually characterize human existence. Nature cannot be structured and understood only with the help of previous human frames of understanding. This illuminates and grasps the challenge of humans not being able to control events. Instead, the focus is to be aware of and to try to understand the strengths and weaknesses in how we as humans try to structure our relation to nature. The teacher's role will be to help students formulate questions more unconditionally, from different perspectives, and challenge different ideas. The teacher also can help students to critically illuminate the background for the questions they ask. In interaction with other students and together with the teacher, students can create networks of understandings. Doing this is meant to help students to develop a curiosity for a network of relationships between the individual, common sense, and the environment. A complexity is maintained where different perspectives and contexts can form the basis for meaning.

The last question in the didactic analysis is about what body of knowledge to be retained. The idea that students can develop values where the intrinsic value of nature has a given place, emerges. Understanding the complexity and dynamics of nature illuminates the unpredictable. The fact that there are different views on nature is important. Students should be able to make choices based on conscious

ethical norms and change perspectives of a point of view. This opens up for students to understand that they are influenced by their cultural contexts and way of thinking. The ethical and moral readiness for action, in general, is important. Deliberative and relational skills between people and human relations to nature come to the fore. This is about belonging, authenticity, and responsibility for oneself and others as well as the voices of nature are valued.

The result shows how the enactment of a new relationship through education, placing values, attitudes, and readiness for action is possible. The importance of reflection on values, attitudes, and patterns of action in teaching emerge. When formulating principles as didactical concepts it seems that issues of change and the unknown can and should be in the foreground. To formulate theoretical concepts and a didactic model, it becomes important not to establish the overall objectives for education or provide restrictive methodological instructions. This view of teaching challenges the modern Western education system, which is characterized by control and standards. Although education needs to incorporate both stability and openness, in this case, stability becomes something else. With the results as a starting point, a pedagogical model for education and teaching can be formulated is discussed through three possible didactical concepts: the principle of order; the principle of questioning, and the principle of wild learning. Those concepts have a background in what Klafki describes as theoretical norms. In our case, this is about how to understand how values and the unknown emerges with interest in ESD in time of crises. Those concepts also correspond to what Klafki (1997;2010b) describes as the aim for the critical constructive didactics as developing relations between theory and practice. A didactical model aims to both a theoretical construction for analysis and planning of didactic action in teaching and learning (Jank & Meyer, 1997).

The principle of order – experiencing and being present in the situ: Just to be in nature becomes central. Participating in nature emerges to be prior and primarily, and to be experience-oriented, intuitive, and also presupposing a presence in situ. It becomes important to capture the moment and thereby develop the ability to ask questions, and searching for relationships. This makes it possible to create meaningful moments through reflection and the opportunity to be aware of the diversity of perspectives and points of view. In the foreground is the importance for students to spend time being in nature and to locate the wild without being forced into a logical rationale or a pre-defined interpretive framework for the experience. The starting point should be the student's prior knowledge from being in situ in a broad sense. This is without the teacher having assumed or being able to predict what the students will learn. It challenges views of knowledge and learning.

The principle of questioning - to understand the relationship between nature and culture: The intrinsic value of nature opens up to test one's actions based on moral and ethical norms concerning the environment and interpersonal relations. This, as well as to test the political and cultural expressions on which values and attitudes are based, is about the ability to ask the question of what could have been different. To constantly reconsidering the relationship between nature and culture becomes the focus.

It includes thinking of networks and challenges an unambiguity in favor of a dynamic and complex relationship between the individual and common sense. Understanding issues from different perspectives gives possibilities to pay attention to power relations. An opportunity that something could have been or understood in another way is essential. This strengthens the importance of acknowledging the unknown, in addition to curiosity when trying to challenge the explanations and answers given.

The principle of 'wild learning' - to understand and acknowledge the unknown: The relationship between experiences and the already known needs to be characterized by creativity as well as questioning from a critical perspective. Instead, the focus is to recognize our lack of knowledge and to be present in the moment that also becomes a prerequisite and basis for a long-term perspective. In the way by asking questions based on experiences in situ, the relationship between theory and practice becomes central not only for education but also in teaching. This challenges the common-sense view of knowledge and learning in education and teaching as it offers a different order and safety not based on control. It also contributes to challenging the notion of knowledge as something unambiguous, measurable, and definable in favor of something that can be altered by putting a changing world in the foreground. Furthermore, it contributes to providing space for the complexity and dynamics of learning by starting from nature as a co-teacher and what can thus be described in terms of "wild learning".

4. Conclusions

To challenge the dominant versions of education and the current dominant relationship with the planet and nature, our conclusions are based on the need for a vision and corresponding educational tools that could enact a new relationship with the planet through education. The results and discussion of didactical concepts show that educators need, but also how they can problematize the dominant versions of education that are enacted in powerful ways and thus turning outcomes towards a human-centered and unecological *status quo*. This 'new' relationship presupposes that the three didactical principles: The principle of order; The principle of questioning and; The principle of 'wild learning', need to be combined with a perspective that challenges attempts to predict and control knowledge and learning and, in the end, also the future. There has been a dream – more or less – to predict the future based on a false idea to control nature and the future like a machine that can be started stopped and started again, by a human being. This is perhaps the most disastrous mistake made. In giving up this idea, we have to accept that the future is unknown. One conclusion is that there is a need to challenge the hierarchical view between teachers and students. As a leader, the teacher needs to be curious and with a first-hand interest to understand students' experiences and then helping them to understand based on diverse perspectives and a variety of ways. The teacher becomes the co-teacher to nature. This understanding might be demanding and may require a re-conceptualization of what learning and knowledge are about in ESD. The simplified individualistic and instrumentalist views on knowledge do not correspond with nature as a co-teacher and learning in a setting as per se. This also challenges the use of nature for an

explicit objective and that might support the idea that nature should be used for excursion based on the perspective of man's master and control. WP offers a perspective that puts nature itself in the foreground making questions of different perspectives and values central.

Another conclusion is that WP provides a view of knowledge as complex and dynamic and learning characterized by creativity and critical questioning gives support to living and learning concerning an unknown future. Knowledge and learning are uncontrollable and need to be given a direction that constantly is reconsidered. Although some kind of assessment is necessary, however, if this has the result that the content and meaning of knowledge are reduced and the complexity of the knowledge and the different notions minimalized, the assessment practice has to be questioned.

When educating young people, the principles we formulated could be a start and contribute to new strategies in education. But without approaches, theories and practices understood as theoretically based norms as important guidelines for our ability to act and handle future challenges, they fail. First, this seems to presuppose approaches that illuminate values as central and counteract defined objectives for education. It thereby also challenges SD as a concrete defined goal for education and also the relation between SD and ESD needs to be critically analyzed. This is something else than nature as a study object and used for a predetermined goal, regardless goals are intrinsic or instrumental ones as traditions in outdoor education and ESD. Dewey (1997) emphasizes that the objectives need to be open but that a direction is needed that links to the role of education in society. Nature's value as equivalent is underlined and emerges to be consistent with the way the question of values in our lives appears to be the “keel and rudder” (Faarlund, 2015, s. 131). Second, it seems to has an impact on how to understand learning and teaching theoretical. Traditional views of nature, regardless of intrinsic or instrumental views are used in education are challenged. To start with experience and then develop meaning in different ways includes critically examine the relationship between culture and nature. Etymologically, "wild" is related to the old English "wilde", which refers to a natural and uncontrolled state (“Wilderness”, 2021). According to the same source, Wild has a connection with the old Old Norse "villr" which means "will". In this way, wild learning includes something uncontrollable but also can have a will-direction. Thereby the relation between knowledge and values becomes an objective itself. Third, in practice, the role of the teacher changes. When defining goals and opportunities to set the agenda becomes a goal per se, it changes relations between teachers and students and illuminates power relations in education and teaching. Overall, this is closely related to democratic values and that nature itself has its own value that needs to be understood, encompassed, and included.

SD includes many important aspects and activities. As a concept, it has been criticized for being too ambiguous. Regardless of this, we conclude that SD is not radical enough and in a pedagogical perspective and could conserve a kind of continuance of status quo – business as usual. We posit there is a need in education and teaching to talk about a more nature-friendly approach instead of SD as commission. The principles we discussed underline the need for openness in education and teaching

corresponding with being in nature, experience, and sensing nature. One important side of this is a change in the relationship between man and nature. This is an opportunity to leave the anthropocentric worldview and slowly move towards a more equivalent relation between man and nature.

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Posters

The 27th International Sustainable Development Research Society Conference
13–15 July 2021
Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis
Mid Sweden University
Virtual Conference, Sweden

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Quinnipiac Univeristy

Combatting Climate Change: The Roles of National Culture and Education

Introduction

Climate change has quickly become a controversial focus point for officials. Previous studies suggest that national culture and education have direct and indirect roles on the environmental progress of a country. The purpose of this study is to explore how cultural values and education play a role in the progress to combat climate change.

Methodology

A sample size of 70 countries was used in this study. Hierarchical regression and hierarchical Bayesian tests were utilized to determine significance in addition to Variance Inflationary Factor to test for multicollinearity.

Hypotheses

H1: The higher the degree of Uncertainty Avoidance, the higher climate change progress

H2: The lower the degree of Individualism, the higher the climate change progress

H3: The higher the degree of Long-Term Orientation, the higher the climate change progress

H4: The higher mean years of schooling, the higher the climate change progress

RQ1: To what degree do the cultural values impact education?

RQ2: To what degree does education mediate cultural values and climate change progress?

Conclusion

UAI, IND, EDU play a significant direct role in predicting the variance of climate change. EDU plays a mediating role for IND and LTO to climate change. Creating policies that reinforce these cultural values and developing a strong educational system will aid in combatting global climate change.

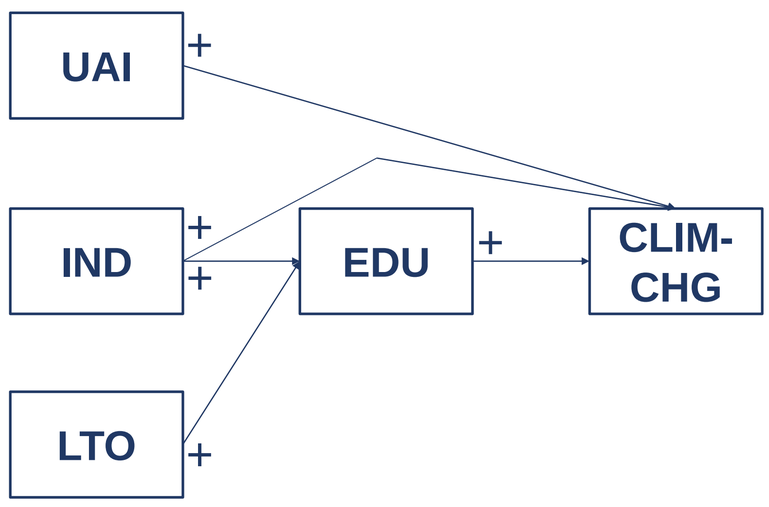
Limitations include the small sample size and limited access to prior research studies.

For future research, it is recommended to expand sample size and further explore national culture's impact on climate change.

	Model 1a Std. Beta	Model 1b Std. Beta	Model 2a Std. Beta	Model 2b Std. Beta	Model 2c Std. Beta
PDI	-0.124		-.126		
IND	**0.517[3]**	**.631[3]**	**.505[3]**	**.343[2]**	**.357[2]**
MAS	-0.043		-.070		
UAI	0.137		**.291[2]**	**.232[2]**	**.213[1]**
LTO	**0.388[3]**	**.305[3]**	**.241[1]**	.065	
IVR	0.175		**.229[1]**	.165	
EDU	**Dep.**	**Dep.**		**.402[2]**	**.439[3]**
GDP		-.127			.008
Clim-Chg			**Dep.**	**Dep.**	**Dep.**
R^2	0.609	.573	.521	.570	.550
Adj. R^2	.571	.554	.475	.536	.523
ΔR^2	.609	.015	.521	.065	.000
F Value	**16.322[3]**	**29.852[3]**	**11.412[3]**	**16.941[3]**	**19.884[3]**

[1]p<.05, [2]p<.01, [3]p≤.001

Settings and Results	IND>EDU >Clim-Chg	LTO>EDU >Clim-Chg
Computational Accuracy Settings Confidence Interval Setting (%)	Excellent 0.95	Excellent 0.95
Confidence Interval	**.0809, .3227**	**.0267, .1741**
Partial Posterior p-value	**0.0003**	**0.0018**



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3. Biodiversity and Ecosystem Services

3a. Life on land

Abstracts

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Combatting Desertification under SDG 15: Meeting Future Demands for Ecosystem Services – a Case Study

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Abstract

The Monchique Natura 2000 site, an area of 76,135 hectares protected under the European Union (EU) Natura 2000 network (EC, 2008), is in southwestern Portugal. However, unsustainable land use typologies (LUTs), inappropriate land use decisions and poor land management, combined with wildfires and increasing land abandonment, as well as an influx of invasive plant species, such as the Australian acacias, will severely impair the potential for this site to meet future demands for ES. The reduction in land potential and biological productivity, described by the IPBES as processes of land degradation, will in turn exacerbate the effects of climate change (UNEP, 2016; IPBES, 2018).

Meeting future demands for ecosystem services (ES) implies that the health, integrity, and stability of current ecosystems is intact. The potential flows of ES, created from ecosystem functions as emergent properties, are the result of interacting elements of ecosystem structure and fundamental underlying ecosystem processes (van Andel & Aronson, 2012). Without this natural ecosystem framework of interacting plants, animals, microorganisms, and present abiotic resources, future flows of ES will be severely impaired.

Despite the protection status afforded to this site under the EU Nature Directives, LUTs focus primarily on industrial forestry. This has resulted in the clearing of large areas of land, further modified by the construction of terraces cut into the hillside slopes for the planting of eucalyptus (*Eucalyptus globulus*) and, in some instances, pine (*Pinus pinaster*). This forestation of previous agricultural (farmland) areas is historic, the intensification of which started around the late 1950s and early 1960s driven by the demand for wood pulp for the burgeoning paper industry in Portugal at that time.

The restoration of impacted habitats, terrestrial and riverine, the amelioration of soil, and the planting of endemic tree groves in conjunction with a managed strategy for planted forests is envisaged to recover the social-ecological and socio-economic potential this area represents. The aim of this study, which is in progress, is to establish a baseline from which to measure and plan ecological restoration efforts. The focus is on SDG 15, life on land, and target 15.3, the 'proportion of land that is degraded over total land area'. By following the 'Good Practice Guidance' (Sims et al., 2017) for SDG Indicator 15.3.1, this study aims to: 1) assess and evaluate, land cover and land cover changes and trends; 2) analyse the status and trends of land productivity; and 3) determine values and changes in the carbon stock, using soil organic carbon as the proxy.

By analysing these sub-indicators in the context of sustainable development, intergenerational equity - meeting future demands for ES - and climate change, a baseline will be established for developing measurable ecological, social, and economic strategies that support the sustainable development of this protected area. This approach will be centred around landowners working with rather than against

nature to achieve both ecological and economic goals aimed at meeting future demands for ES; a process that can be replicated and scaled-up for supporting progress towards meeting SDG 15.

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Biodiversity in California: From Policy to Implementation

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Abstract

California is a bio-diversity hotspot, with over 1500 native species of plants of which more than 70% are impacted and threatened by extinction. California is the most bio-diverse of the 50 US States. Meeting California biodiversity and sustainability needs requires defining the needs, expanding funding, and reducing non-native plants in publicly and privately funded capital projects and maintenance activities.

This study looks at the connection between the current high-level policies, City level ordinances and initiatives, and the inclusion of native plants across neighborhoods through research and case studies. Volunteer based organizations like the California Native Plants Society promote native plants. The State of California has a Statewide Executive Order on biodiversity. In 2017 Governor Brown initiated it to preserve California's vast and biodiverse flora and fauna.

California sustainability needs include:

- Enhance biodiversity - local native plants and wildlife - to enhance human and ecosystem health, pollination services (including green corridors), clean air, clean water.
- Reduce/remove invasive species from these ecosystems and replace with local native plants and wildlife to enhance biodiversity.
- Measure and moderate water use to adjust to increased water needs for development of people, agriculture and industry
- Mitigate climate change - enhance use of local native plants specifically in grassland plant communities, woodland plant communities and coastal water plant communities to absorb carbon, clean water, clean air and pollination services. These local native plants are also needed in cities and suburbs where grassland plant communities and woodland plant communities occurred to absorb carbon, clean water, clean air, mitigate urban heat island effects.
- Adapt to climate change - protect land and sea, including low lying coastal areas, including using adaptive, green storm and tide management techniques and wildfire resilience.

Funding opportunities to enhance California biodiversity include: State, City and Federal sources which will be researched in more detail.

At the City level, San Francisco has a Biodiversity Initiative which promotes biodiversity, improving access, awareness and stewardship. Other ways such as incorporating biodiverse greening into open space and utilizing natural ecosystems to build resilience are also included in this initiative.

In addition, the San Francisco Estuary Institute (SFEI) provides a roadmap to enhance biodiversity with its Making Nature's City: A Science-based Framework for Building Urban Biodiversity. These biodiversity success indicators are our roadmap to advocate for funding and prioritizing biodiversity projects.

Privately funded green projects on private land, such as homeowners' properties, choose to add limited local native plants and ecosystems, preferring mid-20th century landscaping styles, regardless of the negative effects of biodiverse dead zones, excess water and excess herbicide and pesticide use.

Landscape architect use, promotion and understanding of the value of native plants and ecosystems could benefit private landscapes, enhance bio-diversity and enhance climate resilience. The appeal of a well-mowed lawn, and exotic ornamentals is being tested against the need for more biodiversity and a better understanding of the implications of not following climate change imperatives.

This presentation will study SDGs 11, 13, 15 and 17. Given the imperative of climate change, this study would address the changing conditions in California.

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Biodiversity and multiple value chains in boreal mountain forests

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Abstract

Extensive commercial forestry in the North European boreal forests have left forests and forest landscapes substantially transformed and dominated by young and middle aged managed forests and with only few and small remnants of natural forests left. However, along in the westernmost part of northern Sweden, a belt of forests with limited harvesting still exists – the Scandinavian Mountain Green Belt (SMGB). This belt extends almost 1000 km and include more than 2.2 Mha forestland with a significant share of old-growth and natural forests with high biodiversity values, and as such unique in a European perspective.

The debate around the future of the SMGB is intense. Although a significant share of the area is already protected, a recent government review has suggested to set aside additionally 500 000 ha of the area as a contribution from Sweden to fulfil the goals and targets of international agreements (CBD and EU directives). Beyond the conservation benefits, this will have implications also for rural development in the region. It would support the economy for the tourism sector, support amenity migration, secure land for reindeer husbandry and in general provide opportunities for value chains related to non-wood resources such as fishing, hunting, berry- and mushroom harvest and carbon sequestration. On the other hand, industrial and non-industrial forestry actors sees the initiative as a threat to their resource base.

We have analyzed the spatial distribution of different forests types and presence of forests with high natural values across the SMGB and highlight how these are distributed across public, forest company and non-industrial private forest owners. Traditional wood-based economic value chains are often in conflict with value chains based on socio-cultural and ecological benefits and hence calls for discussion on multiple-use strategies that involve all landowner categories and other stakeholders. There is an urgent need to identify methods for comparing wood/biomass-based value chains and new value chains that take into account both direct benefits (such as wood or mushrooms) and indirect benefits linked to immaterial forest values (such as recreation and tourism), as well as non-use and bequest values.

Relations to conference themes:

Our study address several SDGs goals and targets, including 8.3, 8.9, 11.4, 13, 15 and 17.17. The loss of biodiversity is one of the planetary boundaries that are already passed, and there is an urgent need to reverse the trends of biodiversity and ecosystem services loss while at the same time ensure the potential for rural sustainability.

Full papers

Reported & Reported: differences among local and international game hunting data and potential reasons on the example of South Africa

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Abstract

Trophy hunting constitutes globally a major part of the wildlife tourism industry and is connected through the export of kills to international wildlife trade. Inconsistencies found between kills and exports can contribute to identify illegal trophy hunting that constitutes a major threat to biodiversity conservation. This paper quantitatively analysis in how far data of trophy hunting kills and of trophy exports are consistent on the example of South Africa and what are potential reasons for inconsistencies found. Data was extracted from two different sources for the year 2018. These were the South African Professional Hunting statistics (SAPHs) containing trophy kills information for each species and the country of origin of the hunter on the one side and trade data reported under the CITES Trade Database on export of trophy items from South Africa on the other side. The findings show on the one hand in both data bases the same 28 trophy-hunted endangered taxa reported. On the other hand the same data reports hunters with in total 64 nationalities from abroad participated in a total of 4,726 trophy kills were reported while a total of 3,131 hunting trophy items were exported out of South Africa to 37 countries as the final destination. The data of trophy hunting kills and data of trophy hunting export was found to differ to varying degrees across the countries contributing to trophy hunting and CITES-listed trophy-hunted species. Possible reasons for this inconsistency are identified and also recommendations for improving the CITES reporting system are made.

Keywords: CITES Trade Database, South African Professional Hunting statistics, Trophy hunting, canned hunting

1. Introduction

Wildlife tourism can be determined as tourism that is based on encounters with non-domesticated animals, and the encounters can occur in either the animals' natural environment (e.g., national park) or captivity (e.g., a zoo). It includes both non-consumptive (e.g., game viewing, hiking and walking safaris) and consumptive activities (e.g., hunting and fishing) (Higginbottom, 200). Wild life tourism including trophy hunting, and trade are globally interconnected and particular related to Africa (Mac Donald 2005, Lindsay et al. 2016, Hodgetts

et al. 2018). The South African tourism industry is based on wildlife tourism including trophy hunting (t Sas-Rolfes 2017, Mkono 2018).

Trophy hunting is broadly defined as "the killing of animals for recreation with the purpose of collecting trophies such as horns, antlers, skulls, skins, tusks, or teeth for display" (Sheikh & Bermejo, 2019 p. 1). Within the South African trophy hunting industry, the executing companies are usually run by hunting operators who offer hunts to clients and employ a relevant staff (e.g., professional hunting guides, professional hunters, drivers, trackers, and taxidermists) (Lindsey, Roulet, & Romañachac, 2006). The difference between South Africa compared to other countries where trophy hunting is taking place, lies in the legislation that was implemented in the 1960s and 1970s and according to which animals are classified as the property of the landowner (Cirelli & Morgera, 2010). This act encouraged the transformation of many livestock farms into hunting farms with a significant progress at that time towards the protection of wild animals. For instance, trophy hunting programmes have contributed to the recovery of African White and Black Rhinos (IUCN, 2016).

Private game farms and game ranches which represent part of the wildlife tourism are an important source of revenue and a significant contributor to the national economy. In economic terms, yearly, thousands of hunters participate in hunting activities in South Africa (Saayman, Merwe, & Saayman, 2018) and pay higher daily-rates compared to ordinary tourists. The hunting packages consist mainly of two offers, daily rates and trophy fees, and differ considerably among species. Basically, the more days they have clients for and the more trophies the clients shoot, the more money they make. Therefore, incomes can be generated from lower volumes of clients (Lindsey, Roulet, & Romañachac, 2006). In social terms, several studies provide an information on the benefits of trophy hunting to local communities and the contribution to the state economy (CIC & FAO 2010, SCI 2015). These studies are mainly focused on the economic consequences of the hunting industry in South Africa.

Nowadays, many problems with commercial hunting are emphasized. Trophy hunting can lead to the decline of rare and endangered species and the way funds are transferred from trophy hunting to nature conservation can be linked to corruption (Lindsey et al. 2015, Sheikh & Bermejo, 2019). On the other hand, trophy hunting is considered also to be beneficial for the protection of wild animal populations in certain circumstances (Palazy et al. 2011, Minnin et al. 2016).

Trophy hunting had been at the centre of controversies for at least two decades. Although most contentions have been around ecological and management issues, the controversy also has roots in ethical considerations (for discourse examples see e.g. Bauer et al. 2004, Batavia et al. 2019, Dickman et al. 2019, Ghasemi 2021). Another form of trophy hunting is 'canned hunting' in which usually lions are bred in captivity to be later shot by hunters. It involves unfairly preventing the target animal escaping the hunter either by physical constraints such is fences or by mental constraints such is being habituated to human. Thus, eliminating the 'fair chase' and guaranteeing the hunter a trophy (Norris et al. 2002). However, the South African government has taken no measures against predator breeding in captivity in hunting industry, thus it is not unlawful in terms of existing animal protection legislation.

International wildlife trade is closely connected with the hunting of wild species in South Africa. South Africa traffics thousands of dead animal trophies and products made therefrom across international borders and the legal trade in wildlife is usually overshadowed by illegal trade and wildlife crime (TRAFFIC, 2020). CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) and it implementing bodies regulate and monitor the import and export of 35,000 species threatened by trade. CITES has 183 member countries ('Parties'), that must submit annual reports on their international trade in CITES-listed species (CITES, 2020). Therefore, the CITES Trade Database is the globally most effective and unique tool ever implemented to regulate trade in endangered species and it is source of information on the recorded international trade of fauna and flora (Foley, Stengel, & Shepherd, 2011). CITES is implemented in the EU through a set of Regulations called EU Wildlife Trade Regulations that are directly applicable in all EU Member States. However, the necessary enforcement provisions must be transferred into national legislation and supplemented with national laws. Each Party of the Convention is obligated to designate its Management Authority in charge of granting permits and certificates under the terms of the Convention and Scientific Authority to advice on the effects of trade on the status of species (CITES, 2020).

In general, trophy hunting is not so much researched, even though it attracts attention among conservationists and even media (Saayman, Merwe, & Saayman, 2018). Several studies have looked at the export of commodities from certain species out of South Africa using the CITES trade database. For instance, Lindsey, et all (2012) researched the South African captive-bred lion hunting industry or Brennan & Kalsi (2015) examined ivory trafficking problems in Sub-Saharan Africa generally, but not South Africa specifically. Hence, the available literature provides some results on how many commodities made from certain CITES-listed species are exported out of Sub- Saharan Africa or South Africa, but a more comprehensive overview is apparently missing. In particular, no study on trophy hunting in South Africa could be identified that has made a comparative analysis of trophy killed animals with trophy exported animals out of the South Africa in order to assess the consistency of that data. Thus, the research evidence on the number of trophy-killed animals belonging to endangered species especially in South Africa and exported from there, remains scant and a better understanding of this contentious sector of wildlife tourism is needed.

The focus of this research is therefore to assess the extent of trophy hunting and its export, the distribution of the nationality of trophy hunters and the consistency of the ratio of trophy exports related to a certain species with the hunted numbers by those hunters.

In detail, this paper aims to compare whether the number of exported trophies out of South Africa shot by hunters with a foreign nationality is consistent with the number of imported trophies to the countries of nationality of those international hunters, and to determine in case of inconsistencies the potential reasons for these inconsistencies.

The further parts of the paper are structures as following: first the methods are presented in detail with a particular focus on the two data bases used, the extraction of the data, its allocation to countries and the method of comparison. Afterwards the results are presented in form of

different tables about hunted and exported species numbers as well as country comparisons. Then, separate discussions follow on the method and result. The paper ends with conclusions and recommendation.

2. Methods

2.1 Data Collection

The study will compare data from two databases, one from South Africa about the reports trophy kills and one from CITES about the reported exports for the year 2018. The South African Professional Hunting Statistics (SAPH, 2020) data obtained from the Custodians of Professional Hunting & Conservation – South Africa. This statistical data collection contains the number of kills and the country of origin of international hunters.. It provides the reported extent to which trophy hunting is practised.

This data is contrasted with the records from the comparative tabulations reported into the CITES trade database (CITES, 2020). The number of trophies exported across national borders out of South Africa reported to the CITES will be determined.

2.1.1 South African Professional Hunting Statistics data (SAPHs)

The South African hunting statistical data collection (SAPH 2020) was received upon inquiry from the Custodians of Professional Hunting & Conservation – South Africa for the year 2018. Data is listed therein for each province and in the way it was reported to the SAPH Register. This document contains information such as permit-client holders, countries of origin of the clients, species hunted, and number of species hunted. For the quantitative analysis all the none-CITES-listed species were excluded, since this study is only focusing on the CITES-listed endangered species threatened by trade and limited availability of data on trade in none CITES-listed species does not allow them to be included in the quantitative analysis.

2.1.2 The CITES trade database (CITES)

The CITES trade database was approached by mean of the CITES Trade Database Guide (CITES 2013) and the following parameters and related variables were selected to gain the data:,

– the year range (from 2018 - 2018);

– the exporting (South Africa) and importing (All) countries;

– the source of species or specimens traded (animals bred in captivity, animals bred in captivity for commercial purposes, animals born in captivity, wild sourced and ranched specimens);

– the trade term (trophies, skins, skulls, skeletons, bodies, rug, skin pieces, horns); and

– the taxon (all species traded out of South Africa) of interest ;

– the purpose of the trade (hunting trophy and personal purposes).

The term "personal purposes" is included in the quantitative analysis because the CITES trade database sometimes classifies terms such as trophy, skulls, and skins for personal purposes and sometimes as "hunting trophy".

In the next step, the database produces a type of report file containing this data that can be downloaded. This file is a detailed comparative tabulation that can be opened in Microsoft Excel, wherein the further working steps have been executed. These are the allocation of species, the allocation of countries and the final comparison in a table, which are all briefly described in the following.

2.2 Allocation of Species

The allocation of species needs to be done for both gained datasets respectively with the aim of connecting both databases. According to SAPH (2020), in total 155 species can be hunted in South Africa in 2018. From this number, 35 CITES listed species were extracted for the quantitative analysis. The SAPH data distinguishes its species killed by using English terms while the CITES trade database uses Latin terms for species traded. When building the final comparison table for the quantitative analysis, allocation of the species hunted, and species exported had to be secured and connected to one another. These English and Latin names where matched for the work with the final comparison table for the quantitative analysis continued.

Additionally, the CITES trade database does not identify several species as a particular species but by the abbreviation "spp.". That indicates here "several species" and as it cannot be secured to which species they belong, they were left out.

Besides that, in the case of and antelope species (“lechwe”), SAPH data contains subspecies like species while CITES separates them. According to the SAPH data derived, 40 Lechwe – Black, 12 Lechwe Kafue and 359 Lechwe Red were killed in the year 2018. The data derived from the Cites database calls them instead “Kobus leche smithemani”, "Kobus leche kafuensis" and "Kobus leche" respectively and indicates them as subspecies. In the analysis these were grouped together.

2.3 Allocation of Countries

The allocation of successful hunter to countries is also a precondition for connecting both databases.

SAPH (2020) had provided the total number of international hunters that came to South Africa in 2018 and therefrom the number of hunters that successfully hunted CITES listed species were extracted. This data was further used and some county naming needed to be re-assessed as several permit holders (hunters) do not have correctly indicated their country of origin. Some country names were wrongly written e.g., "Maxico" (obviously “Mexico”). In several cases, multiple terms are used for one and the same country of origin of a successful hunter (e.g. “Spain” or “Expanya”). The term "Iberia" was found in the data which can be Spain, Portugal

or Andorra. Therefore, all countries and their short names, official names and standard country codes were cross-checked with the classification of the International Organization for Standardization (ISO, 2020). If the allocation of a person to one country could be computed, the data was left out.

Moreover, the information about the country of origin in a certain table cell for three hunters is not provided by SAPH (2020), instead the abbreviation not applicable ("N/A") is given. Therefore, the number of animals hunted by these hunters has not been included into the quantitative analysis.

Out of the 77 countries that were computed, hunters from 9 countries did not participate in the hunting of endangered species listed in the CITES as well as they did not participate in the trophy trade of threatened taxa. The countries are Bosna and Hercegovina, Ethiopia, Greece, Jordan, Ireland, Macedonia, Mauritius, New Caledonia, and Zimbabwe.

2.4 The Final Comparison Table

The animals are sorted first according to the class they belong too e.g. Mammalia, Aves, Reptile. The list of animal species is organized by Latin names as well as English names and their order e.g. (Carnivora, Primates) and family e.g. (Hyaenidae, Cercopithecidae). These appendices are also noted in the final comparison table for all species. Each species name is followed by two columns; one containing the number of trophy (hunted) individuums and one containing the number of (exported) trophy items exported out of South Africa. The number of trophy exports is further sorted according to the countries of trophy import, and all trophy hunted species were additionally sorted by the country of origin of the hunter who killed them.

3. Results

In the following, first the results of hunts and exports are provided, while in the next chapter the detailed country information is provided and included into the presentation of the results.

3.1 Global Taxa Trophy Hunted and Export Data Analyses

Inconsistencies were found between the overall number of animals killed (n=4726) and the export of trophies (n=3131) as well as within the numbers of most of the species accessed (Figure 1).

Comparison among number of animals hunted and number of trophies exported out of South Africa in 2018

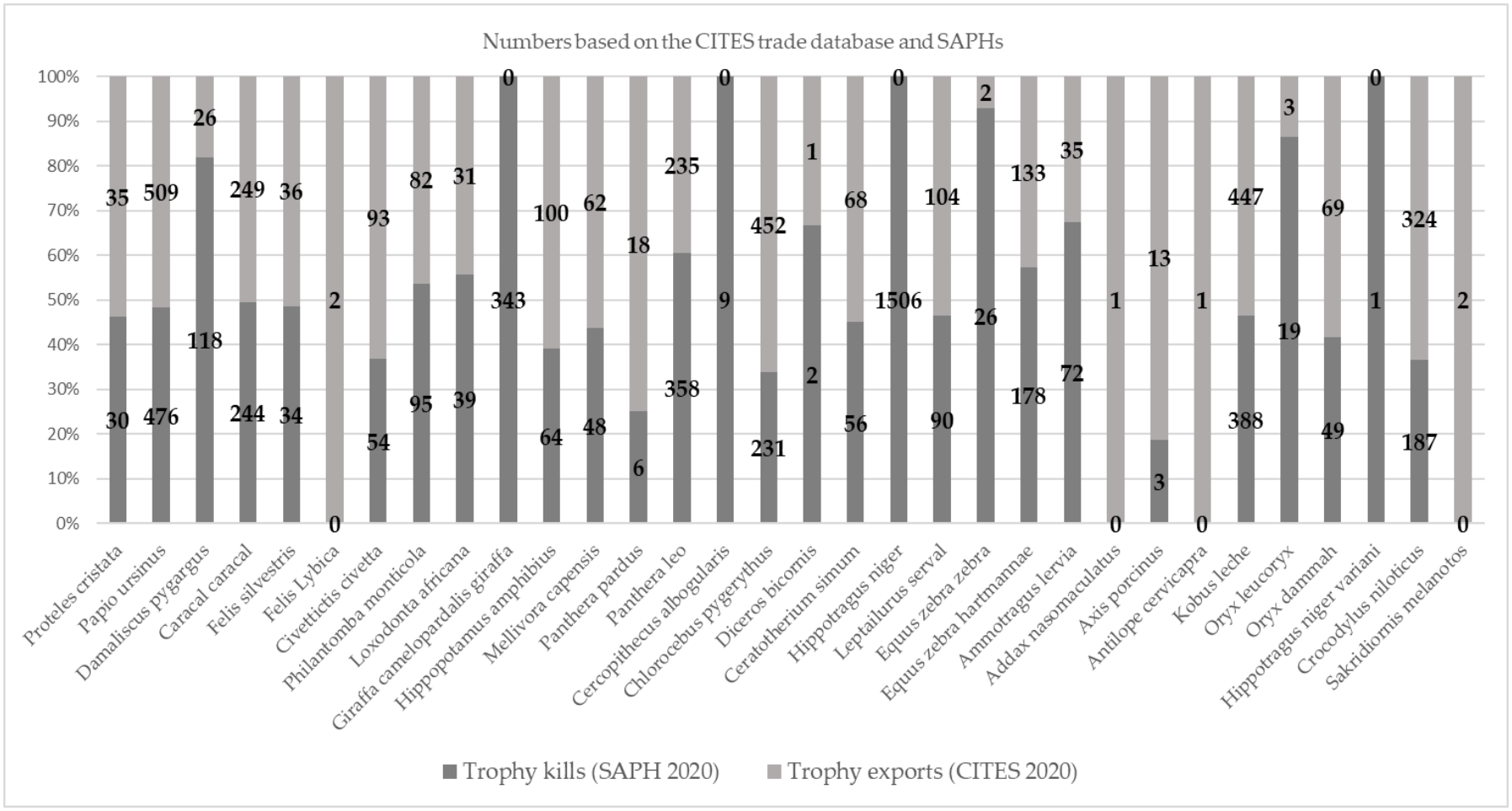

Figure 1**.** Comparison among numbers of animals hunted and numbers of trophies exported out of South Africa in 2018

Figure. 1 comprises 32 endangered species that were either hunted or the trophies of those species have been exported out of the South Africa in the year 2018. Several species were exported out of the South Africa as trophy items but not a single animal of the same species was hunted within the same year, e.g., northern African wild cat (*Felis lybica*), addax (*Addax nasomaculatus*), Indian blackbuck *(Antilope cervicapra)* and knob billed duck *(Sarkidiornis melanotos).* Some species, e.g., giraffe (*Giraffa camelopardalis giraffa)*, samango monkey *(Cercopithecus albogularis)* sable antelope *(Hippotragus niger),* sable giant antelope *(Hippotragus niger variani)* showed zero trophy exports, however, have been hunted by foreign hunters.

Figure 1. further reveals that out of the 32 species with none of them the numbers were identical, 19 species were more trophy exported than killed and 13 species were more trophy killed than exported.

Figure. 1 additionally reveals that the most favourite hunted species of foreign hunters in 2018 in South Africa was the sable antelope *(Hippotragus niger)*. Another finding is that this species is listed in CITES Appendix I and despite being hunted the most, it has zero reported exports of trophy items as it demonstrated in Fig. 1. There is no obvious reason for this inconsistency. An inconsistency for the African lion (*Panthera leo*) and the Nile crocodile (*Crocodylus niloticus*) appear to be related to the selected variables used in the CITES trade database and will be discussed further in the relevant sections. The analysis of giraffe shows that not a single trophy item from a giraffe *(Giraffa camelopardis)* was exported while a total of 343 individuums were hunted. A possible reason for this inconsistency will be also discussed later.

If the numbers of killed animals and exported animals seems to be rather consistent for a one country, this does not indicate that the numbers of kills and number of exports are consistent for each species (Figure. 1).

In the following, the data for the African lion (*Panthera leo*) is more in detail analysed. The reported hunts of African lions are distributed quite differently among South Africa's provinces. According to the data supplied by each province individually and collected in the SAPHs, it is evident that the dominant destination of African lion trophy hunting is the North West province, where most of the lions (42,4%), were killed in 2018, followed by Eastern Cape province (23,6%), Limpopo (16,5%) and the remaining 6 provinces constitute (16,5%). Thus, it can be assumed that a great majority of the hunting captive-bred lion facilities in South Africa are in the North West province. Additionally, according to the CITES trade database the vast majority (82%) of all trophies of African lion exported out of the South Africa are sourced as "Animals bred in captivity in accordance with Resolution Conf. 10.16 (Rev.), as well as parts and derivatives thereof, exported under the provisions of Article VII, paragraph 5, of the Convention". Only a minority (17%) of trophies of the African lion were taken from the wild or were born in captivity (1%). The practice of canned or captive-bred hunting will be further discussed in context of reliable sources.

During the year 2018, out of the 32 endangered species included into quantitative analysis, 30 species were mammals (93,75%), 1 species was reptiles (3,13%) and 1 species was birds (3,13%). These hunted species protected by the CITES convention against over-exploitation through international trade are included in one of three appendices with different degrees of protection. (Table 1).

Table 1.: Number of Trophy Hunted Species Protected under CITES according to Appendices

Appendix	**I.**	**II.**	**III.**
Mammals	7	18	5
Birds	0	1	0
Reptiles	0	1	0
TOTAL	7	20	5

CITES regulates international trade only, not the hunt itself. If an animal is on private land, with the owner's permission, it can be killed, including lion, rhino, and other endangered species. Therefore, it is possible to hunt all the species of the three appendices on the territory of South Africa. Even though, animal species included in the CITES Appendix 1; leopard (*Panthera pardus*), black rhinoceros (*Diceros bicornis*), sable antelope (*Hippotragus niger*), addax (*Addax nasomaculatus*), oryx – Arabian (*Oryx leucoryx*), oryx - Scimitar Horned (*Oryx dammah*) and sable giant (*Hippotragus niger variani*) are threatened with extinction. Figure 1. reveals that Oryx - Scimitar Horned was the most traded and hunted species, followed by the Leopard.

Species not necessarily threatened with extinction are included in the CITES Appendix II, however, the trade must be still controlled in order to avoid utilization incompatible with their survival. This group of hunted and traded species revealed to be the most numerous (Figure 1).

According to the SAPH (2020) from 1 January to 31 December 2018 international hunters hunted 28 out of 37 hunting game species listed in CITES which South African trophy hunting industry offers to be hunted.

3.2 Countries and extent of their involvement in South African Trophy Hunting and Trophy Exports

The findings from the reports show for 2018 for South Africa that 64 countries participated in trophy hunting of total of 4,726 trophy kills of trophy-hunted endangered taxa while only 3,131 hunting trophies of endangered taxa were exported to 37 countries (Table 2).

Table 2 List of the Countries Participated in Trophy Hunting and Trophy Trade in South Africa (2018)

COUNTRY	Number of killed animals	Number of exported trophies		COUNTRY	Number of killed animals	Number of exported trophies
Argentina	46	0		**Mexico**	99	0
Australia	48	0		**Mongolia**	7	0
Austria	51	31		**Morocco**	7	5
Bahrain	1	0		**Mozambique**	1	0
Belgium	20	180		**Namibia**	0	1
Brasil	4	8		**Netherlands**	14	0
Bulgaria	10	24		**New Zealand**	5	10
Canada	180	0		**Norway**	34	30
Costa Rica	5	0		**Oman**	1	0
Cote D'vore	1	0		**Pakistan**	10	0
Croatia	6	1		**Peru**	6	0
Czech Republic	35	55		**Phillipines**	2	1
Denmark	158	128		**Poland**	73	100
Dominic.Republic	1	0		**Portugal**	4	0
Ecuador	1	0		**Qatar**	1	0
Estonia	3	3		**Romania**	13	4
Finland	30	12		**Russia**	130	13
France	77	18		**Samoa**	1	0
Germany	124	92		**Saudi Arabia**	9	0
Great Britain	59	16		**Singapore**	0	1
Hungary	85	66		**Serbia**	9	6
Chile	2	0		**Slovakia**	51	38
China	6	21		**Slovenia**	4	1
Iceland	1	0		**South Africa**	55	0
India	2	0		**Spain**	188	186
Indonesia	2	0		**Sweden**	70	38
Italy	21	7		**Switzerland**	17	16
Japan	1	0		**Thailand**	0	3
Kuwait	6	1		**Tasmania**	1	0
Lebanon	2	0		**Turkey**	3	1
Lichtenstein	2	0		**Ukraine**	10	0
Lithuania	18	6		**United Arab**	4	0
Luxembourg	7	0		**Uruguay**	1	0
Malta	0	9		**USA**	2881	1999
				TOTAL (SAPHs and CITES)	**4726**	**3131**

Out of the 68 countries a total of 4 countries participated in the trade of CITES-listed species but did not participate in killing them. These countries are Thailand, Singapore, Namibia, and Malta. With a focus on the overall numbers, 4,726 animals belonging to endangered species were trophy-hunted by 64 countries. Nonetheless, only 3,131 hunting trophy items of endangered taxa were traded to 37 countries. Therefore, 51% more individuums were killed than trophy items were exported.

Table 3a and 3b: 3a (left).: Top-10 countries ranked by number of kills; 3b (right): Top-ten countries ranked by number of exported trophies. Grey shaded are changes in ranks.

COUNTRY	Number of Kills (SAPHs)	Number of Exported Trophies (CITES trade database)
USA	2881	1999
Spain	188	186
Canada	180	0
Denmark	158	128
Russia	130	13
Germany	124	92
Mexico	99	0
Hungary	85	66
France	77	18
Poland	73	100
Other	731	525
TOTAL	**4726**	**3131**

COUNTRY	Number of Exported Trophies (CITES trade database)	Number of Kills (SAPHs)
USA	1999	2881
Spain	186	188
Belgium	180	20
Denmark	128	158
Poland	100	73
Germany	92	124
Hungary	66	85
Czech Rep.	55	35
Sweden	38	70
Slovakia	38	51
Other	245	1041
TOTAL	**3131**	**4726**

These top-10 analyses of number of trophy kills and exported trophies out of SA in 2018 and related origin countries of hunters show the dominance of one nation. More than half of the number of kills and exported trophies relates to the USA. The USA are the major client of the South African wildlife industry and at the same time the biggest importer of trophy items from South Africa. The resulting values differ widely and even the number of kills and the number of exported trophies of certain species as is demonstrated in Figure 1. are not consistent. A country may have relatively consistent trophy kills and trophy exports in one species but not in other species.

When it comes to the contribution to trophy hunting of endangered species, South Africa's major client countries from Europe are Spain, Denmark, and Germany in absolute numbers (Table. 3).

A comparison of Tables 3a and 3b reveals that the countries ranked according to their contribution to the trophy hunting kills widely differ to the countries ranked according to their reported number of trophy exports. Across all taxa, the USA, Spain, Belgium, Denmark, Poland, and Germany, respectively, are the main countries with the highest reported exports out of South Africa of trophy items.

Poland followed by the Czech Republic and Belgium have lower reported numbers of trophy kills than of exports.

A relative comparison reveals that compares the number of killed individuums with the number of exported trophies provides a different view (Figure. 2).

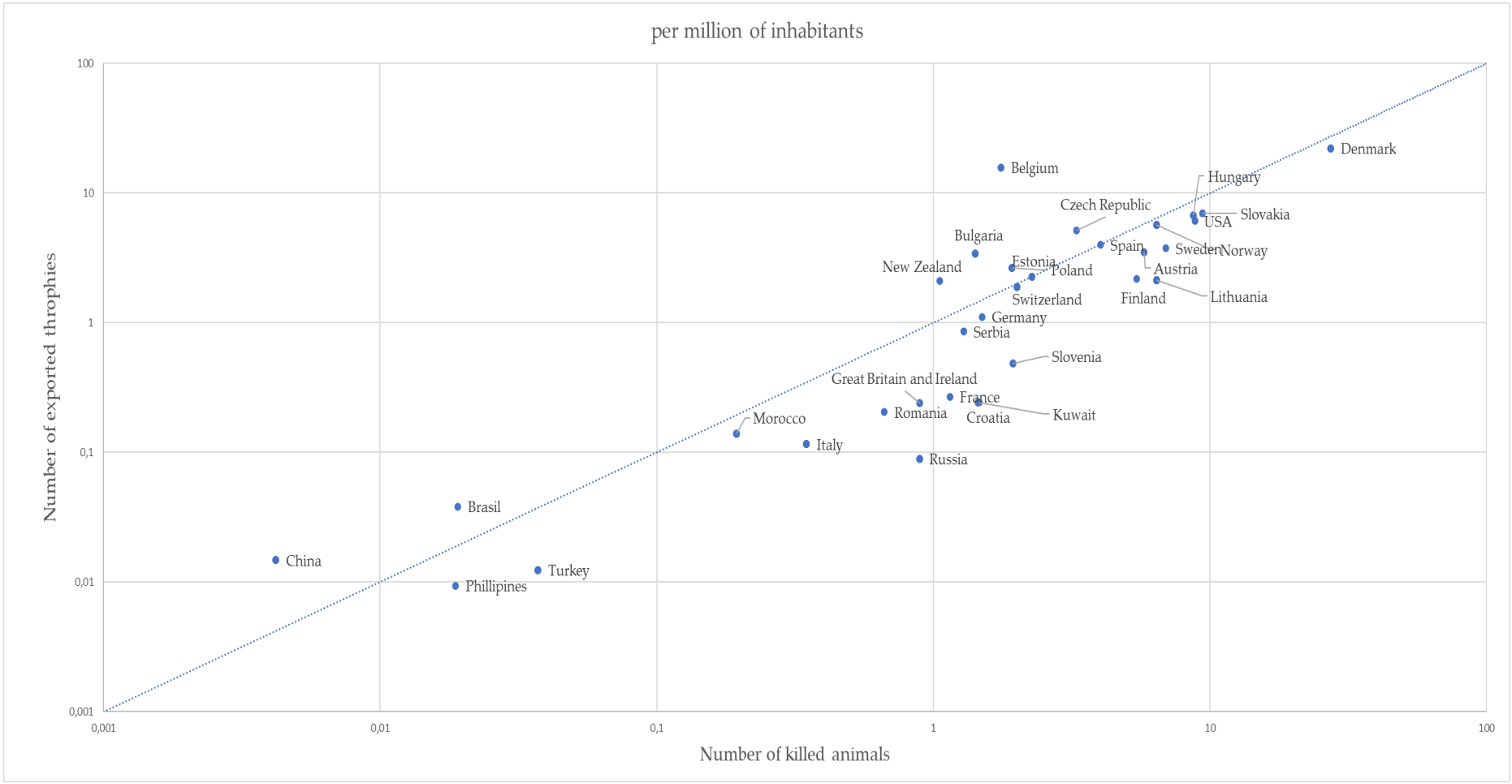

Figure 2.: Logarithmic distribution of hunter's origin countries per million of inhabitants in relation to trophy individuums killed and trophies exported.

From this relative per capita view, three smaller EU Member States countries with Denmark far on top outnumber the USA in both, killed animal individuums and trophies exported, and Belgium outnumbers the USA solely in the number of exported trophies (Figure. 2).

Canada and Mexico, despite displayed in the list of the top-10 countries when it comes to kills (Table 3a), could not be included in the display for Figure. 2, as they both showed zero trophies exported.

4. Discussion

4.1 Discussion of the method

The export trade data for South Africa from the CITES trade database were extracted on the 1st of April 2020 for the year 2018 because the year is a recent year for relatively complete data. However, the fact that data for 2018 has been submitted by all countries assessed does not guarantee a consistent quality of the data. It has already be pointed out that not all Parties submit their annual reports complete (UNEP, 2013). According to (Berec, Vršecká, & Šetlíková, 2018), incomplete submitted data in the CITES trade database is more of rule than an exception and only a small number of published papers have admitted discrepancies when using the CITES trade database. Several studies that used the recorded data from the CITES trade database, did not specify how they distinguished the traded volume, for instance (Bennet, 2015).

Papio ursinus with 476 trophy kills and 509 trophy exports are the most popular of all African trophy primates, followed by *Chlorocebus pygerythrus* with 231 trophy kills and 452 trophy exports. However, these primates would not be the most exported commodity if different trade terms were selected in the CITES trade database. For instance, if (e.g., ivory, hairs, leather products. etc.) would be included, the largest number of exported trophies would be species as lion, elephant, and the Nile crocodile. The reason why these trade terms were not selected for the analysis is that it is not possible to determine from how many animals of endangered species the number of exported e.g. leather products comes from. Therefore, selecting different variables in the CITES trade database would affect the results.

The use of the term “trophy” in the CITES database is ambiguous and it could have several meanings. Berec, Vršecká & Šetlíková, (2018) also noted, that large differences among the exporter and importer recorded data can occur when including into the reporting system also individual trade reports. For instance, unspecified units are automatically assigned to be a specimen (UNEP, 2013). Each Party of the Convention may designate authority to various institutions, e.g. (What the Czech Environmental Inspectorate does in the Czech Republic is done by the Police in Germany and the Customs Service in Poland). Therefore, the delegated authority structure has each Party of the Convention set differently. Parties of the Convention that have a provincial structure designate authority in each province separately e.g., South Africa. The Department of Environmental Affairs

has been designated as s CITES management authority of South Africa with the responsibility of communication between the CITES Secretariat, other parties, and the provincial management authorities.

In such an environment, international cooperation takes place. The trade is cross-border; thus, Parties must effectively communicate and cooperate, and it can sometimes cause problems if there is no communication with the same designated authority on the other side.

Also, the country related results are differing depended on how accurate the data from SAPHs are if hunting operators from all 9 provinces of South Africa enter the records to the database individually. The methods section has already mentioned that a specific country has been referred to by multiple terms, and several terms were not possible to allocate.

4.2 Discussion of the results

Hunting trophies traded in total, including domestic hunts and domestic hunts traded from South Africa within the year 2018, are not provided because the South African Professional statistics only reflects international trade and not domestic hunting. Therefore, the numbers stated in this paper are incomplete estimations of the total wild and captive bred animals hunted for trophies (Casamitjana, 2016).

Furthermore, this data analysis was limited to CITES-listed species only, because while the scale of trade in CITES-listed species is relatively well recorded, trade in none-CITES-listed species is usually only collected in market surveys.. In addition, a record is subject to the willingness of individual countries to provide or record data (Janssen & Shepherd, 2018). Thus, the reason why there are no recorded trophy exports for *Giraffa Camelopardalis* is that the species at the time of data processing (the 1st of April 2020) was CITES-listed though, it was a noneCITES-listed species in the year 2018. Therefore, without any international trade rules that would protect the species, this means that trophies and body parts could be exported and also imported without any quotas or records, despite of the fact they are vulnerable according to the Red list and their population is decreasing. (IUCN, 2020). In August 2019, following a resolution that was passed at the Conference of Parties to CITES (CoP, 2018) agreed to protect giraffes with the degree of protection on CITES Appendix II, which regulate the international trade with giraffe commodities. A more stricter domestic measure to regulate the import and export of African lion items has introduced the Australian Government on 13 March 2015, as though they are listed on Appendix I of the CITES Convention. This measure limits Australian trade in African lion items, including preventing imports and exports of African lion hunting trophies and it has been introduced in response to Australian public concerns about 'canned hunting' of African lions (Australian Government, 2021). In general, is almost impossible to identify whether a particular African lion trophy item has come from a lion that has been killed in a canned hunt or in a wild.

For better understanding the role and contribution of the South Africa wildlife sector to the conservation, the High-Level Panel report (South African Government 2021) on the management, breeding, hunting, trade and handling of the lion was released. This report confirms that the captive lion industry has not contributed to protection and that it damaged South Africa's reputation for conservation and tourism. Thus, South Africa's Department of Forestry, Fisheries and the Environment (2021) will be adopting the majority of the report's recommendation. Captive-bred lions have no conservation value whatsoever, as those lions are inbred and genetically tarnished and reintroduction of those South African populations into the wild would-be disaster. The question arises as to what consequences the ban on canned hunting would actually have on wild lion populations. For instance, Lindsey, et all (2012) claims that bread lions take off the pressure of the wild lion and on the contrary Williams & 't Sas-Rolfes (2019) researched that the captive hunting industry in South Africa has not done anything to stem lion declines in the wild across the continent.

According to Saayman et al. (2018), the USA is the major contributing country to the South African wildlife industry (Saayman, Merwe, & Saayman, 2018). This paper confirms and quantitatively specifies this assumption. The USA has the largest number (2,881) of trophy kills of trophy-hunted endangered animals and at the same time is South African's largest exporting country (1,999) of trophy items. However, if the size of USA's population is taken into account, the statement of Saayman et al. (2018) can be questioned due to the higher values per capita in Hungary, Slovakia and especially Denmark found in this study.

In Europe, Spain, Belgium, and Poland are the largest client countries of South Africa when it comes the absolute numbers of trophy exports from endangered species killed by trophy hunters with origins in those countries relatively. The numbers of trophy exports (186) and trophy killed animals (188) for Spain are rather consistent. However, this cannot be claimed for Belgium with (180) trophy exports and only (20) trophy kills. The latest TRAFFIC and WWF report (Musing, Norwisz, Kloda, & Kecse-Nagy, 2018) proposes a possible reason for this inconsistency and provides information about Brussel Airport as an important trading destination CITES-listed species, particularly from Africa. The airport can create opportunities for both legal and illegal wildlife trade to occur. Belgium's city Antwerp is the second highest amongst all EU Member States in the term's tonnes of shipments in the EU's seaports (Musing, Norwisz, Kloda, & Kecse-Nagy, 2018). Therefore, there is a degree of probability that most trophy items hunted by international hunters from a country other than Belgium may eventually be exported out of South Africa to Belgium. However, is important to note, that these findings are estimated from the legal trade of trophy items, it is difficult to accurately assess the scale of the global illegal trade with trophies.

A factor which may affect the results is taxidermy and its duration. The length of time it takes to get a trophy back from a taxidermy studio is usually between 7 to 10 months after confirmation of the hunter's order. Orders that need specialized mounts and pachyderms may take even longer. Therefore, trophy kills included in the SAPH data happened all 2018 while their exports could have happened 2019 and are not listed in the CITES database for 2018. Similarly, kills of specimen

could have happened prior to 2018 and but listed in the CITES database as exported trophies for 2018. Unfortunately, the distribution of kills and exports for a longer period, e.g. from 2017 to 2019, could not be undertaken which would have smoothened this time-overlapping impact, because data sets holding the information about permit holder and trophy kills for 2017 and 2019 were not provided by Custodians of Professional Hunting & Conservation – South Africa. However, this impact is assumed to happen for the data of each year when doing such a comparison. Also for 2017 and for 2019, this effect cannot be excluded. Species killed in 2016 are not included in data related to trophy kills in 2017, but in 2017 export data, and species killed in 2018 are not included in export data of 2018, but 2019. Thus, the effect can be expected to be relatively even in all years while perhaps not fully negligible.

Another factor that can play a small role when interpreting results is double citizenship of some hunters. The daily rates and trophy fees are rather expensive and only a small group of people can afford trophy hunting. These wealthy hunters can often travel and have property outside of their country of origin where the trophy is sent after taxidermy.

Another aspect to consider with certain species is that every year the antlers (used as trophies) fall and every year the new antlers grow. Due to this factor, it is possible that some exports were not actually hunted trophies but were found as fallen antlers or horns.

5. Conclusion

Data of trophy hunting kills and data of trophy hunting export on the example of South Africa differs widely and to varying degrees across the countries contributing to trophy hunting of CITES-listed trophy-hunted species. According to the reports compared for 2018, 64 countries participated on trophy hunting in South Africa and a total of 4,726 trophy kills of 28 trophy-hunted endangered taxa. While a total of 3,131 hunting trophy items of 28 endangered taxa were exported out of South Africa to 37 countries that contributed to trophy hunting trade in South Africa.

The data analysis, using data recorded in the South African Professional Hunting statistics (SAPH) compared with CITES trade database provides particular findings on descriptive statistical data on trophy hunting kills and trophy hunting exports and provide findings about the level of inconsistency for 32 species threatened by trophy hunting or trophy trade. Although, this analysis does not provide all the reasons and answers on the inconsistency as to why this is the case.

The trophy hunting kills and trophy hunting exports within the year 2018 proved to be inconsistent across trophy-hunted species and countries of origin to varying degrees. While several species, such as *Proteles cristata, Caracal caracal* and *Felis silvestris* have been revealed to be relevantly consistent though, species such as *Hippotragus niger, Crocodylus niloticus* and *Kobus leche* with higher trophy exports or trophy kills, calls for an answer.

The number one destination for African lion hunting in South Africa is North West province where (42%) of all lions were killed. Moreover, the vast majority (82%) of all trophies of African lion exported out of the South Africa are sourced as "Animals bred in captivity thus it can be assumed that the North West province has the most hunting captive-bred lion facilities of them all.The United States has been confirmed as the major contributing country in absolute numbers to the South African wildlife industry and has the largest number of trophy kills of the trophy-hunted endangered animals and at the same time is the country with highest export numbers of trophies out of South's African. The European countries that have contributed the most to trophy hunting in South Africa are Spain with relatively consistent trophy kills and trophy exports, followed by Belgium with high trophy exports and significantly low trophy kills and Denmark with not significantly higher number of trophy kills than trophy exports.

The findings from the paper research had highlighted several new directions that could be explored in future studies by building on the same findings. This research provides explanations for the inconsistency among trophy hunting kills and trophy hunting exports. It is suggested applicate the same method in a new location where trophy hunting is practised.

One of the recommendations for improving the CITES reporting system could be a possible detailed explanation of term "trophy" to more detailed terms such are (antlers, claws, skins, skulls…). Some of these terms of course are in the CITES trade database used and were also selected for this quantitative data analysis, however the term "trophy" could have several meanings.

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Jaguars substituting Tigers? Results from a Systematic Literature Review on Illegal Wildlife Trade

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Abstract

Jaguars and Tigers are both threatened species and top-predators in their natural surroundings in the Americas and in Asia respectively. In the Americans, jaguars are now considered "near threatened" by the International Union for Conservation of Nature despite all the international trade of jaguar products being prohibited under the Convention on International Trade in Endangered Species since 1975. The population of tigers has declined, they become listed as endangered species and poaching is considered to be the primary cause. Recent research indicates an increasing pressure on Jaguars, which is likely to begin to replace tiger products being sold for a variety of reasons but particularly as ingredients used in traditional medicine in some Asian countries. Latin America now represents a potential new hotspot for the opening of such a market mainly due to lack of funding for wildlife crime prevention, insufficient enforcement provisions (control and sanctions) and poverty. This paper assesses if and how a substitution of tiger products by jaguar products is already reported in the literature as well as aims to identify related future research questions. The method is a systematic literature review implemented in scientific databases (esp. Web of Science, Scopus) as well as in grey literature (Google Scholar, etc.). The inclusion and exclusion criteria were carefully selected and the search presented in detail in accordance with the Prisma 2020 model. Three reviewers were involved in the final selection of records to minimise the risk of bias. The information found has been organized based on literature quality and presented in a common rubric. Limitations of the data are presented as well as limitations of the applied method, particular with regard to grey literature. In summary, the current research project results indicate that there is the need for academic research that focuses on Illegal Wildlife Trade (IWT) in jaguars and the substitution itself. The wide lack of evidence does not allow the derivation of reliable conclusions whether jaguars are used as substitutes or complements to body parts of tigers while it appears clear that at least one of both happens. Further research questions for future work are also presented.

Keywords: illegal wildlife trade, jaguar, demand, body parts, traditional Chinese medicine

1. Introduction

Tigers are mostly threatened by poaching and illegal trade (Davis et al., 2020) as a consequence of desires for body parts. For instance, tiger bone is used for its value in traditional medicine (Davis et al., 2020; Nowell, 2010; Coals et al, 2020). Tiger bone wine is made by soaking bones (United Nations Office, 2020; Coals et al, 2020) or bone glue that is made by cooking bones to paste-like form (Lemieux and Bruschi, 2019). Although, the existence of fake tiger glue, which is made of other animals than tigers, was also indicated (Davis et al., 2020). Other reasons behind the desire are lifestyle and symbol of status (Zhang and Yin, 2014). Besides that, body parts of tigers are used as symbols, talismans for protection, to show social status particularly in Asia, luxury food or simply for decorative purposes (Morcatty, et al., 2020).

All trade in body parts was prohibited in 1987 under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Although, tiger bones of farmed tigers have been legal in China since 2018 if used for "*medical treatment and research*" (Coals et al, 2020). China was the predominant destination of mammal seizures in airports worldwide (31%) according to the Center for Advanced Defense Studies (2018) as cited in Morcatty, et al. (2020). However, China as a major consumer of tiger and lion parts (Wong, 2015) is not the only demand-side country. For instance, Vietnam also plays a role in the consumption of tiger products (Coals et al, 2020).

The increasing scarcity of tigers and thus tiger parts has begun to be linked to the search for alternatives. Just recently an increasing number of articles have begun mentioning the association between Asian markets and jaguar body parts. For instance, Lemieux and Bruschi (2019) mentioned that a method of dissolving bone glue is not unknown to jaguar bones implying the substitution of tiger bone in China and perhaps even in Vietnam. Morcatty et al. (2020) referred to Fraser (2018) when mentioning the possibility of searching for jaguars to satisfy the demand for body parts in Asia. Threats to jaguars among other species such as lions, leopards and other felids caused by international illegal trade seems to attract more attention within literature in recent years while evidence, causes and consequences within this young topic are still appearing to be little assessed. Addressing this issue further in research has relevance for biodiversity beyond these species because it concerns top predators which are essential elements in mutually shaping together with its prey whole ecosystems.

This review strives to understand the current research status. We sought to answer three primary Research Questions (RQs): (*RQ1*) What scientific and GL does exist when it comes to jaguar body parts if used as substitutes for tigers?; (*RQ2*) What different levels of literature quality do indicate about this topic?; and (*RQ3*) What does literature indicate about the future research?

2. Methods

To answer RQs, we divided this systematic literature review into five phases.

Phase 1) Problem formulation and research questions.

Phase 2) We searched Peer-Reviewed (PR) and non-peer reviewed - "Grey Literature" (GL) - records addressing jaguars substituting tigers in various comprehensive databases of scientific publications (i.e.,Web of Science database, Scopus database incl. Secondary documents) while also searching in Google Scholar, Google search engine (hand-searching). Backward search was also performed. The search started in January 2021 and was completed in Mars 2021.
A trial version of NVivo Release 1.3 was used to automatically detect and code main themes of twelve hand-searched PR records available in full-text. From these themes, keywords and their combinations were identified and used to compile search terms used in databases. Four search terms were defined (A, B, C, D) and each was tailored to accommodate requirements of different search processes. Quotation marks were mostly used in a combination with an asterisk to search using approximate or loose combinations of keywords while allowing for variations within keywords. Since used search methods varied as described in detail further below, search terms had to be adjusted correspondingly.

Search term A (Figure 1) was used in the Web of Science database and the search consisted of ´Web of Science - All databases´ and included the search in the Topic Field, Titles, Abstracts, Authors, Keywords and more ("more" was not further specified). The timespan was kept in default; All years (1945-2021) before restrictions were applied, i.e., timespan > 2000, English language only, all research areas were excluded except for Environmental Sciences Ecology, Biodiversity Conservation, Criminology Penology and Social Sciences Other Topics.

Search term B was used in the Scopus database. The search was performed within Article title, Abstract and Keywords. This term differs from the search term A in that it excludes words and combinations of words that were found to result in an identification of irrelevant records during the search within the Web of Science database. The Boolean operator *AND NOT* was used to exclude undesired subterms from the search, which reduced the number of identified records by nearly 50% compared to the search in the Web of Science database. The search term was inspected by a librarian from the Mid Sweden University to ensure its proper function. The number of identified records was reduced by the same restrictions as used in Web of Science, however, only following subject areas were included: Agricultural and Biological Sciences, Environmental Science, Social sciences, Medicine, Multidisciplinary, Earth and Planetary Sciences, Veterinary, Pharmacology, Toxicology and Pharmaceutics and Decision Sciences. Moreover, Scopus-generated results included so-called secondary documents, which "*are documents that are not indexed in our database for three possible reasons: 1) They are*

*retrieved from the references or citations of the documents that are covered by Scopus. 2) Scopus is unable to match documents with certainty due to incomplete or incorrect data. 3) There is missing conten*t" [4]. Secondary documents were also screened.

Search term C was used in the Google Scholar (citations included). The reason for that was the allowable number of characters (250). Only Boolean operators *AND/OR* were used to search using exact terms. This search engine was used as a complement to above mentioned databases.

Search term D was used in the Google search engine. Records were simply reviewed using Titles and provided descriptions. Records in full-text were reviewed when it was deemed to be necessary in order to assess the level of relevance adequately. This search was not restricted. Moreover, hand-searching was performed using a trial & error method; different keywords and their combinations were used (i.e., basic search).

Search term A: *("Jaguar*" OR "Panthera onca" OR "Tiger*" OR "Panthera tigris")* ***AND*** *("medicinal value*" OR "talisman*" OR "social status" OR "prestige" OR "luxury food*" OR "jeweller*" OR "primary threat*" OR "paste-like" OR "captive-bred" OR "consumer motivation*" OR "decorati*" OR "Vietnamese demand*" OR "Chinese demand*" OR "bone wine*" OR "wine product*" OR "diaspora" OR "boiling tiger*" OR "felid bone*" OR "bone-glue" OR "bone glue" OR "Chinese bone wine" OR "Vietnamese bone wine" OR "big-cat bone wine" OR "Asian bone wine" OR "bone wine consumption" OR "tiger bone*" OR "lion bone*" OR "boiled bone*" OR "cook* bone*" OR "bone trade*" OR "medicinal bone*" OR "jaguar conservation" OR "conservation of jaguar*" OR "bone market*" OR "bone medicine*" OR "Vietnamese consumer*" OR "Chinese consumer*" OR "Consumer demand*" OR "consumer* prefer*" OR "tiger product consumption" OR "consumption of tiger*" OR "skin export*" OR "beheaded" OR "head*" OR "body part*" OR "fangs" OR "bone paste" OR "seizure*" OR "teeth*" OR "trafficking" OR "Chinese market*" OR "Vietnamese market*" OR "wildlife product*" OR "Asian medicine" OR "Chinese medicine" OR "Vietnamese medicine" OR "medicine trade*" OR "traditional medicine" OR "medicinal purpose*" OR "illegal trade*" OR "black-market*" OR "black market*" OR "domestic trade*" OR "international trade*" OR "wild-cat trade*" OR "wildlife trade*" OR "big-cat trade*" OR "wildlife traffick*" OR "lion trade*" OR "lion substitut*" OR "tiger substitut*" OR "tiger consumer*" OR "substitut*" OR "claw*" OR "poaching" OR "smuggling" OR "cao hổ cốt" OR "seized" OR "farmed tiger*" OR "canine*")*

Search term B: *("Jaguar*" OR "Panthera onca" OR "Tiger*" OR "Panthera tigris")* ***AND*** *("medicinal value*" OR "talisman*" OR "social status" OR "prestige" OR "luxury food*" OR "jeweller*" OR "primary threat*" OR "paste-like" OR "captive-bred" OR "consumer motivation*" OR "decorati*" OR "Vietnamese demand*" OR "Chinese demand*" OR "bone wine*" OR "wine product*" OR "diaspora" OR "boiling tiger*" OR "felid bone*" OR "bone-glue" OR "bone glue" OR "Chinese bone wine" OR "Vietnamese bone wine" OR "big-cat bone wine" OR "Asian bone wine" OR "bone wine consumption" OR "tiger bone*" OR "lion bone*" OR "boiled bone*" OR "cook* bone*" OR "bone trade*" OR "medicinal bone*" OR "jaguar conservation" OR "conservation of jaguar*" OR "bone market*" OR "bone medicine*" OR "Vietnamese consumer*" OR "Chinese consumer*" OR "Consumer demand*" OR "consumer* prefer*" OR "tiger product consumption" OR "consumption of tiger*" OR "skin export*" OR "beheaded" OR "head*" OR "body part*" OR "fangs" OR "bone paste" OR "seizure*" OR "teeth*" OR "trafficking" OR "Chinese market*" OR "Vietnamese market*" OR "wildlife product*" OR "Asian medicine" OR "Chinese medicine" OR "Vietnamese medicine" OR "medicine trade*" OR "traditional medicine" OR "medicinal purpose*" OR "illegal trade*" OR "black-market*" OR "black market*" OR "domestic trade*" OR "international trade*" OR "wild-cat trade*" OR "wildlife trade*" OR "big-cat trade*" OR "wildlife traffick*" OR "lion trade*" OR "lion substitut*" OR "tiger substitut*" OR "tiger consumer*" OR "substitut*" OR "claw*" OR "poaching" OR "smuggling" OR "cao hổ cốt" OR "seized" OR "farmed tiger*" OR "canine*")* ***AND NOT*** *("jaguarundi*" OR "Jaguariaíva" OR "Jaguatirica" OR "shrimp*" OR "automobile*" OR "soybean" OR "shark" OR "virus" OR "crab" OR "mosquito*" OR "seahorse" OR "mushroom" OR "morph*" OR "engine*" OR "nuts" OR "gecko*" OR "spiketail*" OR "cyperus" OR "beetle*" OR "muskellunge" OR "moth" OR "Jaguaribensis" OR "damselfly" OR "*virus" OR "head-shoe*" OR "salamander" OR "sand goby")*

Search term C: *("Jaguar" OR "Panthera onca") AND ("substitute" OR "substitution" OR "substitutes") AND ("tiger parts" OR "tiger body parts" OR "tiger bone" OR "consumption of tiger" OR "traditional medicine" OR "bone wine" OR "tiger product" OR "bone glue")*

Search term D: *"substitute" and "jaguar" and "chinese" and "medicine" and "tiger"*

Figure 1*. Definitions of search terms A, B, C and D.*

Phase 3) This phase was a primary filtration using exclusion criteria as described above. However, simultaneously, five categories were distinguished for an overview of main themes as follows: ***A*** - Explicit mention of jaguar body parts *with* ties to the Asian market and/or Traditional Chinese Medicine (TCM). ***B*** - Explicit mentioning of specific jaguar body parts with regard to IWT *without* ties to the Asian market and/or

TCM. ***C*** **-** Mentions specific body parts of tigers *without* ties to the Asian market and/or TCM. ***D*** **-** Mentions causes for killing of jaguars other than poaching associated with the demand for specific body parts. ***E*** **-** Mentions tiger body parts *with* ties to the Asian market and/or TCM. These categories helped to shed light on nuances between identified records while simultaneously verifying the level of relevant content by reviewers leading to a decision whether a particular record meets the inclusion criteria. Concurrently, this categorisation made it possible to collect additional information along the identification of records, e.g. it allowed us to roughly estimate the abundance of literature when it comes to the mentioning of other possible substitute species and recognize most discussed categories.

However, only records in category ***A*** were relevant for answering RQs and thus addressing the purpose of this review. All identified records (RQ1) were copied into Google sheets and identified in Mendeley desktop version 1.19.8. Each record had its own raw and cells used by reviewers to indicate whether they agree or disagree with suggested initial categorisation made by one reviewer. Mendeley desktop was used to organise and export records into pdf files then were then sent to other two reviewers. Two reviewers focused on all categories while three reviewers focused on category ***A*** records. An ID was assigned to all category ***A*** records. Disagreements were resolved using comments in Google sheets.

The backward search was performed as well to complete results derived from previously described search processes. The focus was on jaguars, tigers, wildlife-trade, possible substitutes, and records focusing on other species that could perhaps indicate connections to body parts of relevant species and/or ties to the Asian market. However, the backward search was performed only from category ***A*** records. It was assumed that remaining categories, which do not explicitly mention jaguar body parts as substitutes to tigers or do not link jaguars to TCM, may not lead to relevant records. Moreover, not all identified records were available in full-text and mostly Titles were screened for possible relevance during this search. It is worth mentioning that the second-level backward search was performed only for some records, however, it was not prioritized. Moreover, resulting categories from individual search methods/processes were merged to get an overview over the abundance of records in each category. The secondary purpose was to confirm the suitability of search terms. Duplicates were removed after the merge. No automation tool was used. A Prisma model 2020 that represents an evidence-based minimum set of requirements for the reporting of systematic literature reviews was created.

Phase 4) Category ***A*** records were reviewed for coherency with respect to research questions (i.e., secondary filtration using eligibility and quality criteria. Table 1, Annex). The only purpose of this phase was to exclude those records that do not fulfill predefined criteria. A point system was established to keep track of unsuitable records. The minimum permitted number of points was 10. Records having less than 10 points were automatically excluded since quality criteria were not met. Such records were assumed to represent a higher risk of bias, therefore, records to be included had to show at least some level of firmness. However, five additional requirements had to be fulfilled even though records had 10 or more points (Table 1, Annex).

Furthermore, a network of selected category ***A*** records for Phase 5 was created and analysed for interrelations (i.e., mutual referencing) using the Graph Commons platform (Graph Commons, 2021). A visual representation of these interrelations was presented. Records were sized by the degree of centrality, which can be understood as the number of connections that is proportional to the importance of a particular record based on its references within the frame of records in this category. Hansen et al. (2019) used the degree of centrality in social network analysis describing it "*as a kind of popularity measure*" without prejudice or bias. Top five records were identified. Additionally, betweenness centrality that captures how much a particular record is in between other records (Perez and Germon, 2016) was also assessed. The analysis was performed for all category ***A*** records as well before the elimination by the eligibility and quality check in order to verify whether records with the highest degree of centrality were included in Phase 5 and to estimate the loss of information caused by the elimination.

Additionally, all category ***A*** records were compared using the publication date to identify oldest selected and excluded records. The focus was on the highest degree of centrality records and their temporal relationships to others. This part was completed after selected records were reviewed to avoid creating an environment that could bias reviewers´ opinions. It is worth noting that the reviewer who performed the initial identification of records was completely unfamiliar with the topic at the beginning of this review, which reduced the confirmation bias. Biases are about exaggerating or underestimating (Khan et al., 2003), displacing our perception of objectivity, which was the reason to include a third reviewer when it comes to category ***A*** records to attempt to further minimise the risk of bias.

Phase 5) This phase was characterized by the combination of a thematic and content analysis. This in-depth review was built on a narrative synthesis approach to summarise and discuss findings. Firstly, a preliminary synthesis was performed during which extracted data based on predefined criteria (Table 2, Annex) was collected and copied into a table in Google sheets, i.e., tabulating and narrative descriptions to ensure a systematic way of this process. These categories (coding) were used to identify main themes and other information such as geographical location of involved institutions/universities, the demand for specific body parts, supply-side countries, etc. in selected records. This combination of thematic and content analysis made it possible to get an overview of the amount of important information with respect to RQs while also collecting additional data with a lower level of importance along the way. Findings and/or conclusions from selected records were linked once a relation was recognized (i.e., exploring relationships, e.g., similar findings/conclusions were linked). A particular interest was on which research questions have been covered so far, what is already known, and which new research questions are indicated in existing research (*RQ3*). The focus was on knowledge gaps and/or shortcomings and difficulties presented in these records. Finally, extracted information was transformed into a common rubric.

Moreover, the Prisma 2020 checklist (Page et al. 2020) was used to guide this systematic review, although, we could not completely avoid some deviations, e.g., "*effect measures*", "*statistical synthesis*". Identified records were divided into different quality levels, i.e., GL sources were included in this review. The purpose of that was to complement the search, avoiding bias in this review by including information not controlled by traditional academic or commercial publishers. However, to avoid the generalisation bias, results (i.e., findings/conclusions, etc.) from different quality records in the sense of output control were evaluated independently. The Mid Sweden University online library´s discovery tool Primo was used to verify whether a record was PR or not. Primo is a tool used to search for ebooks, articles, journals, print and digital media, theses, research publications and other material. The purpose of it was to get a rough understanding about the abundance of literature between these two categories. This clustering was also used to avoid misinterpretation of quality of our conclusions and thus increase the trustworthiness of the synthesis while making a comparison possible about what different literature quality states when it comes to the substitution (*RQ2*).

3. Results and Discussion

3.1 Phase 2 & 3

We retrieved 54 records from 4223 identified ones (Figure 2). We did not strictly follow the format of the Prisma 2020 flow diagram in that we deemed that it was not necessary to divide the diagram into two parts, i.e., "*Identification of studies via databases and registers*" and "*Identification of studies via other methods*" as presented in Page et al. (2020) because we reported the number of records identified by each search process rather than the total number across all search processes.

3.1.1 Combining results of all categories

Figure 3 shows results of merged categories from individual search processes. Category ***E*** was found to be the most frequent implying that tiger body parts are mostly discussed in relation to their trade on Asian markets and/or their use in TCM rather than the substitution itself. Surprisingly, the number of records that explicitly mentioned jaguar body parts with ties to the Asian market and/or TCM was nearly the same as the number of identified records that discuss causes for killing of jaguars other than poaching associated with the demand for specific body parts. On the other hand, the number of records mentioning jaguars without ties to the Asian market and/or TCM was not neglectable. Body parts of tigers can be said to be nearly always associated with ties to the Asian market and/or TCM if considering this search. This was revealed by the neglectable number of category ***C*** records. These results also revealed the difference between tigers and jaguars in that the decline of jaguars can be either linked to Asian market and/or TCM (91 records), or to other causes (95 records) whereas body parts of tigers are nearly always discussed in relation to TCM and/or the Asian market in general.

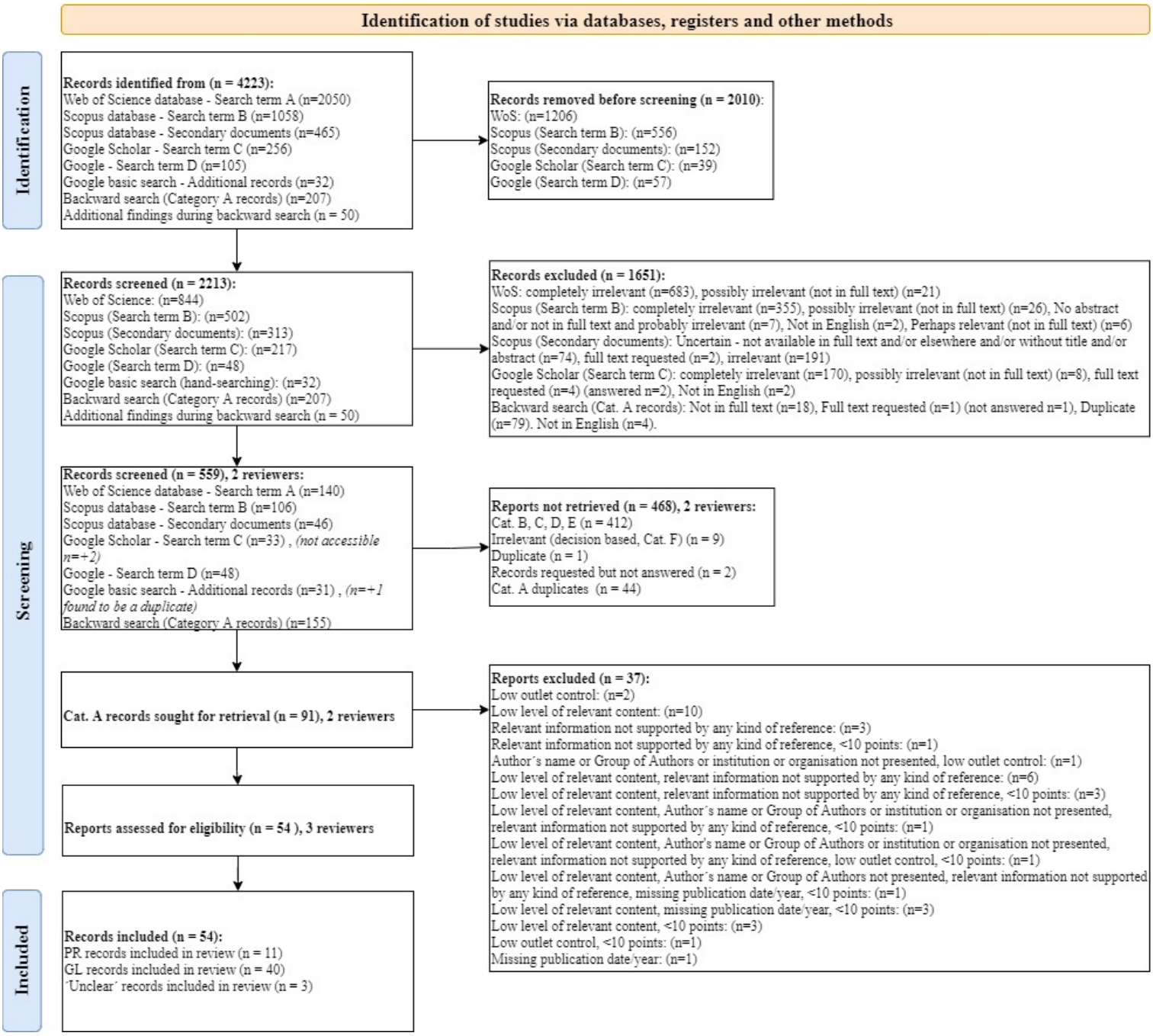

Figure 2. *Flow diagram documenting the entire search according to the Prisma 2020 model.*

Figure 4 shows that search terms used in this review served their purpose relatively well. The highest number of substitute species was associated with jaguars (37%) followed by lions (22.8%) and leopards (19.6%, including snow and clouded leopards). This result also suggests that only 3.8% of records discussed legal substitutes and 1.6% farmed tigers as replacements to tiger body parts. Some implications of the substitution (14.1%) was also noted.

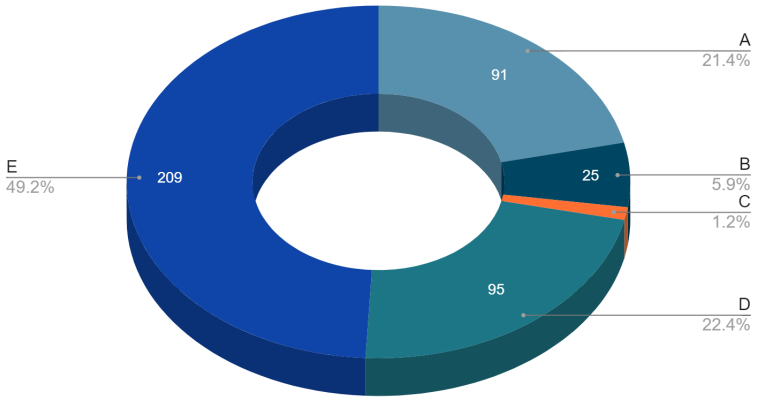

Figure 3. *Percentage per a category - combined search results after duplicates were removed indicating the dominance of category E (Mentions tiger body parts with ties to the Asian market and/or TCM).*

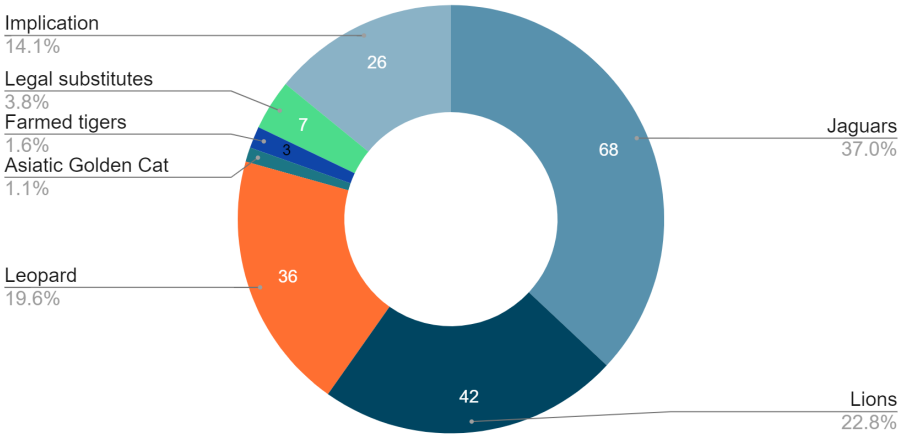

Figure 4. *Explicit mentionings of substitute species to body parts of tigers - combined search results (i.e., all categories).*

3.2 Phase 4 results

Phase 4 resulted in 91 category ***A*** records sought for retrieval. 22 PR, 64 GL and 5 ´Unclear´ records. 37 records were not deemed suitable for Phase 5, which resulted in 11 PR, 40 GL and 3 ´Unclear´ records. Records were excluded mostly due to a single reason (Figure 2); low level of relevant content, or due to multiple reasons such as the former accompanied by the lack of any kind of reference linked to relevant information, which could be an interview, news, video, blog, etc., i.e., even a low output control source. Some records did not mention the publication date and/or name(s)/institution or organisation, etc. while some records were also excluded having less than 10 points.

3.2.1 Degree of centrality and betweenness of selected category A records

Selected category ***A*** records were analysed for interrelations. In total, 64 node types (i.e., corresponding to IDs of records) sized by the degree of centrality with 123 edges (Figure 5) were identified. The top five records were 27a, 3a, 12a, 52a and 22a (see Tables 3, 4 and 5 in Annex for IDs), in this order incl. references unrelated to the substitution itself. Moreover, the betweenness centrality, i.e. the highest influence over the flow of information was found to be the most prominent for records 27a, 3a, 12a, 45a and 44a.

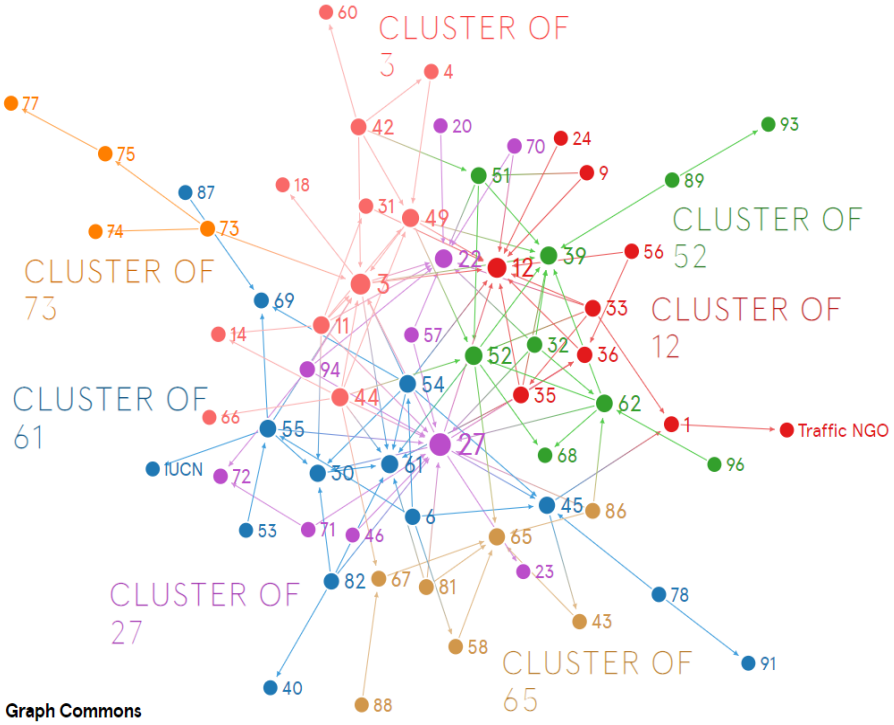

Figure 5*. Identified clusters of selected category A records (64 with 123 edges) - sized by the degree of centrality - showing interrelations between selected records for Phase 5 (Graph Commons, 2021).*

In order to verify whether records with the highest degree of centrality were all included in Phase 5, the analysis was performed for all 91 category ***A*** records before the exclusion performed by three reviewers. This resulted in 79 identified nodes sized by the degree of centrality and 146 edges in total (only nodes with at least one edge were included). The highest degree of centrality was found for records 27a, 12a, 3a, 52a and 49a. The betweenness centrality was highest for 27a, 3a, 12a, 45a and 55a in this order. The difference between the degree of centrality of eliminated records and selected records was not significant since the number of connections was rather low for most excluded records (Figure 6). Those records having a higher number of connection (red pentagon) were excluded due to the lack of any type of support behind relevant information (61a, 65a), having a low level of relevant content (5a), missing publication date (68a) or writer´s name(s) (34a), or having a low credibility/low outlet control (34a).

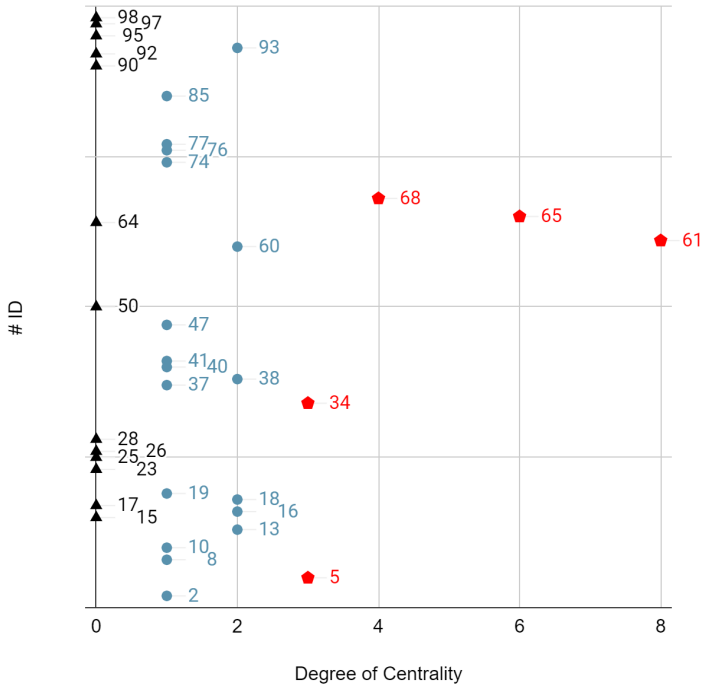

Figure 6*. The degree of centrality of excluded category A records. Red pentagon-marked records are those having > 3 connections. Black triangles indicate records without references to other category A records while also being not referred to except for 23a (cited once in 27a) and 64a (cited once in 34a). Y-axis does not represent any data and was merely used to spread out records.*

Although the order of the top five records was slightly changed after the elimination, none of the top 25 records with the highest number of connections was actually excluded because selected records referred to excluded ones as well. After the removal of records that did not fulfill criteria, the number of identified nodes was reduced by about 19%. The number of edges was reduced by nearly 16%. The number of records after the elimination was reduced by nearly 41% compared to a rather sparse reduction of nodes and edges. It was, therefore, assumed that the elimination did not have a significant effect on conclusions made in this systematic literature review.

Several oldest records were not selected for Phase 5 such as 23a from 2000, which mentioned wine containing Jaguar Panthera onca bone. 23a was excluded due to the lack of reference and low level of relevant information (Level 1). Some records lacked the exact publication date - only a year was stated. In that case, the 1st January of that year was assigned to get an overview of the publishing trend over time. The oldest selected record (14a) was published in August 2016. The oldest PR record was 28a from December 2011 (not selected for Phase 5). The oldest selected PR record (12a) was from February 2018 - reported as news. The number of published records increased significantly between 2018 and 2021, making the record 27a undoubtedly the most central one over this period of time especially while also referring to the high degree of centrality records 3a and 12a.

3.3 Phase 5 - In-depth review results

3.3.1 Answers to RQ 1 from PR records

The main aim, focus, attempt and/or objective of selected PR category ***A*** records (Table 3, Annex) varied significantly. Only a handful of records´ aims could be explicitly linked to jaguars and illegal trade. Two PR records (11a, 27a) explicitly hypothesized that Chinese market could be linked to trade of jaguar body parts. For instance, record 27a confirmed the hypothesis that the trade increases with Chinese investment in areas with higher concentrations of jaguars while also mentioning the relation to the corruption perception index, GNI/capita and lower trade rates. On the other hand, the hypothesis about exports to China and the contribution of Chinese residents to jaguar market chain establishment was not confirmed. Record 11a attempted to verify whether Chinese presence is the driver behind jaguar trade in Mesoamerica among other factors affecting jaguars such as the human-jaguar conflict. This hypothesis was not confirmed in 11a for Belize and Guatemala, providing no evidence of organised crime.

The degree of centrality was the highest for the record 51a if merely considering the explicit mentioning of jaguars as substituting species for tigers, Figure 7 shows that record 51a referred to National Geographic (39a) regarding the substitution (selected GL record), which was the oldest record when it comes to the information about the substitution to which PR records referred to. The second most central node was record 49a, which also referred to National Geographic (39a). The third was 12a, which implicated the substitution, referring to the news article "*China to roll back regulations for traditional medicine despite safety concerns*" published by Nature when noting TCM, however, the article did not link jaguars or tigers to TCM. The fourth was 39a which linked increasing "*China's appetite for jaguars*" to tiger parts, however, only jewelry in which jaguar teeth are used was noted. The scale of the use of teeth, canines, fangs in TCM was not indicated and remains blurry. The last record with the highest degree of centrality was 11a, which referred to 49a. Record 49a was associated with the highest influence over the flow of information followed by 39a, 51a, 11a and 12a.

3.3.2 Answers to RQ 2 from PR records

All peer-reviewed category ***A*** records discussed IWT as one of the main threats to jaguars as expected. For instance, jaguar bone glue found in China and perhaps even Vietnam was mentioned as well as the surge in trafficking of body parts seen as a possible by-product of persecution by ranches. This trade was often linked to Chinese investors in Latin America. Both domestic and international trade was mentioned. 54.5% of PR records also discussed threats caused by the human-jaguar conflict (i.e., 11a, 12a, 27a, 31a, 45a, 49a). In addition, 45.5% (9a, 27a, 31a, 45a, 49a) also discussed habitat loss from which one record focused specifically on agricultural expansion (9a). One record also noted the fragmentation of habitat and road mortality as well (27a). Two of

these records mentioned specifically retaliatory killings (45a, 55a). On the other hand, this result does not represent the whole picture since category D records were not reviewed. Figure 8 merely shows what threats were discussed in PR records.

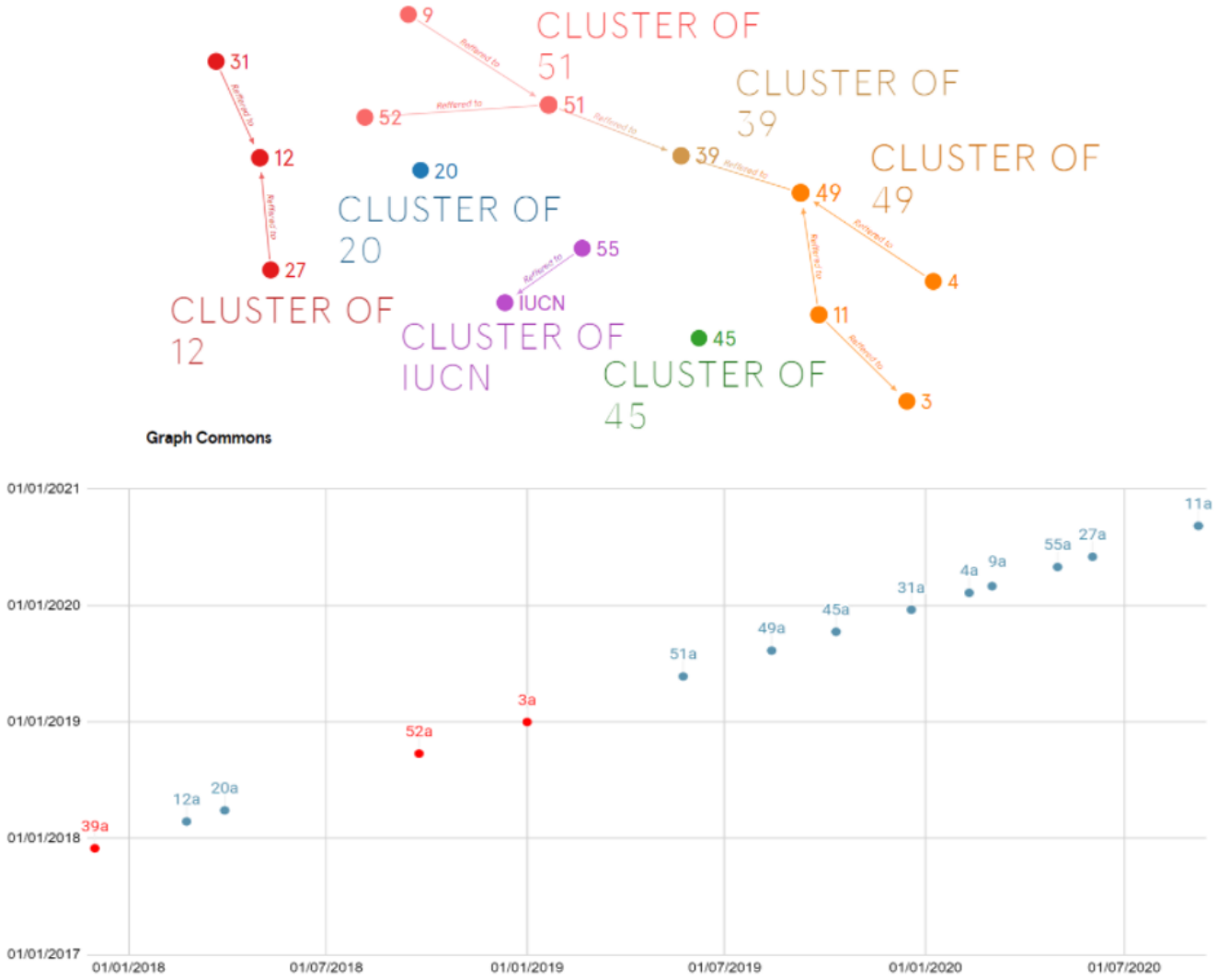

***Figure** 7. Clusters of PR records (4a, 9a, 11a, 12a, 20a, 27a, 31a, 45a, 49a, 51a, 55a, letter a not displayed in the figure) and links to the source of relevant information on the top (i.e., explicit mentioning of the substitution). Records 39a and 52a are GL (National Geographic). A visual representation of three GL records in red to which some PR records referred to when it comes to the explicit mentioning of the substitution of jaguar body parts (bottom).*

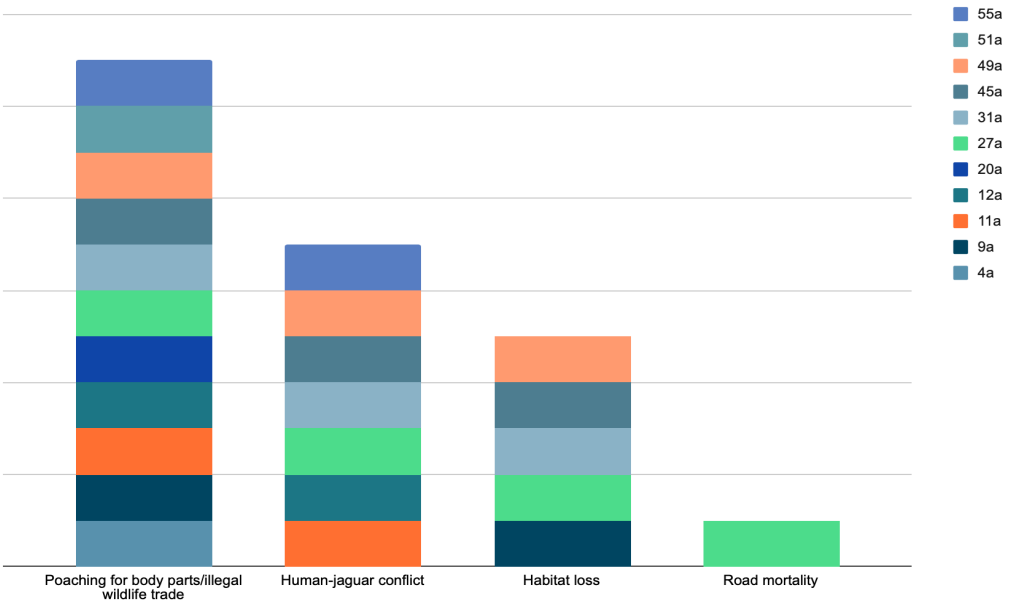

***Figure 8**. Threats to jaguars based on mentionings in selected category A - PR records.*

On the supply side, Bolivia was the most mentioned country followed by Suriname, Peru, Brazil, Costa Rica and Belize. On the demand side, China was the most often mentioned country followed by Asia in general, Vietnam, and latin America countries implying the existence of both international and domestic trade. This result also suggested that PR records did not discuss IWT in jaguar body parts in many other central and south American countries that still provide habitat to jaguars such as Nicaragua, Honduras, Panama, Colombia, Ecuador, Venezuela, Guyana, Paraguay and more. What is known about the state of jaguars in these countries when it comes to the illegal trade? GL records complemented PR records by mentioning all of the above mentioned countries.

When it comes to the explicit mentioning including implications of tiger body parts being replaced by jaguars especially in TCM, PR records referred to each other to some extent and to GL records (Figure 7). For instance, record 4a referred to record 49a when stating that jaguar bone glue was found in China. Record 9a referred to 51a when linking tiger body parts to recent surge in the trafficking of jaguars. Record 11a mentioned jaguar teeth destined for China and referred to 29a (which was not included in Phase 5 due to the lack of information about the connection to TCM or the substitution itself). 11a also referred to record 49a when mentioning the demand of Chinese for jaguar bone-paste. Record 27a was also mentioned in record 11a in association with the trade of jaguar body parts. Record 12a mentioned a trafficking route involving jaguars that has emerged due to scarcity of tiger parts used in TCM in China. Record 27a referred to multiple sources (not included in Phase 5) when mentioning jaguar canines to be likely substitutes for teeth of tigers, lions, and other cats. On the other hand, record 27a also referred to 12a when it comes to jaguars being substitutes in the medicinal bone market, etc.

In addition, four PR records mentioned lions as substitutes to tiger body parts. Two records also mention leopards and other felids in general, from which one specifically mentioned clouded leopards and snow leopards. One record noted decoys, e.g., teeths of South American sea lions and caiman being sold as jaguar fangs. Record 45a stated that glue paste made of boiled jaguar parts is used for medicinal purposes in Southeast Asia among others reasons behind the desire for body parts of jaguars (i.e., jewellery, home decor), however, an explicit mentioning of the substitution was not mentioned in 45a. On the other hand, glue paste is often associated with tigers in TCM and thus jaguar glue paste could be either linked to the substitution itself or jaguars could be complements. This remains uncertain. Record 49a referred to 39a (National Geographic, GL) when mentioning the existence of reports indicating the substitution for tiger parts using jaguar products. Record 51a also mentioned employees of construction companies located in Bolivia and Suriname who attempted to send jaguar body parts to China in order to be used in TCM, substituting tiger parts. Record 55a referred to the IUCN Red List assessment group noting that jaguars are starting to replace tigers when it comes to tiger bone used in TCM through the Asian community located in Latin America. Other species such as snow leopards, clouded leopards and lions were also mentioned in 55a.

Several reasons behind the demand for body parts of tigers/jaguar body parts as substitutes were mentioned among which medicinal purposes was the most abundant factor. Record 55a described tiger glue or glue paste as follows: "*Tiger glue is a concentrated product manufactured by boiling the bones for three to seven days, producing a red-brown substance that is poured into a frame to make a gelatinous cake*" or other forms that can be consumed with alcohol after being ground into powder (55a). Record 49a mentioned the use of glue paste to treat arthritis pain while it is also supposed to enhance health and increase sexual potency. The second most prevalent reason was the use of jaguar body parts such as teeth, claws, skins, etc. for decoration/ornamental purposes, jewelry, amulets, skin bracelets, canine pendants, etc. The third reason was for trophies/collectibles, especially fangs, skulls, claws and skins. The fourth most mentioned reason was the use of jaguar body parts as symbols of bravery and power followed by spiritual, cultural beliefs and relational purposes.

3.3.3 Answers to RQ 3 from PR records

Based on information extracted from PR category A records, future research should address:

1) The potential of legal substitution for species that are affected by IWT. Is it possible to shift the behaviour of consumers away from wildcat products? More information/evidence is needed about what species are used in TCM. Jaguars should be recognized as either substitutes to body parts of tigers or rather complementing species in IWT - Are jaguars substitutes or complements to body parts of tigers? Are jaguar body parts more affordable compared to tigers or other possible substitutes? What are other substitute species? There is the need to

recognize both legal and illegal alternative species and their interactions on the market. It is essential to collect evidence, information about market availability, supply and demand side and define reasons behind the demand.

2) The need for more concrete examples about drivers of IWT in jaguar body parts in countries that still provide habitat to jaguars. For instance, record 55a mentioned the existence of significant gaps in research and data in many countries of Latin America. Many of south American countries that provide habitat to jaguars were not mentioned at all, which could mean many things, however, it is important to investigate what is it known about countries such as Nicaragua, Honduras, Panama, Colombia, Ecuador, Venezuela and others when it comes to both human-jaguar conflict and illegal trade while searching for relations. This is especially important for targeting the investments into conservation efforts. At least some of these countries are characterized by poor patrolling ability and despite national and international bans, IWT is difficult to prevent. It is necessary to implement conservation measures in locations where it is most needed. Despite the fact that international trafficking of jaguar body parts exists based on mentionings in all selected PR records, there is still the paucity of evidence to undoubtedly support conclusions leading to an effective response, increasing the level of conservation efforts.

3) The possibility of rural residents and communities living in proximity of jaguars being involved in IWT in jaguars. What are the factors driving local communities to contribute to the IWT? Record 45a stated that body parts of jaguars such as fangs were found in both frequent touristic locations and less touristic areas, implying that local communities are linked to the domestic IWT. What methods could be used to recognize and identify involved actors? IWT in jaguars is understudied and there is a need for acceptable methods such as surveys or interviews involving a sufficiently large population size.

4) Poverty and corruption may play a significant role, contributing to IWT in jaguar body parts. For instance, record 31a mentioned that laws are rarely enforced in Bolivia, which involves local communities and local governance and may negatively affect efforts for jaguar conservation. Therefore, it may be necessary to focus on socio-economic factors in relevant communities to reduce the level of corruption and poverty while consequently reducing the willingness or needs on the supply side to engage in IWT. What is the magnitude of poverty and corruption in relevant communities and how it may affect the trade of body parts of jaguars?

5) There is a need to investigate the involvement of Chinese traders, drug traffickers and regional immigrants, which is not well-evidence based. On the other hand a positive relationship was mentioned in 27a between the amount of Chinese private investment and the number of seized jaguars, which indicates that the legal market may provide structure for the illegal one. This was also supported in 49a, stating that the demand for jaguar paste can be linked to areas near industries such as mining and logging and that China is the demand side

country. The third main driver of jaguar trade mentioned in 11a was the Asian demand, however, the number of concrete examples was rather limited, which also applies to the fourth main demand identified in 11a as drug trafficking. The contribution of Chinese immigrants to the establishment of the jaguar market chain was not confirmed.

6) The relationship between retaliatory killings and opportunistic trade in jaguar body parts. What is the link between retaliatory killings and opportunistic trade and what is the scale of it? Results of record 31a showed the existence of negative perceptions of jaguars without the connection to cattle depredation by these species, which suggests that retaliatory killing is not the only reason when it comes to killing of jaguars. It is therefore needed to address jaguar persecution where the loss of livestock is not the issue. On the other hand, record 11a focused on jaguars being killed because they attacked livestock and linked jaguar teeth or the whole jaguar to Chinese citizens stating that they pay good money for jaguars. The protection of jaguars relies on local communities and the perception of these communities on jaguars should be further investigated to prevent killings. Future research should, therefore, address possible measures to reduce negative impacts from human-jaguar conflict in such communities, promoting the coexistence of communities with jaguars. Retaliatory killings may increase the rate of opportunistic trade in body parts (i.e., the supply of body parts to the illegal market trade), it is therefore needed to assess possible ways to prevent it. Opportunistic trade in jaguar body parts is not well documented and thus the possibility of ITW on the international level cannot be simply rejected, therefore, more evidence is needed to verify this potential contributor among others especially when only a handful of isolated cases have been studied.

3.3.4 Answers to RQ 1 from ´Unclear´ records

Three selected category ***A*** records (Table 4, Annex) were neither categorized as PR nor GL due to uncertainty among reviewers. These records had heterogenous purposes. Record 75a provided a summary of wildlife whistleblowers and their submissions that could potentially lead to a concrete action against IWT. Record 94a conducted an undercover investigation on trade and trafficking of jaguars in Bolivia. The focus of the record was to unveil different aspects of a criminal supply chain. Record 42a focused on linking Chinese demand among other actors involved in IWT in jaguar.

The substitution was not explicitly mentioned in 75a, however, tiger balm and herbs made of jaguar body parts to be shipped to China represent the connection to TCM. Record 94a on the other hand mentioned jaguars as "*American tigers*" due to the lack of a specific word for jaguars in China. The record mentioned selling jaguar fangs in China as a substitution for tiger fangs. Also substitutes to tiger canines were specifically mentioned together with the surge in jaguar trafficking to China. However, the substitution itself was not supported by information from external sources or it was not as such presented. 94a referred to 3a, 2a, 22a and 72a from those

recognized in this review. However, the particular section suggesting increasing demand in East and South Asia together with the increased presence of Chinese descent in Latin America resulting in the surge in jaguar trafficking was not referred to (Figure 9). The same applies for jaguar fangs used as substitutes to tiger canines. Record 42a stated the existence of jaguar body parts (i.e., mainly jaguar teeth) in Bolivia and Suriname destined for China. However, jaguar paste as an alternative to tiger paste was also mentioned, referring to record 49a. The explicit mentioning of other felids used as substitutes to body parts of tigers was only mentioned once in record 42a; lions, leopards (incl. clouded and snow leopards) were noted while referring to record 51a.

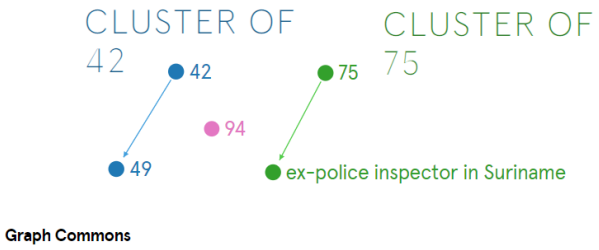

Figure 9*. Clusters of ´Unclear´ records (42a, 75a, 94a, letter a not displayed in the figure) and links to the source of relevant information (i.e., explicit mentioning of the substitution of tiger body parts by jaguars). Record 49a is PR. 75a referred to an ex-police inspector in Suriname.*

3.3.5 Answers to RQ 2 from ´Unclear´ records

Most prevalent threats to jaguars were poaching and illegal trade. Record 75a linked killings mainly to Chinese buyers using jaguar body parts for a variety of reasons. The international trade was also suggested using tree logs to hide jaguar parts on the way to China in large container boats (Chinese shipping companies). This was also mentioned in some GL records. Record 94a also linked the poaching to China through the medicinal value of jaguar parts and the presence of Chinese citizens while referring to the record 27a (selected PR record). Record 42a, on the other hand, mentioned several other threats to jaguars such as human-jaguar conflict (i.e., mainly retaliation for livestock degradation), cultural (i.e., local uses and traditional beliefs), safety and commercial reasons (i.e., profit driven killing on local markets). Besides that, Chinese demand for jaguars was noted as well.

Suriname was mentioned as the supply side in 75a and 94a, Bolivia, Peru and Suriname was mentioned in 42a. According to 94a, Bolivia has become the epicentre when it comes to the demand of Chinese and seizures of jaguar body parts. The demand side was discussed as well in all three records. 75a mentioned Chinese citizens and Chinese supermarkets in Suriname together with China suggesting both domestic and international illegal trade. The same was suggested in 94a, however, Bolivians were also involved in the trade mostly as hunters involved in sourcing jaguar parts and also acting as middlemen selling jaguar teeth to Chinese buyers or other Asian middlemen.

The connection to China was also discussed in terms of smuggling of jaguar parts to their final destination in China. 94a suggested that jaguar body parts are often smuggled using transit points such as Brazil, Vietnam and Hong Kong to avoid stricter controls when using direct routes. Payments via WeChat (China) or by cash was also mentioned as well as the existence of 3 criminal groups from which the so-called Putian Gang is supposed to control the trade. On the other hand, record 42a saw Bolivians as the most reported traders. Chinese organized crime was mentioned together with cocaine and human trafficking in Suriname, however, further details were not presented in 75a. Record 42a also referred to record 3a (selected GL record) when mentioning Chinese-long term immigrants and the trade stating that Asian descent traders (mainly Chinese but also Japanese, Korean and Thai) were the next most prevalent group of traders following Bolivian nationals. Jaguar paste made from jaguar bones and meat was linked to an Asian trader in 42a. Moreover, jaguar body parts were also connected to prison fees in local prisons.

All three records mentioned the demand for specific body parts. Record 75a noted the demand for skin, bones, genitals, teeth and also meat. Record 94a also mentioned meat, teeth bones, genitals, fangs and jaguar parts in general. Two restaurants in Santa Cruz were found to serve jaguar meat according to 94a, however, Chinese actors were not linked to the sale of meat but rather teeth suggesting the existence of different actors/demands. The replacement of tiger teeth by jaguar fangs was also noted. Record 42a noted teeth, skin, fat, meat, claws, tails, skulls, bones, the paste made of bones, other parts in general and even live animals.

Reasons behind the demand were noted as well. Record 75a mentioned jaguars for their meat, bones to make tiger balm and herbs. The use of teeth and male genitals were not linked to a particular reason. Record 94a mentioned the use of jaguar parts for medicinal purposes, linking genitals to aprhrodisiac. Jewellery was also noted when it comes to jaguar fangs, which were associated with the symbolisation of social status. Moreover, decorative, medicinal, nutritional or cultural reasons were mentioned in record 42a, where the most common part of jaguars was skin followed by fat, teeth, claws, etc. The international trade or demand was associated with jaguar teeth, skulls and bones implying that Asian traders were interested in buying skulls and bones the most. An implication was made in 42a about the use of bones in the production of jaguar paste in Suriname to be used in TCM while referring to 49a and 3a records.

3.3.6 Answers to RQ 3 from ´Unclear´ records

Future research should address:

1) The need for evidence especially when it comes to actors involved. For instance, record 94a resulted in the identification of 25 Persons of Interest in Bolivia and 50 in other Latin American countries including Suriname

and Peru, which also resulted in the identification of at least three criminal groups involved in jaguar trafficking in Bolivia. However, more information about these groups/individuals was not revealed. Record 42a stated that the evidence behind IWT to China is lacking, therefore, there is the need to investigate Chinese demand further while addressing both domestic and international trade, which is poorly understood. Record 42a also recommended focusing on deeper research into Asian medicinal market in Bolivia as well as on the role of Chinese immigrants in the field of IWT despite the fact that Bolivians were the most prominent group of traders. Moreover, according to 42a, international trade is more prevalent in Bolivia, however, Europe and North America as demand side regions should not be rejected without consideration.

2) Besides involved actors, there is the need to investigate whether profit-driven killing of jaguars is the leading threat to jaguars in Bolivia and other countries that provide habitat to jaguars. Poaching was recognized here as the primary threat to jaguars based on data from PR and GL records, however, the result was based on mentionings and not evidence.

3) Corruption and methods used in trafficking/smuggling when it comes to wild-cat body parts. Smugglers often use luggages for smuggling of jaguar parts when travelling by planes using rather indirect routes to avoid stricter controls according to 94a. Law enforcement capacity, which is low in Bolivia together with ineffective government structures that hinder collaboration and are characterized by corruption and poor control are factors that support IWT in jaguars among others such as newly constructed roads in forests. GL records provided more information about the ways of smuggling.

4) Future research should address the need to establish a standardized system of reporting. An international database perhaps. For instance, record 94a mentioned the existence of conflicting data in jaguar trafficking in Bolivia. That is, there is a need to investigate reasons behind conflicting data, which has become a challenge for conservation efforts of jaguars in the country.

3.3.7 Answers to RQ 1 from GL records

Selected GL (Table 5, Annex) is heterogeneous and dominated by news articles followed by a significantly lower number of reports and magazine articles. Nine GL records did not refer to an external source (7 news, 1 magazine article, 1 report). Eleven GL records referred to other GL from which seven records referred to GL sources eliminated in Phase 4 and four to other selected GL records. Records published on websites that were not explicitly presented as news, blogs, reports, commentary, or others were considered to be news articles. A specific aim/objective/attempt/investigation/focus or a particular argument was explicitly mentioned only in six out of 40 selected GL records. The oldest selected GL records were 14a followed by 91a, 48a, 39a and 22a, etc.

The highest degree of centrality (Figure 10) was found to be in the following order: 27a, , 44a, 12a, 61a, 3a (Top five records). The highest influence over the flow of information was then associated with 54a, 3a, 44a, 27a, 12a. PR records were included in Figure 10 since 50% of GL records referred to them. However, the substitution was not found well evidence-based (Figure 11), often its existence was merely implicated. Selected GL records referred to three PR records, 12a, 45a, which did not refer to an external source of information when it comes to the substitution, and 55a, which referred to IUCN. Three GL records referred to other three selected GL records (30a, 39a, 67a), which did not refer to an external source of information. Otherwise specific names or NGOs/institutions were used as external sources of information in eleven records as shown in Figure 11.

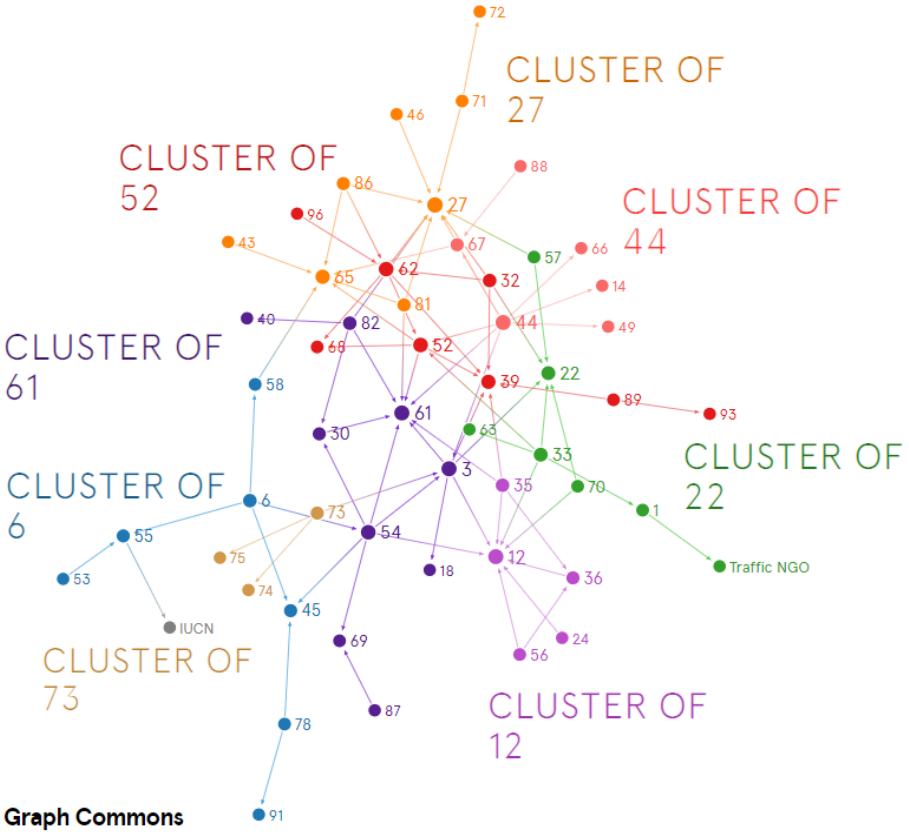

Figure 10. *Clusters of GL including PR sources to which GL referred to.*

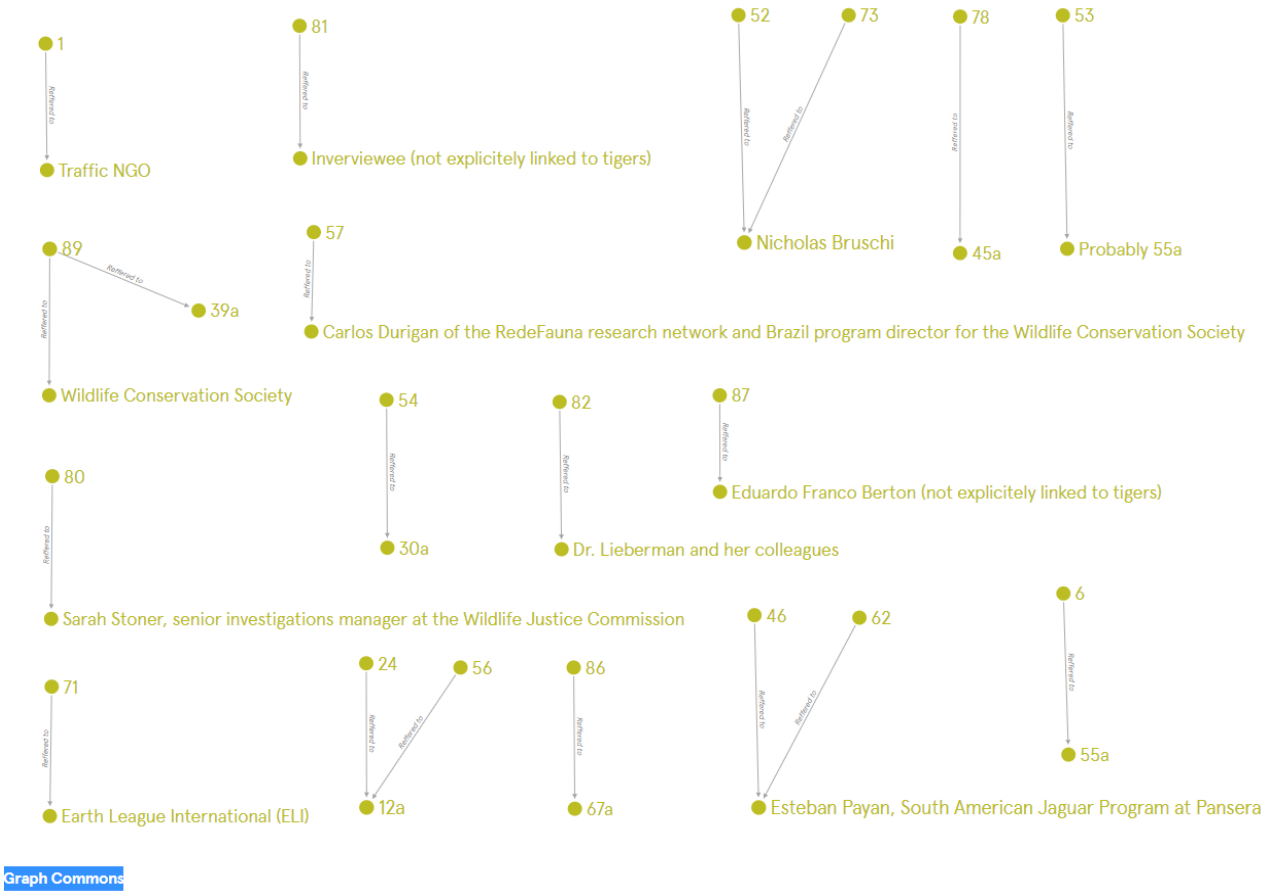

Figure 11. *Clusters of GL records where the substitution is referred to an external source.*

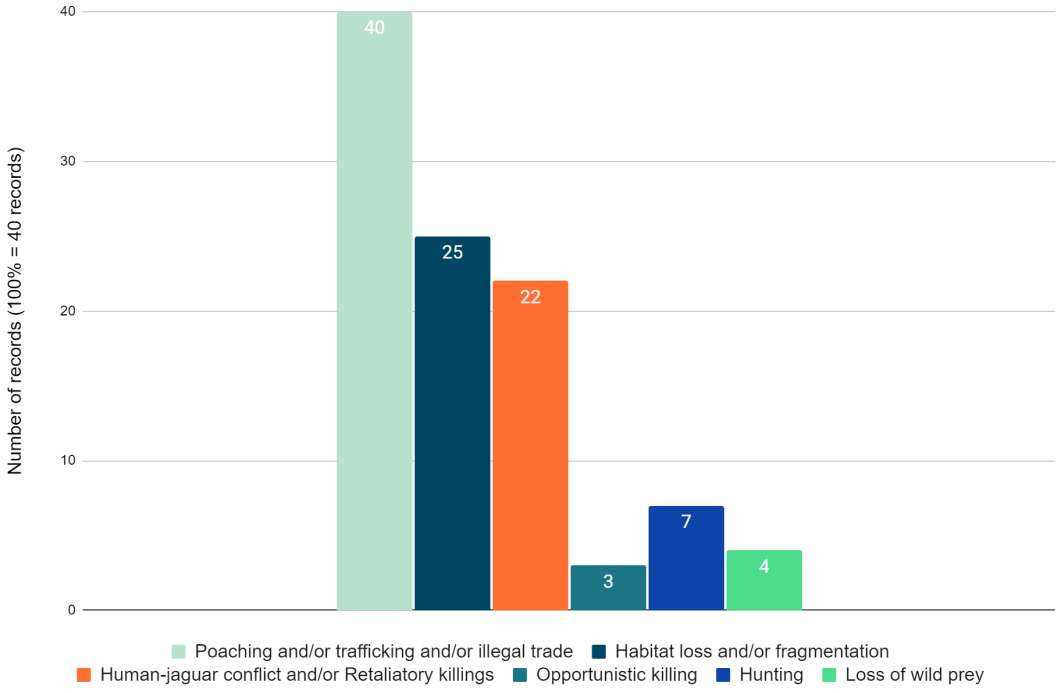

Figure 12. *Threats to jaguars based on the number of mentionings in selected GL records.*

3.3.8 Answers to RQ 2 from GL records

Figure 12 suggests that habitat fragmentation and habitat loss are no longer the dominant threats to jaguars. Human-jaguar conflict seems to be the third most discussed reason for the decline of jaguars followed by hunting. Surprisingly, the loss of wild prey was not discussed as often as anticipated, although search terms were designed to focus on IWT in jaguar body parts rather than other threats. Moreover, category D records were not reviewed and thus Figure 12 may not provide a complete picture.

IWT, poaching and trafficking were the most discussed threats to jaguars as expected. Often GL mentions past killings for the fur of jaguars, implying that this trend has changed over time to illegal trade for their body parts, especially fangs. Jaguar fangs, teeth, and canines are often linked to Chinese smugglers and supply-side countries such as Bolivia and Suriname. The demand side was China in most cases (Figure 13). For instance, record 1a mentioned Chinese citizens involved in IWT in jaguar fangs and other species. 50% of these records refer to selected PR records. The involvement of Chinese workers/immigrants/communities in the illegal trade of jaguars was the most prevalent topic. However, the involvement of local communities seems to play a significant role in IWT as well.

A variety of different reasons behind the desire for jaguar body parts were found, however, medicinal purposes were the most frequently mentioned (39%), followed by jewellery (incl. necklaces, bracelets, belts, wallets, 28%), Ayahuasca ceremonies (experiences incl. spiritual/magical properties, 7%), aesthetics (incl, decoration/beauty accessories, 7%), souvenirs (6%), trophies/collectables (4%) and others. The trafficking of live jaguars (cubs) was also noted in four records (6a, 52a, 67a, 88a) indicating the possibility of these cubs being sold off for parts once grown.

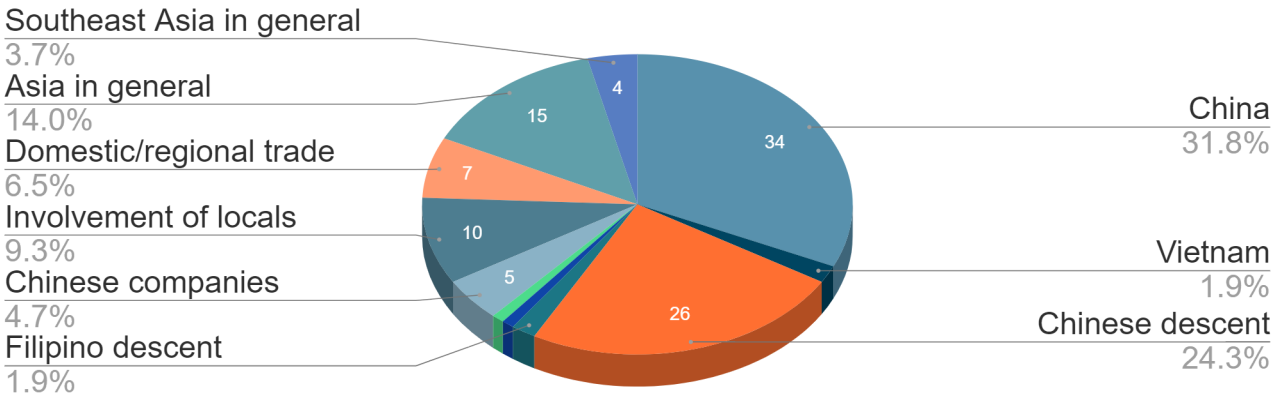

Figure 13. *A percentage distribution based on the number of demand-side related mentionings in GL records. Note: ´Unclear´ records also mentioned Japanese, Korean and Thai traders.*

Many records mentioned multiple affected countries (Figure 14) suggesting that poaching of jaguars increases in the Amazon. Despite the relatively high risk of double counting, clearly, Bolivia was the most discussed country in relation to the illegal trade of jaguars. The second most mentioned country was Suriname followed by Brazil and Peru. The same result was derived from PR records. Countries such as Venezuela, Columbia, Honduras, Panama, Mexico were found to be discussed rather exclusively. Latin America in general was mentioned 15-times, followed by the mentioning of South American countries in general (12-times), Guianas (3-times), Amazonian countries/the region (2-times), and Mesoamerica (2-times). Only one record did not mention a geographical location.

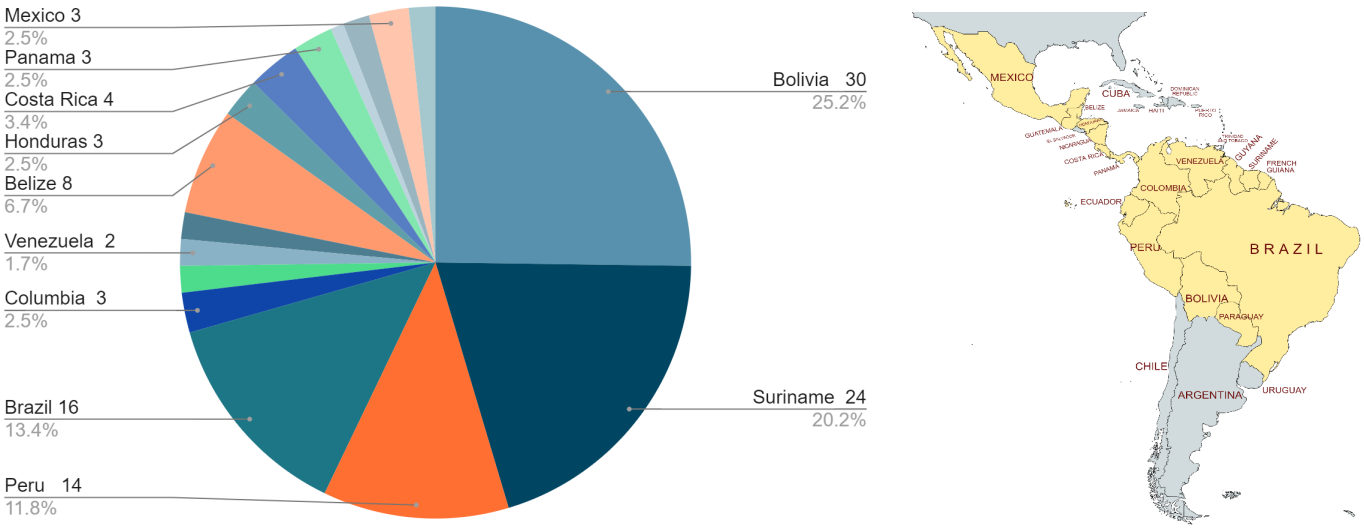

Figure 14. *Percentage distribution of countries discussed in GL records. Double counting is possible due to unclear referencing in these records and the fact that some authors published multiple works using the same geographical location, however, this was assumed not to disturb the holistic overview.*

GL mostly referred to jaguar teeth or canines or fangs when discussing specific body parts in relation to IWT. The mentioning of jaguar body parts in general was the second most frequently used term. Skins (incl. hides, fur) was the third followed by Skulles, Bones, Claws, Meat, etc. in this order (Figure 15).

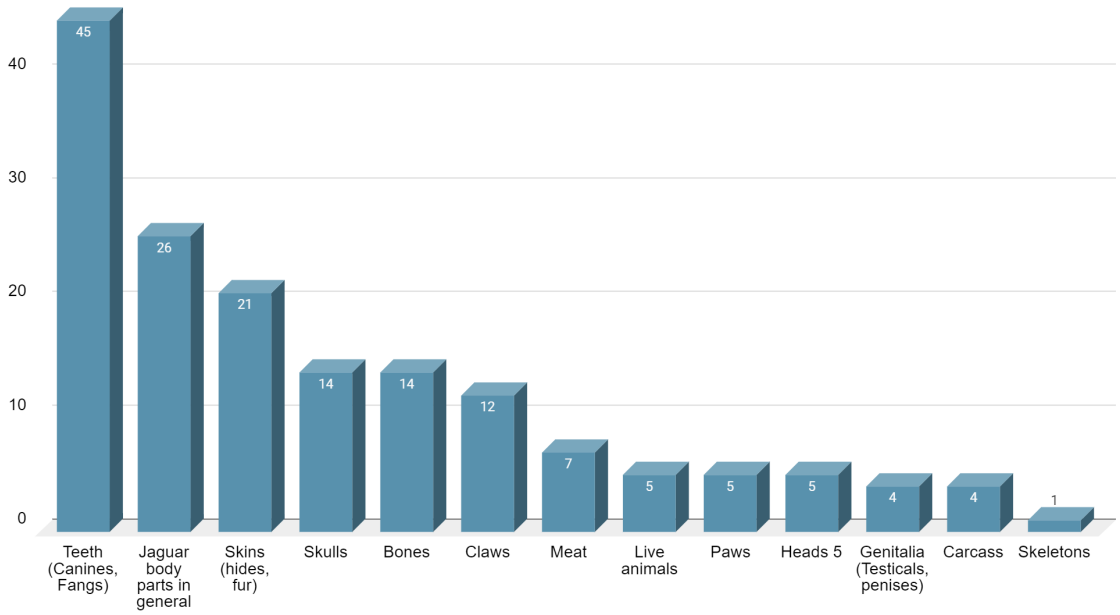

Figure 15*. Specific body parts sorted based on the number of mentionings in selected GL records. Some reports mentioned teeth, fangs and/or canines, which led to a higher number of mentionings than the actual number of selected GL records (40).*

3.3.9 Answers to RQ 3 from GL records

Future research should address:

1) The need to define the primary threat to jaguars. Multiple reasons were mentioned in GL records. Record 91a stated that the biggest threat to jaguars was habitat loss and poaching for their skins used by locals for dancing costumes, however, poaching for their fangs and the association to Chinese market appears to be the dominant threat. IWT was suggested to be increasing (1a, 30a, 81a and other records), involving illegal trafficking networks created by Chinese citizens in Bolivia. Record 84a stated that enough evidence exists to prove the occurrence of domestic and international illegal trade. 6a expressed this as "*the explosion of trade routes between Latina America and Asia*". This was also stated in 3a, both the surge in trafficking of jaguars, their body parts, and the involvement of Chinese nationals (both long term residents and migrant workers), private businesses, and companies in general in Bolivia and Suriname. Chinese-Surinamese born buying jaguar products were also mentioned in 52a among possibly other groups for which evidence is lacking. However, ´other groups´ were not further specified in 52a except for a rumor about Filipinos as consumers of jaguar meat. Record 52a cited Pauline Verheij when stating that "*the influx of Chinese citizens has expanded the domestic market for jaguar parts in Suriname*". What are the exact drivers behind IWT in jaguars and who is involved, how and where?

2) The involvement of Chinese nationals/citizens/migrants/workers/descent, etc. was mentioned in nearly all selected GL records. 6a and 73a mentioned mining and logging operations in the region, 22a building roads, highways and bridges in Bolivia (by Chinese companies), 33a road development as well as logging and mining making areas more accessible, 36a noted major Chinese power plants, rail works also linked to Chinese workers. 24a noted Chinese workers in general, 43a mentioned roadbuilding as well but also the spread of cattle ranches, 56a, construction sites, 71 infrastructure projects, 58a development projects also linked to Chinese descent, etc. 3a stated that the trafficking "*appears to be driven almost entirely by Chinese demand*", although, it was not clear whether Bolivia is the only supply side country or merely a transit point on the way to China according to 3a. On the other hand, 46a mentioned a condition for an increase in the illegal trade, which is a combination of weak governance, corruption and strong ties to China making Brazil, Bolivia and Peru relevant. Weak governance combined with high levels of corruption and poverty was also mentioned in 86a. Based on this, future research should also focus on traces of IWT in other less discussed countries that still provide habitat to jaguars. On the other hand, 82a stated that "*the more jaguars present in a country, the higher the amount of jaguar trafficking*". There is a need to collect information about trafficking routes within countries and between countries as well. However, to monitor changes, the actual number of jaguars in these countries must be known, therefore, a condition is to have access to reliable estimates of jaguars.

3) The possibility of parallel IWT lines. Besides the demand of Chinese workers/companies, etc., 6a also noted the existence of ayahuasca and spiritual experiences that could be linked to IWT. For instance, 78a stated that "*there´s much broader trade that does include trade to Asia*" when referring to ayahuasca tourism suggesting the need to educate both locals and tourists in countries where ayahuasca is used such as Peru, Costa Rica, Colombia, Brazil and others. (82a mentioned the need to educate employees in Chinese companies). 14a and 22a also noted the existence of Chinese mafia, suggesting the possibility that the trafficking in Bolivia is caused by Chinese organised crime, spreading throughout Latin America. 72a mentioned a mafia, however, not explicitly linked to Chinese descent. 91a noted a Korean citizen who allegedly made offers for canines. 71a mentioned Chinese controlled trafficking syndicates and at least three criminal groups in Bolivia. Therefore, future research should address the possibility of organised crime and attempt to collect more evidence. On the other hand, two PR records did not discover evidence suggesting its existence. Despite that, it is believed that Chinese descent is behind the increasing IWT, however, there is paucity of evidence.

4) The involvement of locals should be further investigated since there are indications in literature (22a) that local hunters may be the one who offer jaguar body parts to Chinese workers. 91a mentioned selling points such as souvenir shops, pet stores, protected areas and even airports and bus terminals implying the involvement of locals. 30a stated that most of the trade appears to be local in multiple countries mostly caused by human-jaguar conflicts that could lead to black markets through opportunistic killings, increasing the trafficking of jaguars in four countries - Belize, Honduras, Costa Rica and Panama. Are locals alone involved in the promotion of illegal

trade, giving opportunities to Chinese workers to buy jaquar products? Are Chinese workers asking locals, willing to buy jaquar products? Are both alternatives correct? There is the need to gather more information before claiming who, where and how are individuals/communities, etc. involved.

5) An international database, a standardized way of reporting should be established to summarize all the evidence and share information with minimal bias about seizures, evidence about IWT, retaliatory killings, customer preferences, supply-side/demand-side locations, hotspots, criminal investigations, mentionings in media, etc. should be establish to monitor gaps in knowledge, possible fragmentation when it comes to laws and conservation efforts among localities. Although, the challenge here is represented by illegal activities that may never be intercepted leaving writers nothing more then presumptions about the whole picture. Moreover, the focus should not be on jaguars alone but other species as well. It seems that monitoring other species sharing the habitat with jaguars can be beneficial since the demand for such species can be shared by the same customers, using the same routes, etc.

6) Future research should also focus on human-jaguar conflict and the linkage to IWT. Record 33a mentioned the need to identify existing methods for non-lethal mitigation of human-carnivore conflict. 35a noted the possibility that retaliatory killing of jaguars may be behind the IWT in jaguars (i.e., through opportunistic killings). 82a also noted the possibility of main drivers other than poaching and IWT when referring to Morcatty. Based on information extracted from GL records, future research should address the need to collect evidence especially with focus on mining and logging companies and developmental projects in proximity of locations providing habitat to jaguars and also factors that may motivate locals to become involved, gaining financial resources from retaliatory killings. 83a highlighted the need to improve our knowledge as well. There is a need to assess possible solutions leading to co-existence with jaguars. For instance, 81a mentioned a program that could compensate ranchers for damage caused by jaguars that could resolve killings and opportunistic trade. 89a noted the need to work with farmers to reduce the impact of human-jaguar conflict over livestock. From the analysis it is clear that GL discusses retaliatory killings and opportunistic trade to a lesser extent compared to PR records.

7) Future research should consider the possibility that retaliatory and opportunistic killing may be closely linked to poverty level in relevant communities. 6a, 32a, 44a, 57a and other GL records noted the potential role of poverty in the illegal trade in terms of "*lucrative means of support*" for nearly half of Suriname citizens. For instance, 22a referred to an interview with ´Jesús´ who claimed that Chinese citizens offered him money for jaguar fangs and he would do it again if such an opportunity appeared. 72a stated the following when referring to a specialist - "*The traffickers take advantage of these needs*". 39a cited Nuno Negrões Soares, saying that people know they will not get in trouble if involved in IWT.

8) Future research should investigate reasons for shortcomings in legislation and possibilities to increase conservation efforts. 57a stated that the level of trafficking varies between countries but correlates with socio-economic conditions and the level of disregarding the law. 72 mentioned the lack of laws and less severe penalties. 3a mentioned the need to increase the law enforcement capacity degraded currently by ineffective collaboration, outdated legislation, corruption, bribery and control over the borders where smuggling occurs in Suriname. The need to combat corruption was also mentioned in 58a among others. The lack of funds/resources to control trafficking and research was also noted in 22a, 52a, 73a and others. The importance of NGOs was also implied.

9) Future research should also address the possibility that the construction of new roads and other developmental projects bringing civilization closer to the wilderness make it easier for actors involved in IWT. 3a implied the possibility to shift towards commercial hunting from sustainable hunting as a consequence. Therefore, there is the need to address the lack of enforcement, increase the level of surveillance within and between affected countries, address the lack of conservation plans, and attempt to define specific actions/strategies leading to the effectivisation of the whole system. However, it must be recognised that different locations may require different approaches to ensure an effective conservation of jaguars. Despite that, the need to share information among policy makers at both national and international level was noted in 80a. There is a need for transnational governance. 70a mentioned possible consequences in terms of threatened biodiversity and thus environmental wealth if jaguars are removed from their habitat. Therefore, there is the need to strengthen the protection of relevant localities, increase the awareness about this problem while promoting the value of jaguars and making penalties more severe. A more aggressive approach was also suggested in 78a. In addition, 81a mentioned the need for online surveillance.

10) There is the need to address the issue of advertising often reported through radio stations, posters, flyers, Facebook, Whats up, WeChat, online market websites, etc. For instance, 71a mentioned WeChat used to establish the initial contact between seller and buyer. 81a noted several countries (i.e., Brazil, Mexico, Bolivia, Peru, Ecuador and China) that could be linked to posts about the sale of jaguar parts. The existence of available methods used to identify possible buyers/suppliers through online advertising should be investigated. The use of local radio advertisements was also mentioned in 14a, 35a, 39a, 22a, 71a, 72a, 81a. Encouraging poaching through radio broadcasts as one of methods used by traffickers. However, 71a stated that "*advertising has become more discreet in recent years*". Another method was to go through rural communities and offer money for jaguar body parts, specifically fangs according to 22a. 52a also mentioned rural areas where the desire for body parts of jaguars can be simply expressed by ´putting the word out´ via social media and phone. The use of flyers close to localities such as natural reserves was also noted, for example in 22a, 44a, 72a, 81a and more. In addition, 44a also mentioned the circulation of trophy photos as a way to attract potential customers within Chinese community. The use of photographs instead of the product or the whole animal was also noted in 71a.

What methods can be used to effectively monitor both online and conventional markets to distinguish those involved in IWT in jaguars and other animals?

11) Future research should address the need for crime scripts. Record 22a stated that airports are exit points to China for Chinese workers located in Bolivia. However, before it reaches the airport, the jaguar body must be somehow transported and processed. 73a mentioned that captors have to travel several *km* from the killing site noting that the likelihood of such killings is high in the parks. The use of public transport such as buses and logging trucks was also noted in 73a. Record 52 noted the possibility of multiple transfers from safe house to safe house to keep it moving, which makes it difficult to identify hotspots. 58a also noted the need to transport jaguar carcasses to urban areas for processing. 32a mentioned fangs disguised as key chains or packed as chocolates while also noting the use of postal services by smugglers. The use of postal services was also mentioned in 71a, 72a, 80a and other records. 44a noted jaguar paste in 500 *ml* tabs being smuggled in luggages of Chinese workers on the way back home. 58a mentioned "*thick black and glue-like substance*" packed in tubes. 71a stated that the preferred means of transport is either by cargo or commercial flights, which involves bribes to local authority and that people often carry fangs in carry-on luggages or on their bodies. Hand luggage was also mentioned in 91a and 73a among other methods such as smuggling canines in wooden logs or more specifically hardwood logs that are exported to Asia. On the other hand, 72a mentioned trafficking across the border from Bolivia to Peru. This implies the need for crime scripts, a standard methodology to map IWT in jaguars. What about other species and the means of transportation when it comes to smuggling?

12) Future research should address the need to distinguish what parts of jaguars are most demanded and where and how these parts are used. Several GL records mentioned the importance of jaguar fangs for TCM, however, how fangs are used in TCM was not discussed. 73a stated that "*canines are the most commonly traded parts of jaguars*". Results derived from GL records suggested that teeth (canines, fangs) are the most frequently mentioned body part. Also, 24a stated that fangs are used in Bolivia as medicine in association with Chinese workers, no further details were given about how. 82a noted hundreds of jaguar canines linked to China to be used as jewelry. A detailed assessment focused on body parts of jaguars and IWT in countries that still provide habitat to these animals should be carried out. Although this literature review did not adjust search terms to get an insight in the specific use of particular body parts in TCM, it could be beneficial to gather information about the ways parts are being used. For example, the method of preparation of jaguar paste seems to differ among GL sources that describe its production. For instance, 44a mentioned that it takes boiling jaguar for five days, whereas record 52a and 58a mentioned seven days. 55a three to seven days. What is known about paste made of wild-cat bones? 62a referred to Morcatty when it comes to the need to understand more about the demand side (i.e., consumer preferences) since there is the gap in knowledge about what happens to jaguar products once they reach their final destination. Moreover, several GL records noted the lack of scientific evidence when it comes to health benefits from using body parts of felids, however, the roots or the origin of these beliefs may not

be clear. A question may arise whether knowledge about this could help to shift the perspective of consumers. The same applies to education. Could widespread education about the lack of scientific evidence versus health benefits from body parts of felids encourage the shift towards proven medicals?

13) Moreover, the price for jaguars on black markets should be investigated to find out whether jaguar body parts are potentially cheaper alternatives to tigers and thus becoming a more attractive choice. This is especially important for both domestic and international markets since high prices for animals may motivate local communities/individuals to get involved in IWT. For instance, 81a noted an equivalent of an average monthly income in Bolivia for jaguar canines. In addition, this literature review did not focus on trafficking of live animals, however, some implications were made about jaguar cubs becoming a part of IWT (67a). What is known about trafficking of live jaguars and IWT in their parts once they become uncontrollable or no longer desired?

4. Limitations

One of the most prominent limitations of this review was the lack of independent identification in Phase 2 prior to the categorisation of records by two reviewers. However, many identified themes were often recurring in selected category A records. Besides that, the risk of overlooking references within records was also a factor worth mentioning. This especially applies to records that do not contain a separated list of references, which is a common issue for grey literature sources. On the other hand, some references might not be identified since some records mention citations without actually referring to the original source. Also, the same writer(s) of a GL record may have written several relevant records, publishing the same information several times, which makes it rather difficult to avoid double counting when it comes to e.g., the most mentioning of a supply-side country, etc. However, this limitation was assumed not to deteriorate the holistic picture of involved and most discussed geographical locations or the demand for specific body parts of jaguars among others.

Another limitation of this systematic literature review was the exclusion of records written in languages other than the English language, which could lead to exclusion of important information. For instance, 83a mentioned an investigation of online trade in jaguar body parts "*spanned seven languages and three continents*".
Moreover, the method of identification of PR records has its own limitations as it may not be the most accurate or reliable way to distinguish literature. Records that were not explicitly identified as PR were either recognized as GL or ´unclear´ records. ´Unclear´ was a result of disagreements and/or uncertainty among reviewers. For instance, if an editor of a particular record was considered a peer, there is still no guarantee that the record has been PR. Therefore, the distinction between PR and other records should be only taken with caution.

"*A key goal of a systematic review is to identify all relevant data to answer the research question.*" (Drucker et al., 2016). In this case, data on seizures of jaguars was not specifically searched for, which can be considered as another limitation of this review. However, reviewed literature often referred to seizures. On the other hand, literature often misses the importance of referring to the origin of an information. For instance, even though the presence of an organised crime was mentioned and IWT abundantly discussed, the presentation of evidence or references so far does not allow the derivation of reliable conclusions about whether substitution or complementation happens.

5. Conclusions

One of the greatest challenges seems to be the presentation of evidence (apart of some evidence of trade and documented seizures) or references in literature so far and the abundance of non evidence-based information while also lacking more strict law enforcement and transnational cooperation, which worsen the situation. The presence of an organised crime was mentioned and IWT abundantly discussed, however, the presentation of evidence or references so far do not allow the derivation of reliable conclusions regarding substitution or complementation. Although all records indicate an emerging IWT of jaguar body parts, it is rather uncertain whether jaguars are substitutes or complements to body parts of tigers while it appears clear that at least one of both happens. The exact drivers of jaguar persecution remain often uncertain. Both domestic and international IWT in jaguar body parts, including the involvement of local communities/individuals are poorly understood. There is the lack of empirical research that specifically focuses on substitute species to tigers and their body parts including IWT in jaguars in general. A creation of a standardized system for reporting of incidents could help to mitigate these shortcomings, even though it may lead to an incomplete view on the scale of IWT. The collection of data could help to shed light on factors such as hotspots, other less discussed supply-side countries that still provide habitat to jaguars and may be affected by the IWT while providing a background for crime scripts. The creation of crime scripts as a sequence of logical steps to predict actions of smugglers, predicting locations, pathways and involved actors, among others seems to be a necessary to highlight IWT processes, consequently leading to more evidence.

Conflict of Interest

The authors do not have any conflict of interest to declare.

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Annex

Table 1, Eligibility and quality criteria used for the selection of A-group records for the in-depth review (Phase 5). Text in red font represents conditions that must be fulfilled to be selected for Phase 5.

Eligibility criteria	**Point system based on guidelines/conditions**
Peer-reviewed	Yes = 1 point / No *(or probably not)* = 0 points
Title	Yes = 1 point / No = 0 points
Level of relevant content	Levels: 1, 2 and 3. An article/document must be linked to level 2 or 3 to be included in the in-deep review (Levels 2 or 3 represent appropriate data for research, Level 3 corresponds to an article that is most meaningful when it comes to research questions). **Definition of level 3**: *Jaguars are discussed explicitly as substitutes to tigers **AND** TCM (more than just a mentioning of this occurrence). Primary focus of a study **is** on this issue* - 3 points. **Definition of level 2**: *Jaguars are mentioned, explicitly as a substitute to tigers **AND/OR** used in TCM, as decoration, and other purposes (more than just a mentioning). Primary focus of a study **may be** on some other issue than jaguars alone, however, the issue is discussed using a*t least one paragraph, tigers may not be explicitly mentioned if there is a link to TCM, multiple implications - 2 points. ***Definition of level 1**: Jaguars are mentioned, explicitly as substitutes to tigers **OR** their body parts are used (or meant to be used) in TCM (just a mentioning), as decoration, and other purposes. Primary focus of a study **may be** on some other issue, however, the issue* is mentioned using *at least one sentence* - 1 point.
Refers to # ID(s)	The number of points equals the number of relevant references within the article that support the relevant information *(jaguars as substitutes to tigers and/or ties to Asian market)*
Date (Year)	The article/document will be excluded if no date is given or a publication date cannot be retrieved from elsewhere.
Identified via:	1) WoS, 2) Scopus, 3) Scopus Secondary documents, 4) Google scholar, 5) Google search for grey literature, 6) Backward search (**Max. 6 points**)
Citation Analysis (Cited by others in Google Scholar):	Not available in Google Scholar Citation Analysis / Not cited = **0 points**, **1 point** if less than 3 citations are shown in google scholar, **2 points** if 3 or more than 3 citations, **3 points** if equal to 10 or more citations
Author(s) name:	Yes = 1 point / No = 0 points (to be included, writer´s name must be presented, exception is if the name of a renounced organisation/news/etc., is presented, in that case, 0 points but it is not a reason for exclusion).
Main Author - Citation analysis	Not available = 0 points, 1 point if citation analysis is available in google scholar
Second or other available Co-Author - Citation analysis	Not available = 0 points, 1 point if citation analysis is available in google scholar
Has the author/organisation published other work?	Yes = 1 point (this includes renown organization as well) / No (information not found) = 0 points
Academic structure (introduction, method, results, discussion/conclusions or a book, or similar structure having at least a separated section for references if applicable)	Yes = 1 point / No = 0 points
Publisher	Renown publishers, Universities = **3 points**, NGOs or other organisations/Not renown = **2 points**, News = **1 point**, Blogs, Tweets, unclear, etc. = **0 points**
Does the work cover/explicitly mention a specific research question (focus/hypothesis/brief, evidence)? (Not Title or subtitle)	Yes = 1 point / No (just informative) = 0 points

Is the relevant information (or relevant part - jaguars as substitutes, their body parts used in Asia, etc....) supported by references?	**0 points** = No reference or unclear**, 1 point** = at least one reference (Assumed for NGOs, news, other organisations, video, interviews...the relevant information is not linked to peer-reviewed source), **2 points** = One or more references are linked to the relevant information from which at least one is peer-reviewed, **3 points** = two or more peer-reviewed references can be linked to relevant information. To be included in the in-deep review, at least 1 point is required.
Type of Grey literature (Level 2, 1 or 0)	**2 points** = High outlet control/High credibility *(e.g., books, magazines, theses, government reports, white papers)*, **1 point** = Moderate outlet control/Moderate credibility *(e.g., annual reports, news articles, presentations, videos, NGOs and other non-governmental organisations)*, **0 points** = Low outlet control/Low credibility *(e.g., blogs, emails, tweets, not clear)*. Peer-reviewed articles = **2 points**. To be included in the in-deep review, at least 1 point is required *(0 point group represents low credibility and higher risk for bias)*.
Total points	Quality assessment & eligibility assessment for in-deep review (All red-highlighted text criteria must be fulfilled while having at least 10 points)
Refers to # ID(s), which ones if applicable:	# ID linked to relevant information - from references within the list below (if applicable)
Does it strengthen or refute a current position?	Strengthen *(Jaguar body parts used as substitutes to tigers and/or chinese medicine)* = Yes, Refute = No
Include	**(Yes/No)**

Table 2, Categories/coding/information extracted from selected category A records in Phase 5.

ID
Citation
Level of relevant content *(i.e., only level 2 or 3 from Table 1)*
Authors and location of University/organisation/institution *(if applicable)*
Publication year
Publisher
Link *(online source)*
Used keywords
Explicitly stated focus/aim/objective/attempt/investigation/a particular argument, otherwise merely informative record
Explicitly stated hypothesis *(including hypotheses from other sources if confirmed or disproved but related to the substitution)*
Academic structure *(Yes / No)*, i.e., introduction, method, results, discussion, conclusion, references
Method(s), *(if applicable)*
Threat to jaguars or implications
Geographical location *(supply side)*
Geographical location *(demand side)*
Demand for specific body parts, what parts?
i) Reason(s) behind the desire for jaguar body parts, *ii)* Main drivers if explicitly mentioned
Explicitly stated substitution or implications of substitution to tiger body parts *(jaguars only)*
Explicitly stated substitution or implications of substitution *(Other species)*
Mentioning of future use or implication of future use of jaguar body parts
Limitations of the record *(linked to illegal trade in Jaguars)*
Conclusions relevant to tiger-jaguar relationship *(incl. relatively distant connections or conclusions indicating future research questions when it comes to threats to jaguars incl. those unrelated to the tiger-jaguar relationship and suggestions for improvements if available)*

Table 3, A list of selected PR category A records for Phase 5.

PR Records - ID	Source
4a	E. O. Davis, M. Willemsen, V. Dang, D. O'Connor, and J. A. Glikman, "*An updated analysis of the consumption of tiger products in urban Vietnam*", Global Ecology and Conservation, vol. 22, p. e00960, Jun. 2020, doi: 10.1016/j.gecco.2020.e00960.
9a	A. Romero‐Muñoz, R. G. Morato, F. Tortato, and T. Kuemmerle, "*Beyond fangs: beef and soybean trade drive jaguar extinction*", Front Ecol Environ, vol. 18, no. 2, pp. 67–68, Mar. 2020, doi: 10.1002/fee.2165.
11a	M. Arias, A. Hinsley, and E. J. Milner-Gulland, "*Characteristics of, and uncertainties about, illegal jaguar trade in Belize and Guatemala*", Biological Conservation, vol. 250, p. 108765, Oct. 2020, doi: 10.1016/j.biocon.2020.108765.
12a	B. Fraser, "*China's lust for jaguar fangs imperils big cats*", Nature, vol. 555, no. 7694, pp. 13–14, Feb. 2018, doi: 10.1038/d41586-018-02314-5.
20a	N. C. Pimenta, A. P. Antunes, A. A. Barnett, V. W. Macedo, and G. H. Shepard, "*Differential resilience of Amazonian otters along the Rio Negro in the aftermath of the 20th century international fur trade*", PLoS ONE, vol. 13, no. 3, p. e0193984, Mar. 2018, doi: 10.1371/journal.pone.0193984.
27a	T. Q. Morcatty et al., "*Illegal trade in wild cats and its link to Chinese‐led development in Central and South America*", Conservation Biology, vol. 34, no. 6, pp. 1525–1535, Jun. 2020, doi: 10.1111/cobi.13498.
31a	J. Knox et al., "*Jaguar Persecution Without 'Cowflict': Insights From Protected Territories in the Bolivian Amazon*", Front. Ecol. Evol., vol. 7, Dec. 2019, doi: 10.3389/fevo.2019.00494.
45a	A. Braczkowski et al., "*The ayahuasca tourism boom: An undervalued demand driver for jaguar body parts?*", Conservat Sci and Prac, vol. 1, no. 12, Oct. 2019, doi: 10.1111/csp2.126.
49a	A. M. Lemieux and N. Bruschi, "*The production of jaguar paste in Suriname: a product-based crime script*", Crime Sci, vol. 8, no. 1, Aug. 2019, doi: 10.1186/s40163-019-0101-4.
51a	P. Villalva and E. Moracho, "*Tiger trade threatens big cats worldwide*", Science, vol. 364, no. 6442, p. 743.1-743, May 2019, doi: 10.1126/science.aax5200.
55a	United Nations Office, "*World Wildlife Crime Report 2020: Trafficking in protected species*", Vienna: United Nations Office on Drugs and Crime, ISBN: 978-92-1-148349-9, 2020.

Table 4, A list of selected ´Unclear´category A records for Phase 5.

´Unclear´ Records - ID	Source
75a	Earth League International (ELI), "*WildLeaks Report - The World's first whistleblower initiative dedicated to wildlife crime*", Earth League International (ELI), Los Angeles, USA, 2020.
94a	IUCN NL, "*Unveiling the criminal networks behind jaguar trafficking in Bolivia*", IUCN National Committee of the Netherlands, Amsterdam, 2020.
42a	M.Arias, A.Hinsley, P.Nogales-Ascarrunz, N.Negrões Soares, J.A.Glikman, E.J.Milner-Gulland, "*Prevalence and characteristics of jaguar trade in north-western Bolivia*", 2020, 10.31235/osf.io/s4p6r.

Table 5, A list of selected GL category A records for Phase 5.

GL Records - ID	Source
1a	E. Berton, "*A journey into the black market for jaguar body parts*", http://jaguar.raibolivia.org/en/, 2018. [Online]. Available: http://jaguar.raibolivia.org/en/inicio.htm. [Accessed: 22- Apr- 2021].
3a	P. Verheij, "*An assessment of wildlife poaching and trafficking in Bolivia and Suriname*", International Union for Conservation of Nature, 2019, doi: 10.13140/RG.2.2.33323.59684.
6a	L. Boyle, "*Ayahuasca 'spiritual enhancers', arthritis cures and 'bone' wine: The disturbing rise in the illegal jaguar trade*", www.independent.co.uk, 2020. [Online]. Available: https://www.independent.co.uk/climate-change/news/illegal-wildlife-trade-jaguars-latin-america-amazon-ayahuasca-a9646911.html. [Accessed: 05- May- 2021].
14a	M. Yagoub, "Chinese Smugglers Driving Up Jaguar Killings in Bolivia", insightcrime.org, Bolivia, 2016. [Online]. Available: https://insightcrime.org/news/brief/chinese-smugglers-drive-up-jaguar-killings-in-bolivia/. [Accessed: 07- May- 2021].
22a	R. Navia, "*Fang trafficking to China is putting Bolivia's jaguars in jeopardy*", Mongabay Environmental News, 2018. [Online]. Available: https://news.mongabay.com/2018/01/fang-trafficking-to-china-is-putting-bolivias-jaguars-in-jeopardy/ . [Accessed: 07- May- 2021].
24a	I. Podgorny, "From jaguar teeth to the nail of the great beast: the evolution of animal medicines", sg.finance.yahoo.com, 2021. [Online]. Available: https://theconversation.com/from-jaguar-teeth-to-the-nail-of-the-great-beast-the-evolution-of-animal-medicines-107821. [Accessed: 08- May- 2021].
30a	A. Reuter, L. Maffei, J. Polisar and J. Radachowsky, "*Jaguar hunting and trafficking in Mesoamerica: Recent observations*", Wildlife Conservation Society, New York, 2018.
32a	D. Southerland, "*Jaguar Poaching Driven by Chinese Demand for Teeth and Parts*", Commentary, rfa.org, 2020. [Online]. Available: https://www.rfa.org/english/commentaries/china-jaguars-08032020074647.html. [Accessed: 08- May- 2021].
33a	A. Goyenechea, "*China's Demand for Jaguar Fangs*", defenders.org, 2018. [Online]. Available: https://defenders.org/blog/2018/11/jaguars-are-new-tigers. [Accessed: 08-May- 2021].
35a	M. Arias, "Jaguars in the media: what we know and do not know about illegal jaguar trade", illegalwildlifetrade.net, 2018. [Online]. Available: https://www.illegalwildlifetrade.net/2018/03/14/jaguars-media-know-not-know-illegal-jaguar-trade/. [Accessed: 08- May- 2021].
36a	R. McKie, "Jaguars killed for fangs to supply growing Chinese medicine trade", theguardian.com, 2018. [Online]. Available: https://www.theguardian.com/environment/2018/mar/04/jaguars-killed-for--fangs-chinese-medicine-trade. [Accessed: 08- May- 2021].
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3. Biodiversity and Ecosystem Services

3b. Life below water

Full papers

Study of heavy metals including mercury within Fiber Banks of Västernorrland and Norrbotten counties by portable X-Ray Fluorescence (pXRF) spectrometry

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Abstract

Discharge of wastewater from pulp and paper industries has led to environmental impact in the formation of sediment layers, so called fiber banks, on the coast of Västernorrland and Norrbotten counties in Sweden. These fiber banks are thick underwater deposits which are highly contaminated with some toxic metals such as Al, Cr, Fe, Cu, Zn, As, Pb, Hg. These metals can lead to several consequences for the environment, thus ultimately having harmful effects on living organisms. Our purpose is to study several of these toxic metals and analyze the concentration level by using portable X-ray Fluorescence (pXRF) spectrometry for rapid sample characterization of wet samples. Field analyses are highly affected by moisture and it is difficult to obtain measurement accuracy. Therefore, moisture tests were performed by air drying samples at room temperature from 0 to 24 h. Some of the samples were oven dried for 48 h at 95 ^{0}C, dried, grinded and turned into pellets and performed laboratory measurements to compare results with field measurements. Our aim is to provide an improved state of facts for decision makers to prevent and reduce marine pollution and to protect and restore ecosystems in order to avoid significant adverse impacts, and take actions for their restoration in order to achieve healthy and productive oceans. A future outcome is to reach the sustainable development goal (SDG) stated by the UN at target 14.1 and 14.2 “Life below water”.

Keywords: pXRF, fiber banks, moisture effect, toxic elements, Sweden

1. Introduction

Sweden is among the world leaders in the production of pulp and paper. That´s because Sweden employs a sustainable forestry model. This forest is not only absorbing CO_2 reduce global warming and supporting world´s biodiversity but also presenting us as a land of trees in the world. These pulp industries generated large quantities of wastewater that was discharged into nearby rivers or seas and thus potentially affected the aquatic environment. The production-related wood and cellulose fibers that were suspended in the water accumulated and formed fiber banks at several places in Sweden. Earlier studies done by Hylander and Michael (2006) confirmed that Hg pollutes different regions of Sweden.

The Swedish Geological Survey (SGU) in cooperation with the Västernorrland county administration identified the fiber bank areas within this county (Apler et al., 2014). Another study on the spreading of fiber banks sediments was done by Vogel (2015).

This paper has focused on two areas in Norrbotten, Karlshäll and Notviken in Luleå, and one region of Västernorrland named Essvik in Sundsvall. All these areas have fiber banks and fiber rich sediments. The fiber rich sediments are generally different in their texture and contain higher content of organic compounds compared to fiber banks. Therefore, it is important to know their pulping process and also investigate metallic substance within fiber banks, especially those that have a long historical background. Essvik sulphite factory was first constructed in the late 1800s and in use until the 1970s. The industrial facility was demolished in around 1980. As Essvik was a well-known place for sulfite pulp mill it used mainly sulfurous acid (H_2SO_3) and bisulfite ions (HSO_3^-) as active chemicals to degrade and dissolve lignin from woods (Rydholm 1970). It also applied various sulfite/bisulfite salts like calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+) and ammonium (NH_4^+) and offered a wide range operating pH levels (Deshpande 2016). Thus, conditions range from highly acidic to highly alkaline. During the years of 1912- 1962, around 50 years, abrasive pulp was manufactured on Karlshäll site. For a ten-years period, Hg was used as phenylmercuric acetate (pulpasan) for wooden magazines in the process to prevent mold damage to the pulp bales, as the transport season was limited to 6 months. Uncleaned processed water was discharged into Notviken. However, the fiber bank of Karlshäll is very significant to investigate the spread of pollutants, especially metallic substances that potentially affect the environment. Thus, it is required to know which fiber banks might contain potentially harmful elements.

Portable X-ray fluorescence spectrometry (pXRF) is suggested for rapid analyses, since it requires less demanding sample preparation and less expensive technique when compared to the lab-based analytical methods (ICP-MS). Many researchers extended its applications for elemental analysis in various types such as fossils (Cohen et al. (2017), ceramics (Johnson, 2014; Forster et al., 2011), ore concentrates (Zhou et al., 2019), alloys (Nicholas and Manti, 2014), dietary supplements (Sánchez-Pomales et al., 2013; Sarturi et al., 2019), coal (Kagiliery et al., 2019), pharmaceuticals (Shutic et al., 2017), etc. pXRF has become an effective tool for elemental determination including environmental assessment (Rouillon and Taylor, 2016; Chakraborty et al., 2019) and polluted water (Zhou et al., 2018; Pearson et al., 2018). But in the presence of greatly improves efficiency, pXRF field analysis has been proven to be a useful technique for the quantitative elemental screening even in liquid samples, where pXRF instrument cannot normally be used (Marguí et al., 2010; An, Zeeshan et al., 2021a). Examples are metals in river water (Melquiades et al., 2011) and test of Ag in nano-based liquid dietary supplements (Sanchezpomales et al., 2013). Another liquid application example based on pXRF components is a high precision on site alarm system for Cr contamination in leachate from landfills (An, Reza et al., 2021b).

This study is focused on investigating the presence of heavy metals such as chromium (Cr), iron (Fe), copper (Cu), zinc (Zn), arsenic (As), silver (Ag), mercury (Hg) and lead (Pb) in fiber banks. The measurements were performed into two parts, Field analysis of fresh samples. In this method, several factors for example sample moisture and effects of water contents on characteristic X-rays that can highly affect analysis and provide less accurate pXRF results were studied. (2) Laboratory analysis was conducted with pXRF after drying, grinding, and homogenizing samples. Comparison between field results and laboratory results are also presented for Hg and Pb.

2. Methods

Four samples were collected from the pollutants of Karlshäll region. Two samples were collected from the fiber rich sediments, one from the depth of 0-10 cm (named as S1) and the other one from depth of 10-20 cm (named as S2). Two samples were also collected from the fiber banks, one from the depth of 0-10 cm (named as S3) and the other one from 10-20 cm depth (named as S4). Two samples were collected from the fiber banks of Notviken which is part of the Luleå river at a water depth of approximately 300 cm (named as S5 and S6). Two samples were collected from the pollutants within and close to Sundsvall's fiber banks of Essvik (named as S7 and S8) where the depth of water was 1800 cm to the fiber bank top and sampling depth was 0-200 cm. A long core tube of 200 cm was used to collect the samples. Our sampling techniques involved collecting samples by using boats and divers.

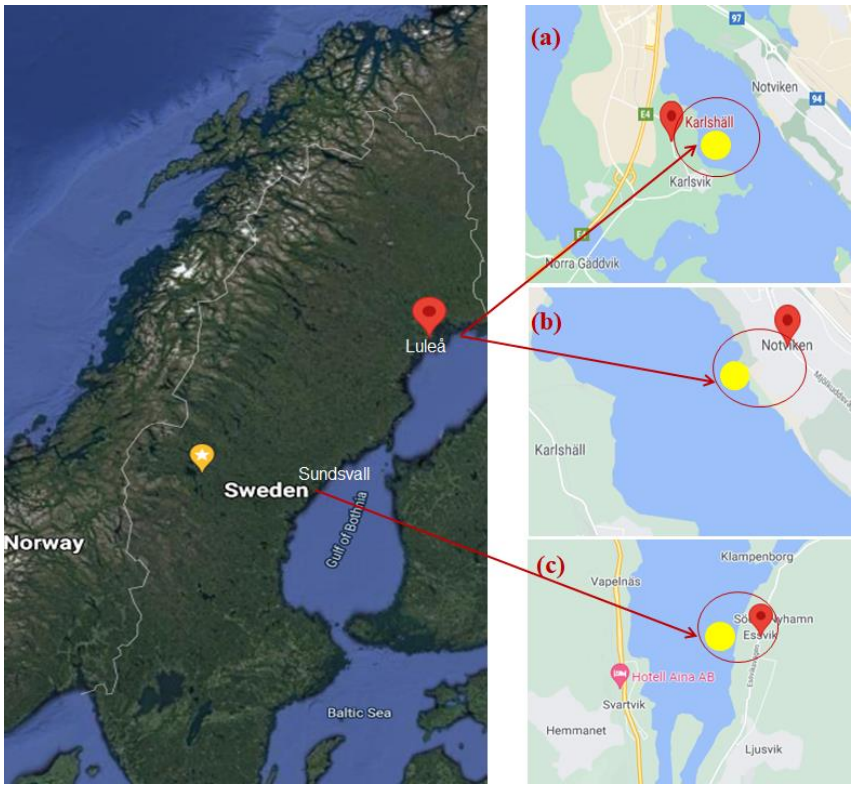

Figure 1*. Sites polluted with fiber banks at (a) Karlshäll (b) Notviken and (c) Essvik regions.*

The Bruker/ Tracer 5i equipment, consisting of a silicon drift detector (SDD) and an X-ray tube (50 kV, 195µA, 8 mm spot size) with a Rhodium (Rh) target and a thin Beryllium window was employed for the field measurements. In this study, the restricted materials mode was used as metal elements were concerned. Restricted materials calibration measurements were performed in two phases. In the first phase, the instrument was operated at 50 kV with a current of 13 µA. In the second phase, the instrument was operated at 15 kV with a current of 13 µA. The acquisition time was 250 s for each measurement.

Wet and dried samples were placed on the head of the instrument for close contact analyses. Using this method, all measurements were controlled using Bruker Remote Control software on the computer. For the stability of the pXRF readings, each sample was measured 2 times (each time for 250 s) and then the Bruker software calculated itself the average measured values and Standard Deviations (STD). The head of the Bruker/ Tracer 5i instrument was enclosed in Mylar film of thickness 2 µm in order to protect the clear window from dust and dirt. Protective films are also recommended in the analyses of liquid samples or samples with small particle size, which may pollute the pXRF analyzer (Weindorf D. C. et al., 2014; Zhou S. et al., 2019).

Field measurements

Wet fiber bank samples were measured with restricted mode by pXRF. Afterwords, samples were placed in an aluminum pan to air dry at room temperature and measurements were done after 2 h, 4 h, 6 h, 12 h and 24 h in order to investigate the effects of moisture contents on the concentration of elements.

Laboratory measurements

Samples from Karlshäll region (S1, S2, S3, S4) were oven dried for 48 hours at temperature of about 95 ^{o}C. The dried samples were crushed into small particles, pressed into pellets and measurements were done with pXRF.

3. Results and Discussion

In XRF analysis, the peak area is related to the element concentration. Figure 2 shows effects of water contents on characteristic X-rays. In the in-set Figure 2, Fe Kα peaks are increasing with the shrinking contents of water, as expected. Moreover, Compton scattering is the dominant mode of gamma ray and X-ray interaction in soft tissues between 30 keV and 30 MeV, resulting in a higher noise level in the wet sample. Hg Lα lines were observed only in karlshäll samples and one of the examples is shown in the in-set of Figure 3. Hg Lα peaks have higher characteristic energy compared with Fe, thus it is less absorbed by the water content. However, the Hg peaks are too small due to the low concentration. It seems Hg peaks are not highly affected much with water contents.

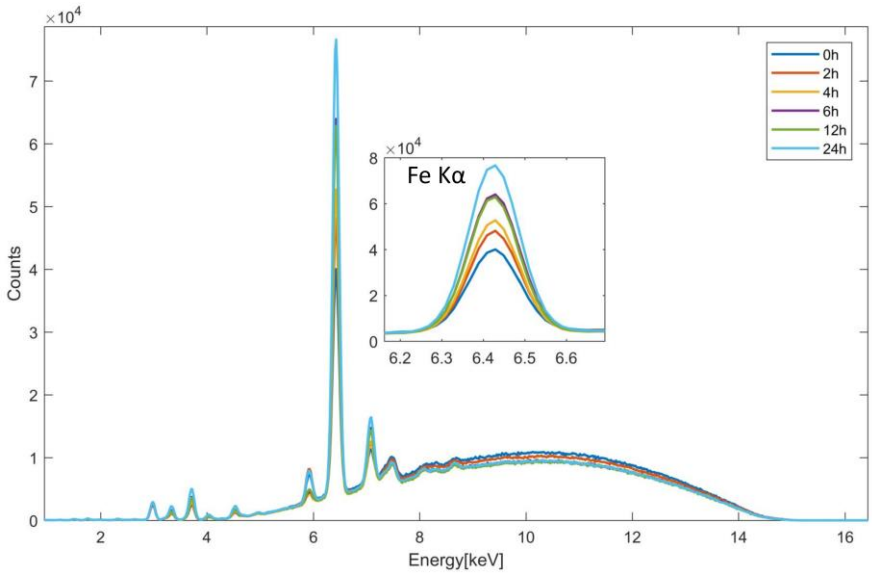

***Figure 2**. It shows comparison of different spectra obtained with sample S4 at 0 h, 2 h, 4 h, 6 h, 12 h and 24 h at room temperature measured in restricted mode (Phase 2) with pXRF. In-set figure shows Fe Kα peaks at different air-dried times.*

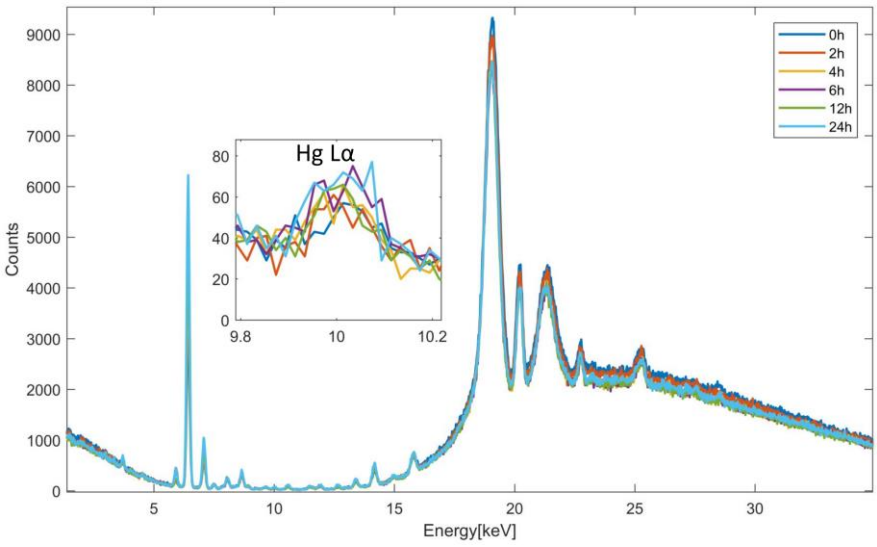

***Figure 3**. It shows comparison of different spectra obtained with sample S4 at 0 h, 2 h, 4 h, 6 h, 12 h and 24 h at room temperature measured in restricted mode (Phase 1) with pXRF. In-set figure shows Hg Lα peaks at different air-dried times.*

In order to investigate the effect of water content in pXRF analysis, the characteristic photon counts from seven major elements in the measured spectra of S4 sample, including S, Ca, Fe, Zn, Sn, Hg and Pb, were integrated, respectively. It should be noted that background subtraction was not applied. The relationship between the elements concentration and drying hours is shown in Figure 4. The peak total counts are increased with the drying time, except Sn. The fluorescence energy of Sn $K\alpha_1$ is 25.2 keV, which is seriously affected by the scattering background. The Sn peak in the wet sample was lifted by the overall backscattering, thus resulting in the highest Sn peak, as shown in Figure 4. While, for the

other elements, where the X-ray emission line are lower, this background shift effect can be ignored. Table 1 list the water impact factor after 24 h drying time. For S, Ca, and Fe, the total counts of the 24 hors air -drying sample is increased 1.61-1.74 times compared with the wet sample. While for Zn, Hg and Pb, the increase is not obvious as for the lighter elements. However, when the concentration is close to the limit of detection (LOD), the uncertainty for Hg measurement is large. One simple adjustment to improve LOD is to increase the counting time. This improvement occurs because the signal varies linearly with counting time, whereas the noise varies with the square root of counting time. In addition, by repeating the measurement and averaging the peak counts can reduce the influence of non-homogenous sample.

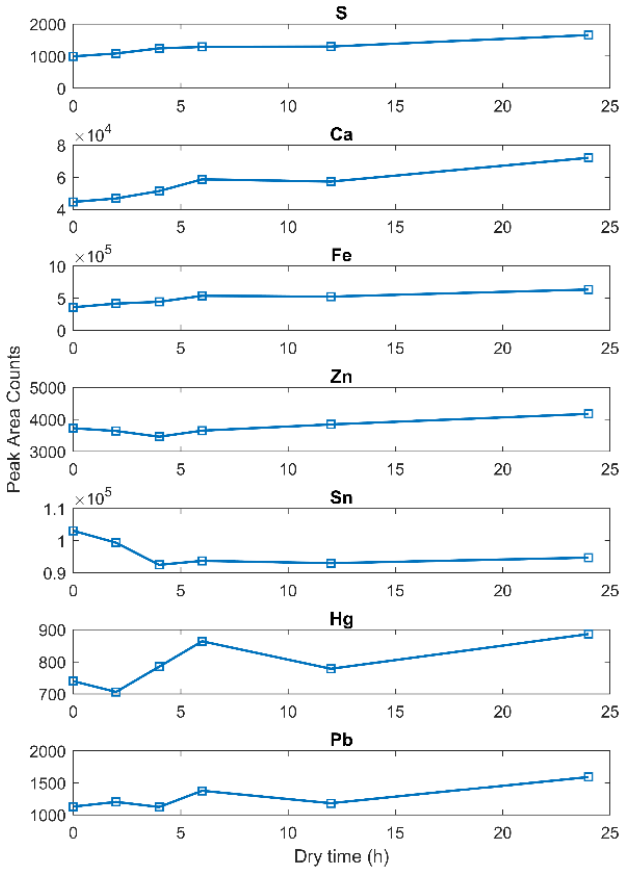

Figure 4*. It shows detected elements with high concentrations in sample S4.*

Table 1. *Photon counts of major elements in wet sample and after 24 h air-drying in sample S4.*

Element	S	Ca	Fe	Zn	Sn	Hg	Pb
0 h	998	4.46×10^4	3.58×10^5	3723	1.03×10^5	739	1127
24 h	1651	7.20×10^4	6.24×10^5	4169	9.47×10^4	886	1590
24 h / 0 h	1.65	1.61	1.74	1.12	0.92	1.19	1.41

To study the water evaporation rate and sample properties, a time-moisture curve with linear fit is shown in Figure 5. The water content was determined by subtracting the oven-dried weight (24 h at 95 ^{0}C temperature) sample from the watered-sample weight. Water evaporated linearly in all the samples and the moisture range was varying from 91% to 75%. After 24 hours of air-drying, the moisture was only reduced 4% to 6%, however, it can increase the photons counts up to 1.65 times for S.

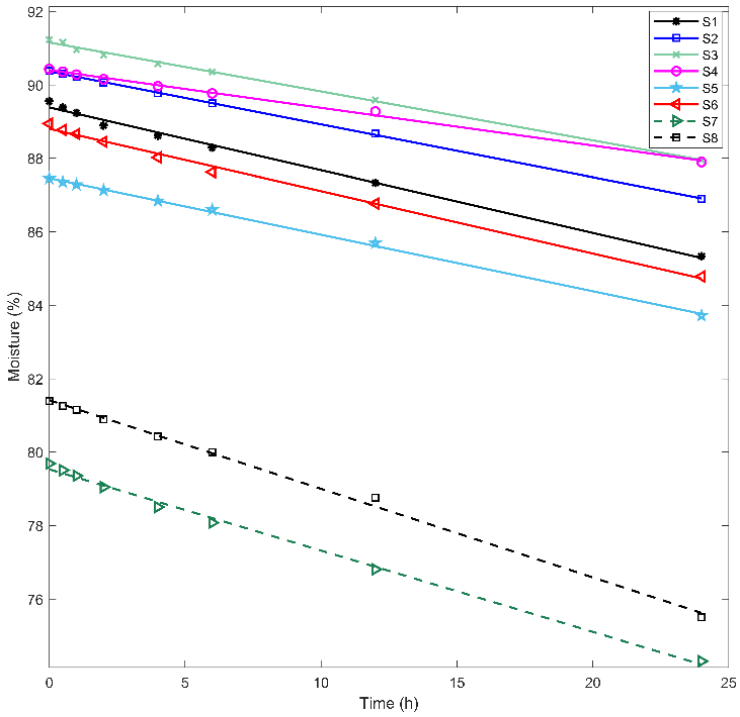

Figure 5*. It shows water evaporation rate in samples with drying time.*

Field measurements were performed in restricted mode: phase 1 (50 kV/ 13 µA) and phase 2 (15 kV/ 13 µA) and X-ray spectra of samples (air-dried 24 h) collected from Karlshäll (S1, S2, S3, S4), Notviken (S5, S6) and Essvik (S7, S8) are shown in Figures 6 and 7 respectively. The two spectra are shown in logarithmic scale. pXRF instrument was able to measure heavy metals in wet samples and provided rapid results. In Figure 6, the primary radiation peak from the Rh is the highest for wet samples due to more water content resulting in more scattering. In Figure 6, $K\alpha_{1,2}$ peaks of the detected elements are shown but $K\beta_{1,3}$ lines were also observed in cases of Fe, Zn, Rb, Zr and Rh and $L\alpha_{1,2}$ lines were observed in cases of Hg, As and Pb. Similarly, in Figure 7, $K\alpha_{1,2}$ peaks of the detected elements are shown but $K\beta_{1,3}$ lines of Ti and Fe were also observed. Due to the strong Fe peak in samples S7 and S8, an escape peak from the silicon detector at 4.66 keV was also observed and can be seen in Figure 7. We found the highest concentration of Fe in all the samples due to pulping processes and bleaching sequences being used in industries. The main source of metal ions depends on wood raw material; the amount depends on the species and place of growth and finally the mill process where water may also contribute with large amounts of metals (Presley and Hill, 1996). It has been observed that the level of Fe may increase

for thermomechanical pulp (CTMP) during the refining process (Colodette and Dence, 1989). It was also reported that the CTMP pulping process increases Fe (Friman et al., 2003).

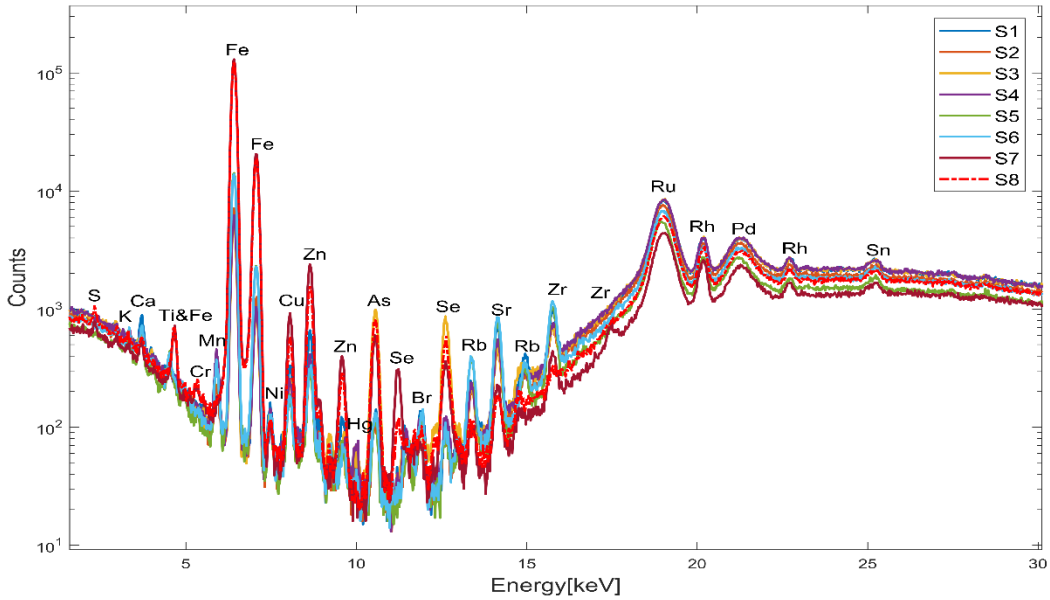

***Figure 6**. Comparison of detected elements obtained from the samples collected from Karlshäll (S1, S2, S3, S4), Notviken (S5, S6) and Essvik (S7, S8). The measurements were performed in restricted mode with pXRF after 24 h air-dried samples. The instrument was operated at 50 kV and current was 13 µA.*

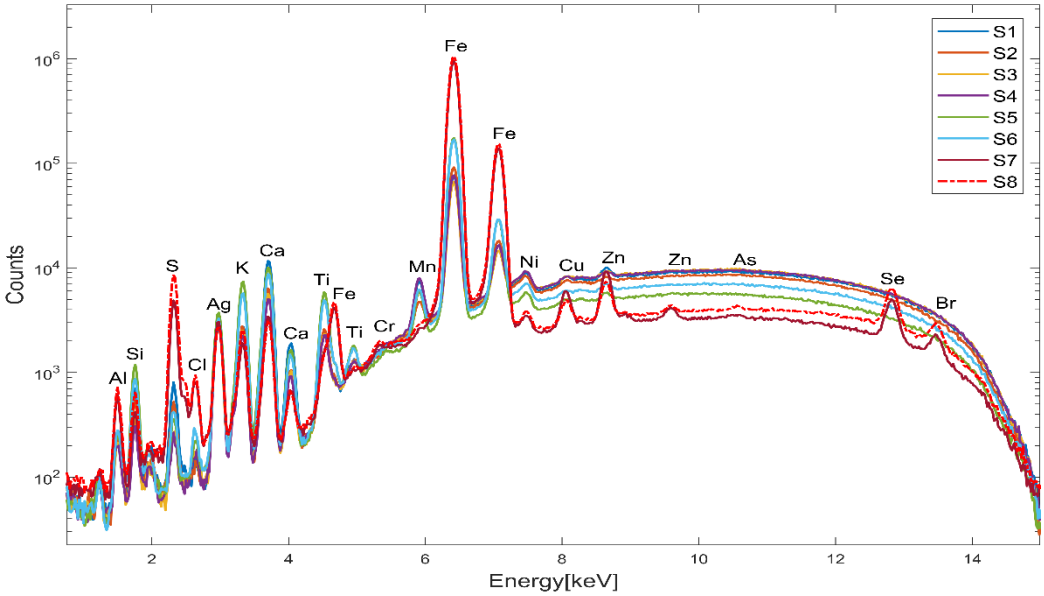

***Figure 7**. Comparison of the detected elements obtained from the samples collected from Karlshäll (S1, S2, S3, S4), Notviken (S5, S6) and Essvik (S7, S8). The measurements were performed in restricted mode with pXRF after 24 h air-dried samples. The instrument was operated at 15 kV and current was 13 µA.*

The highest concentration of Hg was observed in Karlshäll samples (S1, S2, S3, S4) and the results are shown in Table 2. Initially with the wet samples (0 h), pXRF detected Hg only in Sample S4 (2.00 ± 1.00 mg/ kg). After 6 h air-dried samples at room temperature, Hg was detected in samples S3 and S4 as shown in the 1st column. After 24 h air-dried samples, Hg was detected in three samples (S2, S3, S4) and obtained results are shown in the 2nd column. In order to measure accurate quantification of Hg, the Karlshäll samples were oven dried and grinded into small particles, then pressed into pellets and measured with pXRF and results are shown in the 3rd column. We conclude that a Hg value above LOD for the instrument after 6 air drying corresponds to approximately 30 mg/ kg in the oven dried sample. Hence the LOD for Hg for the suggested method corresponds to 30 mg/ kg. The scaling factor noted in Table 3 for Hg measurements of 6 h air-dried samples is between 5 and 20. Although the Hg values are high in an environmental aspect, they are low values concerning absolute content. To compare this with high content, Table 4 lists Fe content for the same samples. The average scaling factor for Fe measurements of 6 h air-dried samples is 21.5 according to Table 3. The Standard Deviations (STD) for the values reported in Table 3 varies between 10 - 20 %. The Standard Deviations (STD) of the highest content element (Fe) were below 5 % for the values reported in Table 4.

Table 2. *It shows average Hg concentrations measured by pXRF at Karlshäll fiber bank samples (S1, S2, S3, S4). All values are represented in mg/ Kg.*

Samples	pXRF (6 h air-dried samples)	pXRF (24 h air-dried samples)	pXRF (dried and grinded samples)	$\frac{\text{dried and grinded samples}}{\text{6 hrs air – dried samples}}$
S1	<LOD	<LOD	6.40	-
S2	<LOD	2.10	12.40	-
S3	1.90	3.00	33.50	17.63
S4	4.40	3.50	28.20	6.41

Table 3. *It shows average Fe concentrations measured by pXRF at Karlshäll fiber bank samples (S1, S2, S3, S4). All values are represented in mg/ Kg.*

Samples	pXRF (6 h air-dried samples)	pXRF (24 h air-dried samples)	pXRF (dried and grinded samples)	$\frac{\text{dried and grinded samples}}{\text{6 hrs air – dried samples}}$
S1	1237.90	1574.10	31378.40	25.35
S2	1396.80	1819.30	26452.10	18.94
S3	1235.20	1556.70	23439.50	18.98
S4	1170.20	1217.20	26578.40	22.71

4. Conclusions

In this study, heavy metals including Hg were investigated in the fiber banks and fiber banks polluted sediments collected from Karlshäll, Notviken and Essvik areas in Luleå and Sundsvall by using pXRF technique, with the help of Mylar films through field measurements. The results of this study have shown that rapid analysis to measure concentration of heavy metals in wet samples and a couple of hours air-dried samples is possible by using pXRF device, particularly if measurements do not require accurate quantification. High concentration of Hg was found in the Karlshäll region. Therefore, to measure accurate quantification of Hg, Karlshäll samples (S1, S2, S3, S4) were oven dried, grinded and pressed into pellets and measured with pXRF and the LOD for Hg is estimated to 30 mg/ kg. We conclude that pXRF proved to be a rapid and reliable method applicable on-site in the field conditions. High concentration of Hg in Karlshäll region is alarming but the municipality and the region are actively working to remove the fiber bank and restore the marine environment of Karlshäll to avoid further spreading of marine pollution and restore the ecosystem.

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3. Biodiversity and Ecosystem Services

3c. Ecosystem services

Abstracts

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Evaluating world's marine ecosystem services through an emergy-based method

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Abstract

Marine ecosystems can provide a variety of services, such as habitat provision, pollution control, floods and storms mitigation, etc. However, with the development of society and the continuous expansion of the scope of human activities, the abuse of marine areas and unregulated pollutant discharge have threatened the marine ecosystem. Besides, the current lack of research on the evaluation of marine ecosystem services makes the value of marine protection, development and restoration underestimated during the decision-making process. Therefore, based on the non-monetary ecosystem service evaluation framework, a marine ecosystem service classification has been established, which divides marine ecosystem services into three categories: direct, indirect and existing services. Direct services are provided due to changes in the flows and storages of the studied ecosystems, including biomass increase, carbon sequestration, soil/sediment organic matter building and groundwater recharge. Indirect services are the additional impacts during the ecological process in producing direct services, including air purification, water purification, erosion control, natural power generation potential, and microclimate regulation. Existing services are the local apportionment of global services and human preference-oriented services, including global climate regulation, biodiversity conservation, and cultural and education value. The world's coastal ecosystem services has been measured as an example by using emergy analysis method.

The results show that (1) the world's coastal ecosystem service value is about 4.26E+23sej/yr, of which Asia and North America contribute about 55% of the total service value; (2) the top ten countries in terms of the world's coastal ecosystem service values are Canada, Indonesia, Australia, the United States, Brazil, the Russian Federation, Norway, the Philippines, Mexico, and China, which contribute about 60% of the total service value; (3) estuaries have the highest ecosystem service values, followed by mangroves, seagrass beds, tidal flats, salt marshes, and warm water coral reefs; (4) developed countries can make better use of their coastal resources and pay more attention to the marine protection while the opposite is true in developing countries, which means that developed countries still occupy an advantageous position in the process of marine protection, development and utilization.

This study assesses the coastal ecosystem service values in various coastal countries from the perspective of ecosystem contributors, emphasizes the importance of protecting them in marine management, and provides a certain reference basis and theoretical support for decision-makers in formulating marine-related protection and development strategies.

This study is related to SDG-target 14: Life below water, aiming at conserving and sustainably using the oceans, seas and marine resources for sustainable development by evaluating marine ecosystem services. In addition, this study also reveals the gaps between developing and developed countries in

terms of developing and protecting the oceans, and provides a certain reference for the sustainable development of the world's oceans, so as to accelerate the progress towards the 2030 SDGs in the marine sector, which is related to the topic of the conference.

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Sequestering carbon in agricultural systems with concrete demolition wastes

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Abstract

Cement manufacture releases CO_2 from mineral components under strong heating. That CO_2 has the potential to be re sequestered by concrete (Xi et al. 2016). Achieving this has been a recent focus (Cao et al. 2020, Schneider 2020). Sequestration of CO_2 by concrete demolition waste (CDW) is most rapid when it is reduced in particle sizes and placed in environments having high CO_2 concentrations and available moisture (Renforth 2019).

China is largest global producer of concrete, and building replacement produces more than 1.3 billion tons of CDW per year (Lu 2014). This country also has short (about 23 years) lifetime of concrete construction (Cai et al. 2015). Most CDW in China and globally is now land-filled in environments with weak CO_2 sequestration (Huang et al. 2018). Their potential for CO_2 sequestration is about 0.1 petagrams of CO2 per billion tons of CDW, of which little is currently being achieved.

Adding CDW to non-vegetated soils caused net sequestration of 8.5 kg of CO_2 m^{-2} y^{-1} (Washbourne et al. 2015). Addition of CDW to agricultural soils has not been examined previously. Here we will report results from adding CDW to soils planted with a non-mycorrhizal crop, a mycorrhizal crop, and a mycorrhizal crop also having nitrogen-fixing bacteria. This is a pot-based study with non-photosynthetic CO_2 transfer rates measured directly by infrared spectroscopy. Fluxes of CO_2 across treatments will be completed by mid-2021, with crop yields, soil chemistry, and soil microbial changes following later. We hypothesize that CO_2 sequestration will be highest with tripartite symbioses (including nitrogen fixation), lower with mycorrhiza alone, and lowest without mycorrhiza. Further, that all rates here will exceed those measured previously in non-vegetated soils.

This is a new way to increase ecosystem services of agricultural systems, particularly where CDW is available nearby (and so with low transport costs). CO_2 sequestration, crop yields, and especially their symbiotic interactions with microbes and CDW added to soil addresses SDG targets 9.1, 9.4, 12.2, 12.4, 12.5 and 13.3.

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Depopulation related ecosystem services supply in Mediterranean rural areas

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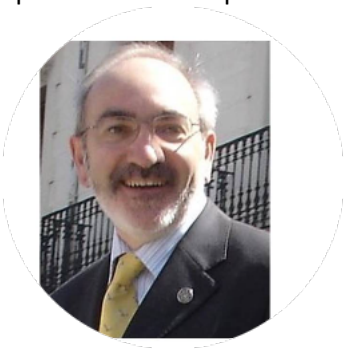

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Abstract

Changes in demography constitute an important factor related to land cover and land use, so to the provision of ecosystem services. Here, we examined the relationships between the dynamics of demographic variables (human population and density, and number of villages) and provisioning and regulating Ecosystem Services (ES) in three Mediterranean rural areas which followed contrasting socioecological and environmental trends. We expected depopulation diminished provisioning ES but increased regulating ones. To test this hypothesis, we compared demographic and ES data between the 1950s and 2010s in three severely depopulated rural areas of Aragón (NE Spain). SWAT (Soil and Water Assessment Tool) was used to estimate water supply, soil retention, food and biomass productions directly as ES, while others were estimated as the combination of two or more output SWAT variables (water and nutrient regulations). Number of inhabitants, population density and number of villages per municipality in the three study areas were calculated from decadal census compiled by the Aragonese Stats Institute (1900-2018). The values of each ES were aggregated at municipality scale to be able to relate ES to population dynamics in subsequent analysis. To check depopulation trends, the changes in the number of inhabitants, population density and number of villages per municipality during the last century (from 1900 to 2018) were analyzed through Generalized Additive Models (GAM). They were performed considering “date” and “zone” (and their interaction) as fixed factors and municipality as random factor. an equivalent LME procedure was applied to compare ES provision between the 1950s and the 2000s (fixed effects: date, area and the interaction between them; random factor: municipalities), and a similar one to investigate the role of depopulation in these changes (fixed effects: inhabitants, population density and number of villages). Goodness of fit was evaluated with Marginal R^2 (associated to fixed effects in LME procedure) and conditional R^2 . Likelihood ratio tests were implemented to compare these models (fixed and random effects) with null ones (only random effects) and detect model significance. An extended LME was performed to check if these relationships between population variables and ES differed among zones and dates (adding them as fixed factors).

We found severe depopulation (-41.7% in population and -44.7% in density) and associated land-use changes, with significant spatial differences between high-altitude mountainous areas, where a more intense depopulation (-63%), and abandonment of agricultural (-35%) trends were observed. Contrasting patterns were found between more fertile and easy-to-access areas where agriculture was intensified, and less productive isolated mountainous ones where rewilding was observed, boosting the food production service (>600%) and regulating services, respectively. Depopulation trends resulted significant for all the ES evaluated, especially through the general increase in water regulation (>1000%) and soil retention in mountainous depopulated areas (>400%). Spatial trade-offs, in particular, among depopulation, crop production and regulating ES, should be considered in the management schemes and policies for rural areas in order to get a balanced and sustainable supply of ES in the long-term.

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The evolution of the main topics in Payments for Environmental Services: Where and why do they differ?

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Abstract

Payments for Environmental Services have become a sophisticated economic instrument adopted by governments and environmental regulation organizations to guarantee the conservation of natural resources. However, the wrong implementation of this economic instrument can generate different environmental, social, and economic problems, especially in developing countries. This article seeks to elucidate the understanding of the different points of view of scientific production on the subject. We analyzed the textual corpus of 1,169 peer-reviewed articles from ISI Web of Science, using the Latent Dirichlet allocation algorithm. The period analyzed was from 2000 to 2018. The association of the searched terms in a cluster was carried out through the online platform CorTextÒ manager. Complementary analyzes were performed with package R.

The research data suggest that:

1) there are three evolutionary moments of the theme during the researched period:
a) the initial phase as a promising approach in the conservation of natural resources;
b) extrapolation to peripheral problems with a focus on social issues; and
c) the suppression of general and discontinuous terms of preservation;

2) the use of the radical Ecosystem or Environmental services in the context of Payments occurs due to the theoretical contextualization of Neoclassical Environmental Economics and Ecological Economics, and

3) conditionality and environmental gain are described as important within the theory, however, there are only two types of environmental service (carbon sequestration and biodiversity conservation).

The main findings highlight that the various initiatives for the conservation of natural resources are "labeled" as PES. The implementation of PES in developing countries has occurred with greater intensity in poverty alleviation than in environmental preservation. Conditionality in the provision of environmental services occurs in favor of changing production techniques, regardless of environmental gains.

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Assessment of water ecosystem services and alternative scenarios to climate change and human impact in neotropical mountains

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Abstract

Water ecosystem services (ESw) are related to aquatic ecosystems and to the interaction with water and land in different ecosystems such as forests, agricultural lands, riparian areas, wetlands, and water bodies. ESw play a central role in human well-being and water management at different scales. However, different drivers of change, such as land-cover degradation and climate change, affect the ability of forests to provide ESw, resulting in water insecurity.

This study explores the forest-water nexus and provides an overview of the water management related to potential hydrological impacts of land-use and land-cover changes and climate change in two neotropical mountain watersheds: Río Grande de Comitán-Lagos de Montebello (RGC-LM) watershed, Chiapas, México, and Las Piedras river (LPR) watershed, Cauca, Colombia. Although ESw related to cloud forest and páramos are of vital importance for their socio-ecological functioning, both study areas face water-related challenges because of different pressures related to climate change, deforestation, and accelerated urban, agricultural, grazing, and touristic growth. Therefore, a combination of methods recommended by the Toolkit for Ecosystem Service Site-based Assessment (TESSA), as well as scenario modelling based on an ecological index of riparian quality, were used to assess how alternative scenarios of reforestation or deforestation and climate change scenarios can affect water provision and water quality at different scales.

Considering the socio-ecological context, a total of four scenarios were modelled on each study area: two of the modelling scenarios included the implementation of land-use policies that aimed at mitigating the likely consequences of land conversion to cropland or cattle grazing. In contrast, the two opposite scenarios represented increased deforestation, forest fragmentation and degradation of riparian vegetation. Hydrological modelling and the impacts of change were assessed annually using WaterWorld modelling tool. In the case of the RGC-LM watershed, the results were statistically compared at watershed and subwatershed scale, whereas in LPR watershed, climate change scenarios were included, and three zones were delimited according to altitude differences.

The results in both watersheds indicate that water quality is positively related to forest cover. The effects of terrain, climate and forest-cover conditions on fog inputs and actual evapotranspiration were relevant to increase or decrease water yield under all scenarios. However, deteriorated water quality and decreased water quantity are not only related to climate change, degradation and reduction of forest and riparian vegetation, but also to inadequate water management in the study areas. Therefore, an effective improvement of ESw in the long-term would require management policies that consider forest-based solutions at different scales, sustainable productive practices, equitable local agreements, and efficient distribution networks for water resources.

The magnitude of today's biodiversity and climate crisis calls for urgent transformative change in public decision making to catalyze pathways towards more sustainable futures. In this sense, this study provides an overview of the potential benefits of some ES-based solutions to address multiple SGDs simultaneously, such as SDG 6 (clean water), 13 (climate action) and 15 (terrestrial biodiversity), as well as increasing evidence for the many benefits for society from working with nature.

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The governance of ecosystem services in oceanic islands: drivers, actors and challenges

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Abstract

Oceanic islands are the home of special and sensitive ecosystems that distribute goods and services free of charge, guaranteeing quality of life for humans and regulating environmental aspects at local, regional and global scales, such as biodiversity conditions or climate. Biodiversity integrity, including endemic and endangered species, presents itself vast in these environments and are subject to great pressures and vulnerabilities, largely due to their territorial limitations.

This work aims to discuss how governance models of oceanic islands, particularly regarding Marine Protected Areas (MPAs), impact the conservation of ecosystem services within these areas and how the different set of actors can contribute to better manage them. A systematic literature review was carried out, based on scientific articles, extracted from relevant databases. A total of 36 articles were collected, of which 16 were analyzed in detail. A revision of international legislation pertinent to the topic was also done, such as laws and decrees around the governance of ecosystems, as well as norms and rules that manage island environments and MPAs, to embody the discussion. Socio-political, cultural, environmental and institutional aspects that comprise oceanic islands governance were considered as main categories of analysis, in a deductive and inductive way in this review.

The analysis done allowed to discuss important elements to how the governance of oceanic islands may influence the conservation of their ecosystem services.

This study concludes that the oceanic islands are usually under protection through some conservation tool, however, they are vulnerable to diverse externalities and to the weaknesses of their own governance models. Thus, there is a need to understand deeper the governance drivers, actors and main challenges in order to seek proposals to reduce conflicts and improve the management of ecosystem services. Overall, the study discusses how environmental and sustainability governance tools of oceanic islands are aligned with Sustainable Development Goals (SDGs) 11 (Sustainable Cities and Communities), 13 (Climate Action) 14 (Life Below Water) and 15 (Life on Land) of the 2030 Agenda. Specifically, it adds exertions to the achievement of the following SDGs targets: 11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage; 13.3 Improve education, increase human and institutional awareness and capacity on mitigation, adaptation, impact reduction and early warning of global climate change; 14.c Ensure the conservation and sustainable use of oceans and their resources by implementing international law as reflected in United Nations Convention on the Law of the Sea (UNCLOS); and 15.a Mobilize and significantly increase financial resources from all sources for the conservation and sustainable use of biodiversity and ecosystems. Additionaly, it contributes to the topic of the Conference by exploring governance issues related to environmental, social and economic aspects of ecosystem services conservation and their interrelations with main stakeholders.

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The role of community perceptions on ecosystem services' valuation: A case study of the Gaddi community of Himachal Pradesh in India

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Abstract

Regardless of the well-recognized understanding of forests' economic importance, forest degradation takes place. At certain point of time, we often fail to consider every ecosystem service and its respective valuations to each stakeholder. This undervaluation makes overexploitation and the resultant degradation permissible. While scientific valuation of forest ecosystem services continues to be important in the academic and policy discourse, studies investigation the role of dependent community's perception in this regard are relatively sparse.

This paper explores the awareness and preference pattern about forest ecosystem services and the perceptions regarding monetary valuation of those services of the Gaddi community of three remote, forest neighbouring villages of Chamba district in Himachal Pradesh, India.

Quantitative and qualitative data have been collected through interviews of 60 randomly selected households with a semi-structured questionnaire and informal discussions with 102 villagers. In-depth qualitative and statistical analysis reveals the following.

The respondents' awareness was highest for 'provisioning services' as it was most important to them. While they had an intuitional understanding of 'regulating' and 'cultural services', they were relatively less aware of the 'supporting services'. Different food and medicinal plants, fodder, fuelwood, timber were the main collectibles and meat, pinecones, pine needles and resin were minor collectibles. While

most respondents collected food and medicinal items, to name the collectibles, they most spontaneously mentioned 'fodder' and 'fuel-wood'. Some benefits from the forest were just too *'obvious'* to report. This perceived *'obviousness'* of an ecosystem service caused significant underreporting and was identified as a major cause of undervaluation. The respondents' forest resource extraction related perception that "One can't be a thief in his/her own house" also caused underreporting. Resource extraction was independent of economic status or caste though some small-scale gender and age based division of labour was observed. Even for the 'provisioning services' obtained from the forest in the form of tangible goods, most respondents were unaware of their respective market values. Estimation based on proxy market prices suggests that on an average, a household yearly received direct benefits equivalent to almost ₹65,400. Though spontaneously or after probing the respondents revealed their strong appreciation for all kind of ecosystem services, the idea of attaching monetary values to other sorts of ecosystem services was beyond their conceptualization. Their inability to attach monetary value again caused an underreporting and hence undervaluation.

These findings conclude that the perceived *'obviousness'* of a service and unique perception regarding resource extraction rights are two main reasons of underreporting and subsequent undervaluation. The mechanism of value formation of the forest dependent community significantly differs from policy makers' perspectives because of the community's unique perceptions.

Understanding the user community's perceptions regarding forest ecosystem services is important for sustainable forest management as it directly helps in achieving SDG 15 while indirectly addresses SDG 2; l 6 and 13 as well. This study helps in "ACCELERATING PROGRESS TOWARDS SDG's IN TIMES OF CRISIS" by offering an understanding of the background of sustainable forest management.

Keywords: Forest, Ecosystem services, valuation, Himachal Pradesh, India

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Ecosystem functions in pond aquaculture and their roles in providing ecosystem services and disservices

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Abstract

Aquaculture ponds are engineered aquatic ecosystems, managed for improving the provision of food and income. Managing aquaculture systems for maximizing not only fish productivity, but also other potential benefits that the “aqua-ecosystems” can provide is a pathway towards more sustainable systems. While a proper management can improve ES delivery, unsustainable practices also generates dis-services, defined as the ecosystems functions and aspects that results in perceived or actual damage for human wellbeing. Ecosystem services (ES) derive from ecosystems functions (EF), which are the ecological processes that control the fluxes of energy, nutrients and organic matter, through ecological systems. This study aims to provide a donor-side approach for accounting the ecosystem functions and its roles on providing services and dis-services in freshwater aqua-ecosystems.

The emergy synthesis is an eco-centric approach that accounts for all the work done by nature, society and economy on a common basis: solar-equivalent joules, named solar emjoules (sej). In other words, emergy with m, is all the available energy directly and indirectly embodied for the production of a good or service We applied emergy synthesis on nine semi-intensive "lambari" aquaculture farms as a model to identify the connections between aquaculture practices and the ways they may increase or diminish aqua-ecosystem services. We accounted for seven water ecosystem functions that are linked to four ecosystem services and three disservices provided by lambari culture in freshwater ponds. Water

regulation and microclimate regulation are services inherent of the systems features. Water provision, fish provision, and global climate regulation are influenced by the management practices adopted and can have positive or negative impact. In this study, the eutrophic effluent causes the larger disservice by demanding energy for water dilution (range from 4.30E+12 to 1.69E+13 sej/ha/year) or treatment (range from 1.45E+15 to 5.65E+15 sej/ha/yr). Greenhouse gas absorption and emissions vary according to the management practices adopted, and in this study has a neutral effect on global climate change. The trade-offs between positive and negative externalities in lambari aquaculture indicates that the services surpasses the disservices as long as the system operates under nature's carrying capacity. The internalization of the environmental costs by remediating the damage does not necessarily leads to more sustainable systems. By doing so, more energy and resources are needed, which diminishes the natural capital in detriment of recovering the damage caused by the system itself. An ecological approach that considers the integration of species and cultures, the upcycling of resources, and the surrounding biophysical aspects, makes systems higher efficient at a lower environmental cost, which seems more effective on the long term.

Track: 1a. Theoretical Approaches (Systems ecology/ emergy / ecosystems services)

Full papers

Valle del Cauca and its challenges in the integral management of wastewater in times of crisis

Analysis of the potential use of sludge rich in struvite obtained from wastewater nutrients recovery

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Abstract

Nutrients recovery from wastewater treatment has become a focus of research, since it allows minimizing negative environmental impacts associated with obtaining and eliminating nutrients such as nitrogen and phosphorus. Likewise, it is an alternative to obtain a product with a potential for use in different industrial and agro-industrial sectors. This paper presents the analysis of alternatives for the use of a struvite-rich sludge obtained from municipal wastewater treatment in Valle del Cauca. The results of our research showed that it's possible to use, the recovered nutrients as an organ mineral fertilizer for crops such as sugarcane, coffee, banana, technified and traditional corn, citrus, mechanized rice, chontaduro, forest plantations, crops of ornamental plants, and as raw material for Valle del Cauca industries related to the formulation, manufacture and distribution of fertilizers.

Keywords: Nutrients recovery, Colombia wastewater treatment, nitrogen removal, struvite, phosphorus removal

1. Introduction

Another great challenge of sustainable development goals is to guarantee the sustainable management and availability of water in quality and quantity to supply vital functions both in normal and crisis times such as the one that humanity is currently experiencing with the COVID-19. This implies that water resources must be protected and safeguarded from negative impacts derived from anthropic activities.

In Colombia, wastewater treatment is an issue that is still under development. According to Superintendency of Domestic Public Services (SSPD, 2013), about 26% of the country's municipalities have some wastewater treatment system and the rest are discharged directly on water resources and soil.

On the other hand, the existence of wastewater treatment systems does not always guarantee the elimination of the pollutants, since it is necessary not only to guarantee the restoration of the affected ecosystems, but also the improvement of existing systems.

Different investigations coincide that wastewater has a high potential for use, because highly usable resources such as water, solids and energy are derived from it (Reardon et al., 2013; van Loosdrecht et al., 2014; Hao et al., 2015).

In recent years, technologies have been developed to carry out not only the elimination of pollutants present in wastewater, but also their valuation through resources recovery. Even today, in times of pandemic where clean water is required available for hygiene activities, this continues to be a prevailing need if the availability of water is to be guaranteed in the medium and long term.

One of the available technologies for nutrient recovery is chemical precipitation processes, which represent one of the most viable options for integration with existing treatment systems as well as those under design and construction. For this reason, it is currently relevant to evaluate strategies to incorporate these processes as an integral part of wastewater management.

The recovery of nutrients in the form of struvite and hydroxyapatite has a high potential for use, since these compounds can be incorporated as a source of nitrogen and phosphorus in industrial and agricultural activities. These practices are promising ways to promote sustainable solutions for wastewater treatment, protect water resources and mitigate the impacts derived from the exploitation of natural resources.

Nevertheless, their incorporation in wastewater treatment systems at the national and local levels is incipient and there is still a technical, social, economic and political gap that needs to be reduced, in such a way that the products and resources obtained from wastewater management are used and incorporated into the production chains.

In this paper, we present an analysis the recovery of nutrients from wastewater, with an application perspective in the department of Valle del Cauca, which represents one of the main departments of Colombia where can be potentiated the use of nutrients recovered from wastewater treatment. This transformative route is expected to reduce the impact of the incorporation of chemical fertilizers in the agro-industry, and water pollution due to discharge of wastewater with a high content of nutrients.

2. Methods

2.1. Nutrients recovery from wastewater treatment

This research was developed at the Universidad Autónoma de Occidente using as a referent the wastewater treatment plant of the campus (UAO-WWTP), located in the Municipality of Santiago de Cali, Valle del Cauca- Colombia – South America.

The UAO-WWTP is composed of preliminary treatment units, an activated sludge reactor in the extended aeration mode, a secondary sedimentation tank, and a complementary stage of rapid filtration and disinfection with chlorine and ultraviolet light.

The sludge rich in struvite was obtained by precipitation process using PB-900 Phipps and Bird programmable mixer, containing six jars with a volume of 700 mL each.

For a typical precipitation run, a sample of wastewater from the UAO_WWTP was obtained; the sample was homogenized and charged in several testing jars. Then a calculated amount of $MgCl_2$ solution was added. After 2 minutes of high stirring at 300 rpm, a small amount of 0,1 M NaOH was added to each jar to adjust the pH, and a downward stirring velocity gradient was allowed according to the conditions indicated in the reaction step showed in Table 1. Finally, 10 minutes were provided for sedimentation to separate the solids obtained.

Table 1. *Operational conditions for precipitation tests.*

Operational aspect step	Experimental conditions
Reagent dosage	High stirring velocity: 300 RPM Stirring time: 2 minutes
Reaction	Stir stage 1: Adjustment of reaction pH. Stirring velocity: 40 RPM and stirring time 14 minutes. Stir stage 2: Stirring velocity 30 RPM and stirring time 7 minutes. Sitr state 3: Stirring velocity 20 RPM and stirring time 7 minutes.
Separation	10 minutes for separation of liquid and solid phase through a simple sedimentation process.

Source: Vásquez and Gandini (2019)

The sludge obtained was dried at room temperature and its characteristics were analyzed by X-ray diffraction (XRD), scanning electron microscopy (SEM) and EDS elemental analysis, in order to compare its characteristics with that of struvite and other fertilizers used in agro-industry.

2.2. Analysis of the uses and applications of struvite-rich sludge obtained from chemical precipitation and crystallization processes of municipal wastewater

To analyze the uses and applications of the sludge produced from the nutrient recovery processes incorporated for the treatment of wastewater generated at the campus of the Universidad Autónoma de Occidente del Valle del Cauca, a bibliometric network was generated through *VOSviewer*® software and the *Scopus*® database, using the keyword *struvite application*. In this way, we obtain a general mapping of research activities related to the applications and uses of struvite in several industrial and agro-industrial processes.

2.3. Analysis of the applicability of struvite-rich sludge in industrial and agro-industrial activities in the Valle del Cauca

Based on the physicochemical and structural characteristics of the recovered sludge, and its applicability and uses presented in the bibliometric network, the activities for potential use and application in the Valle del Cauca were determined, focusing on:

- Uses related to the main crops in the Valle del Cauca.
- Uses related to forestry plantations and ornamental plant crops.
- Uses related to fertilizer production, formulation and distribution activities in the Valle del Cauca.

3. Results and Discussion

3.1. Characteristics of sludge obtained in nutrient recovery processes

The sludge obtained in the process was analyzed and compared with commercial struvite and other products used in the agricultural sector. Figure 1 shows the spectra and images for XRD and SEM - EDS for the sludge.

In relation to the structure and elemental composition, the analyzed sludge showed that in addition to Mg, N and P associated with struvite, it is possible to find in the sludge elements such as C, O, Cl, Na, K, Mg, Si, Fe and Al. These elements indicate the presence of other precipitates such as phosphates, calcium carbonates, and salts of magnesium, iron, aluminum and trace elements, which vary according to the characteristics of the wastewater.

In terms of the structures formed, SEM images showed the presence of crystalline structures typical of struvite, but also the presence of amorphous structures associated with hydroxyapatite and other phosphates that can form in combination with struvite in nutrient recovery processes.

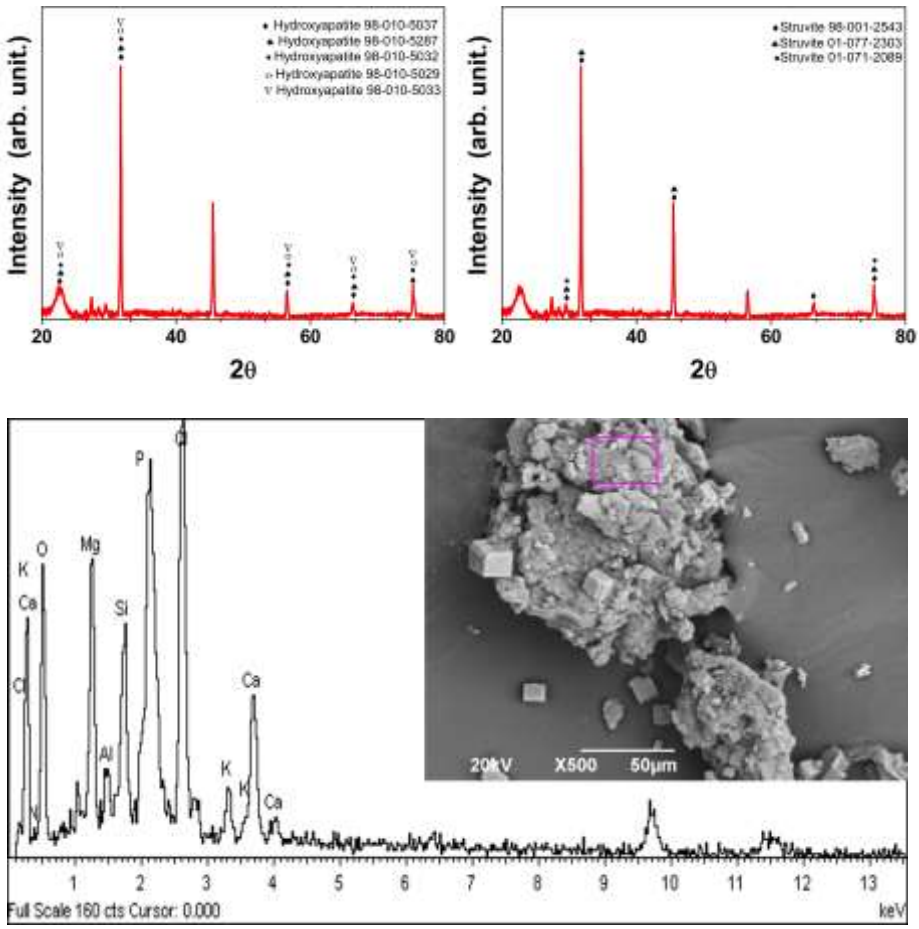

***Figure 1**. Spectra and images for XRD and SEM – EDS for obtained sludge. X-ray diffraction spectrum for RW. pH= 9,32 Units, Mg^{2+} = 131,7 mg/L. Run 9B (J1A190319)*

According to the content of organic matter and complementary elements observed in the sludge obtained, and in accordance with its comparison with the characteristics of commercial struvite and other inorganic fertilizers cited in the EU Fertilizer Regulation, these sludges can be classified as an inorganic fertilizer or as an organic or organo-mineral soil fertilizer (ESPP, 2015).

3.1. Analysis of the uses and applications of struvite-rich sludge produced by chemical precipitation and crystallization processes of municipal wastewater

Figure 2 presents the bibliometric network obtained for the main uses of struvite. As can be seen, struvite is mainly related as a source of phosphorus (larger circles), followed by applications as a source of magnesium, phosphate fertilizers, nitrogen fertilizers, low solubility fertilizers, in agriculture, agronomy and in crops such as corn.

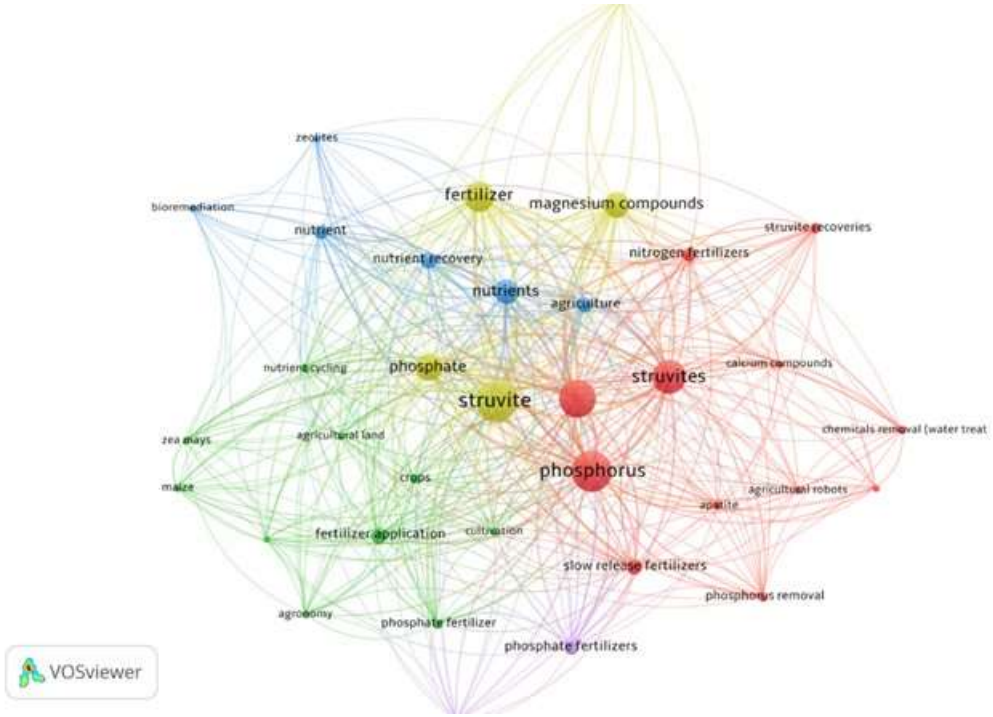

Figure 2*. Bibliometric network for the main uses of struvite.*

Struvite, according to its composition, is presented as an alternative fertilizer, since it is established as a source of essential nutrients such as P, N and Mg.

Likewise, it has characteristics that are key for its application as a fertilizer, since it has a low solubility, which gives it slow P release characteristics. This factor is an important requirement for new generations of agrochemicals, since nutrient losses through runoff or leaching are reduced, and therefore, the risk of causing problems such as eutrophication in surface and groundwater sources around crops and application sites is reduced.

In addition, the low solubility is established as a greater utilization by the plant, increasing the efficiency of P use (Flores et al., 2018).

The application of struvite is appropriate in lawns, tree plantations, ornamentals, vegetables and flower beds, as well as pastures and forests where fertilizers are applied once every several years. Nevertheless; the agronomic value of struvite has not been fully examined (Szymanska et al., 2019).

The presence of magnesium in struvite makes it an attractive alternative for crops such as sugar beet, which requires Mg (de-Bashan and Bashan, 2004). In addition, laboratory and pilot scale research has evaluated the effectiveness of struvite as a multi-nutrient fertilizer, which performs similarly to typical commercial fertilizers, in crops such as wheat, soybean, sunflower, pea, cowpea, corn and pasture on silt loam and sandy loam soils.

In other crops such as canola, spring wheat, winter wheat, peas, alfalfa, lentils, soybeans, corn, potatoes, sugar beets, ornamentals and turf, positive performance has been established with the application of Crystal Green commercial struvite, obtained through Ostara's technology (Ostara, 2017).

In terms of struvite-rich sludge obtained from wastewater treatment and its effectiveness on crops, in studies conducted by Kataki and Baruah (2018) found that no significant difference is presented between the use of conventional phosphorus fertilizers and struvite obtained from urine treatment, municipal wastewater, corn fiber processing wastewater, dairy industry wastewater, synthetic wastewater, swine industry wastewater, leachate, anaerobic sludge, and different types of manure.

Some of the crops studied were, Lentils, Chinese flowering cabbage (*Brassica parachinensis*), Water bindweed (*Ipomea aquatica, I. reptans*), Water spinach (*Ipomoea aquatica*), Corn (*Zea mays L.),* Wheat (*Triticum aestivum L.*), Perennial ryegrass (*English Ryegrass*), Canola (*Brassica napus),* Garden cress (*Lepidium sativum*), Winter barley, Lettuce (*Lactuca sativa L*), Garden rocket (*Eruca sativa*), Dill (*Anethum graveolens*), Fennel (*Foeniculum vulgare*), Parsley (*Petroselinum crispum*) and tomato (*Solanum lycopersicum*), among others.

In addition to its use as a fertilizer and raw material for the manufacture of fertilizers, there are also reports of its use as a filler material for fire-resistant panels and as a component in cement. It is also used in the production of detergents, cosmetics, animal feed and in materials that use phosphates; however, its application in these activities is limited because it is not commercially profitable and its implementation as a raw or complementary material in these activities would require the development of more economical production methods compared to the current ones (Pastor, 2008).

In industrial processes for the production of detergents, food and cosmetics, phosphate rock is used, which is subjected to an industrial process of high temperature and energy for its purification, which is a limitation if phosphate rock is to be replaced by struvite-rich sludge, since struvite is an unstable mineral at temperatures above 50 ºC, but it also represents an opportunity to develop new research on struvite purification and to obtain phosphates with a high purity from wastewater treatment.

On the other hand, the increasing costs of acquiring high quality phosphates, as a result of the gradual depletion of phosphorus reserves in soils, also generates significant pressure on the industry, which reinforces the need for purification of struvite-rich sludge and the establishment of economical and environmentally viable nutrient recovery processes that provide alternative sources of nutrients; but while this is happening, one of the most promising alternatives for the application of struvite-rich sludge is its use as a slow-release fertilizer (de Bashan and Basahn, 2004).

3.2. Analysis of the applicability of struvite-rich sludge in industrial and agroindustrial activities in the Valle del Cauca

In 2016, the agricultural sector in Valle del Cauca had 373 680 hectares planted. Of the total area planted, 36 723 hectares corresponded to transitory crops and vegetables, 334 881 hectares to permanent crops and fruit trees, and 2 076 hectares to annual crops.

The crops with the largest planted area were sugarcane and coffee, with a combined share of 71,48% of the total planted area (Secretaría de Ambiente, Agricultura y Pesca, 2018).

Among transitory crops, corn and rice were the crops with the largest planted area. For annual crops, cassava and onion, were the crops with the largest planted area, and for permanent crops were sugarcane and coffee (Secretaría de Ambiente, Agricultura y Pesca, 2018).

Table 2 presents the main crops in Valle del Cauca, with their percentage of participation for 2016.

Tabla 2. *Main crops in Valle del Cauca for the year 2016..*

Crop	Spread area (ha)	Participation (%)
Sugar cane	187 337	52,2
Coffee	62 955	17,6
Banana	29 879	8,3
Technified corn	17 094	4,8
Banana	7 206	2,0
Sugar cane for Panela	6 927	1,9
Citrus	6 281	1,8
Mechanized rice	4 155	1,2
Traditional corn	3 373	0,9
Chontaduro	2 761	0,8
Other crops	30 654	8,5

Source: Ministerio de agricultura, 2016.

Currently Valle del Cauca is in a growing process of diversification of agricultural crops such as Haas avocado, Golden pineapple, and citrus. The sugarcane product exceeds 160 000 ha, compared to the almost 50 000 ha that are produced from fruit trees, in crops such as pineapple, mango, Tahiti lemon, guava, grapes, papaya and other fruits (Dinero, 2017). These values show the diversification of crops, being the starting point for the development of research, focused on evaluating the effectiveness and benefit of the use of struvite recovered from wastewater treatment, as a fertilizer alternative for crops grown in the region.

Valle del Cauca has approximately 260 companies related to agricultural and livestock products (ICA, 2020), Valle del Cauca has approximately 260 companies related to agricultural products, which could take different roles in terms of the potential incorporation of struvite or struvite-rich sludge obtained from wastewater treatment into the agricultural activities. Table 3 shows the classification of the main types of companies related to fertilizers in Valle del Cauca.

Tabla 3. *Classification of the main types of companies related to fertilizers in Valle del Cauca.*

Function	Number of companies	Participation (%)
Producer	167	64
Formulator	5	2
Packer	19	7
Importer	113	44
Distributor	81	31

Source: Adapted from ICA (2020).

According to these values, 64% of the companies produce fertilizers, showing the potential application of struvite-rich sludge obtained from municipal wastewater treatment as raw material for the production of fertilizers in Valle del Cauca.

In addition, there is a significant number of companies dedicated to import and distribution, 44 and 31% of participation, respectively. This sector would be a key element to compare and evaluate imported products rich in struvite obtained from wastewater treatment, as is the case of Crystal Green, which would make it possible to make known an alternative of other types of fertilizers in the region. This would make it possible to promote the benefits and advantages of the product, not only focusing on its economic value, but also on the environmental benefits of introducing recovered struvite into agricultural processes.

In the same way, importing struvite would allow to have as a reference point and a quality standard for the products generated by the companies present in Valle del Cauca. In the case of the companies that carry out the formulation, it is possible to develop research related to the application of struvite-rich sludge, its incorporation as raw material for the elaboration of fertilizers, and the analysis of the quality criteria required to maximize its use.

In general terms, these results showed that for the agricultural sector it is possible to propose the use of struvite-rich sludge as an alternative to commercial fertilizers, either as a replacement for them, as a

complement to the use of current fertilizers to reduce the amount of chemical fertilizers currently used, or as a raw material for their production.

Another aspect associated with the applicability of struvite is its low solubility and slow release, which allows a single application to be required for a long period. This aspect is very important in the planting and recovery of deforested forests (Szymanska et al., 2019).

By 2017, Valle del Cauca had 146 000 hectares of forests in recovery and an average of 15 000 new hectares are established annually with restoration projects. According to the environmental authorities of the department, one million trees per year are being planted in the Cauca river basin (Lozano, 2017); in such a way, that the struvite-rich sludge obtained from the treatment of wastewater could present a potential use in these areas in the medium and long term, since in these processes requires a periodic application of fertilizers, so the low solubility and slow release of struvite, acquire greater relevance and become an important advantage of its use.

In combination with the application of struvite and struvite-rich sludge as a fertilizer for forests and pastures, its potential application for ornamental plant crops is evident. In Colombia, the trade organization Colviveros has a network of affiliates with more than 500 producers, marketers, and suppliers of ornamental plants located in 12 departments, including Valle del Cauca. This market has grown significantly, generating annual exports of more than US$20 million in foliage and live plants. Ornamental plants include flowering plants, orchids, foliage plants, cacti, succulents and palms (Colviveros, 2020).

No studies have been reported for Valle del Cauca in which the agronomic value of struvite-rich sludge has been analyzed. Therefore, another important challenge is to investigate this field and determine its effectiveness under local environmental conditions.

Finally, although sludge could have a potential application in the construction, detergent, cosmetics and animal feed industries, it cannot yet be considered as a viable alternative in the short and medium term, because economic production processes that are competitive with processes that use phosphate rock as raw material have not yet been established.

4. Conclusions

For Valle del Cauca, the main alternative uses for struvite-rich sludge obtained from municipal wastewater treatment are in the agriculture industry, mainly as an organo-mineral fertilizer for crops such as sugar cane, coffee, bananas, technified corn, bananas, sugarcane, citrus, mechanized rice, traditional corn and chontaduro, as well as for forestry plantations, ornamental plant crops and as raw material for industries related to the formulation, production and distribution of fertilizers in the department.

Struvite obtained from wastewater treatment can replace conventional chemical fertilizers since it has very similar effects on plant crops such as lentil, Chinese cabbage, corn, wheat, tomato, canola, parsley, fennel, dill, garden rocket, lettuce, barley, watercress, purslane, white lupin and English grass.

Given the dynamics of fertilizers used in Valle del Cauca, we identified that it is possible to establish different roles for the incorporation of sludge obtained from nutrient recovery processes in wastewater treatment systems as fertilizers. These roles could be producers, formulators, packers and distributors.

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4. Climate Change and Energy

4a. Predictions and responses

Abstracts

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Accelerating the Renovation Wave in Portugal in the aftermath of the Covid-19 crisis: Key insights from interviews with experts on building retrofitting

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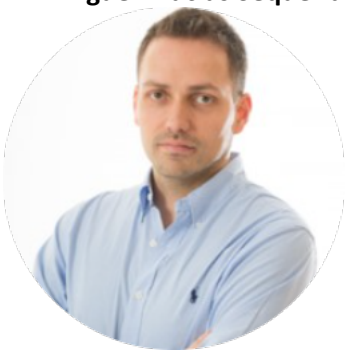

Dr. João Pedro Gouveia

Mr. Pedro Palma

Abstract

The European Commission has launched a Renovation Wave, aiming for decarbonization of buildings, living conditions improvement and job creation. Most Portuguese buildings have low construction quality, poor energy performance and lack thermal comfort. Leveraging the retrofitting economy is crucial to mitigate these problems, which may be exacerbated by climate change.

With the goal of gathering multidisciplinary perspectives on building retrofitting, eleven Portuguese experts were interviewed; key findings are discussed below. The interviews took place on October-December 2020, being performed individually through online meetings, and included 32 questions divided by six topics: Portuguese buildings characterization, retrofitting market evolution, technical measures, policies and regulations, financing instruments, and stakeholder engagement. Interviewees included architects, engineers, journalists, researchers, business leaders, and politicians.

Historically, buildings deep retrofitting in Portugal was scarce (i.e. 0.06%/year, well below European average of 1%). Since 2014, urban centers saw a boom in retrofitting, driven by tourism and gold-visas. However, retrofitting did not consistently abide by regulations due to a deregulatory regime (2014-2019); often only “makeup" interventions were made. In 2020, Covid-19 brought uncertainty to this growing market, freezing investments and lowering incomes. On the positive side, the pandemic might have exposed dwellings’ pathologies and shown that housing is more resilient than tourism. Interviewees agreed that retrofitting seemed mostly immune to the crisis in 2020 and that business-as-usual could return if Covid-19 were swiftly controlled. Otherwise, this market may crash alongside with the economy. Overall renovation rates in Portugal remain very low. Lack of economic capacity and financial barriers hinder the ability to invest, lead to delays, and steer decisionmakers towards non-optimal solutions. Other barriers include slowness of licencing, small labor force, lack of expertise, and insufficient information. Envisioning the future, interviewees underlined recovery funds as a fantastic stimulate for renovation and were adamant about avoiding past mistakes.

Interviewees unanimously agreed that an “insulation first” rule must be applied, prioritizing roofs and façades. Active systems should only come later, and the perspectives were less aligned regarding optimal technologies. Nevertheless, three solutions were highlighted: solar thermal water heating, biomass-based heating, and heat pumps; but there is also a growing demand for solar photovoltaic.

Although interviewees recognize the existence of policy and financing mechanisms aimed at retrofitting, most also affirm that their effectiveness has been modest due to lack of allocated funds, low attractiveness of financing products, excessive bureaucracy, and insufficient awareness. Retrofitting costs cannot fall entirely on houseowners and public funding should be assigned according to families’ income; more information campaigns are also necessary. Local authorities were highlighted as key stakeholders, but most require additional resources.

The interviews provided key insights on how accelerating building retrofitting requires levers as regulations, financing, businesses, authorities and citizens to be all aligned. This work is directly linked to SDG7+Target:7.3. and SDG11+Target:11.1., being insightful for research on improving energy efficiency of Portuguese buildings. It is also related to SDG13+Target:13.2. and SDG1+Target:1.4. Multidisciplinary perspectives are key to successfully implement the Renovation Wave in Portugal, which can provide wide-ranging societal, environmental, and economic benefits for the Covid-19 green recovery.

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Climate change reporting: A comprehensive literature review

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Abstract

Climate change has evolved rapidly over the last few decades to become a crucial issue with implications for the natural environment and companies.

The main factor affecting and contributing to climate change is greenhouse gas (GHG) emissions, directly related to economic activities. Therefore, companies, as generators of GHG emissions, are required to report on their environmental impact. Reporting on climate change impacts and related risks and opportunities provides insight into how companies respond to this problem, how they meet stakeholders' information needs, and how they monitor environmental performance over time.

The authors conducted a literature review on the top 50 most cited papers on Google Scholar dealing with climate change, carbon reporting, and accounting, published in 28 journals over 2008-2020. The keywords chosen were climate change reporting, climate change accounting, carbon reporting, carbon accounting, GHG accounting, and GHG reporting.

Climate change accounting can be considered a subset of sustainability accounting, but specifically focused on GHG emissions. The literature review highlights three relevant findings: 1) In the field of climate change reporting, the lack of mandatory reporting and universally recognised standards has made reporting largely voluntary and difficult to compare. 2) Stakeholders' pressure on companies' climate change impact is growing, and consequently, the request of information on companies' approach to the topic. 3) Companies also have to report on risks related to climate change to establish mitigation actions.

The climate change dimension is increasingly becoming an integral part of companies' sustainability strategies and risk management processes. Companies with better climate change reporting practices and strategies will be able to better assess and manage their environmental performance.

Some suggestions for future research can be identified from the findings of the review. Future research could investigate whether mandatory reporting guidelines lead to greater standardisation of the documents produced. At the same time, it may be interesting to study the progress of reporting in line with climate change evolution. More research is needed on the connections between carbon accounting with other SDGs. Last but not least, the risk management process explicitly related to climate change deserves attention too.

This paper is directly related to SDG 13 on Climate Action. The following are the SDG targets and a brief indication of this study's contribution to the topic of the ISDRS Conference.

1. SDG 13 + Target 13.2: This target can be applied to companies that are expected to extend their reporting to climate change impacts and to integrate the environmental variable into their strategies and decision-making process. SDG 13 + Target 13.3: Companies can implement actions to mitigate their impacts on climate change and extend risk management to environmental risks.
2. Climate Action is a global environmental problem and challenge. The proposed paper contributes to the progress towards the achievement of the SDG 13 as this study shows the state of the art on climate change and the companies' approach to dealing with it.

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Energy transition and decarbonization in resource-based developing countries: The case of oil dependency

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Abstract

Petroleum products combustion is one of the primary anthropogenic sources of greenhouse gases (GHG) emissions. Holding more than 85% of world crude oil reserves, the Organization of the Petroleum Exporting Countries Plus (OPEC+) plays a crucial role in the world oil product market and consequently,

its related GHG emissions. Environmental and social injustice resulting from the oil supply chain in OPEC+ members goes beyond their territories and threatens the planet's wellbeing. Thus, addressing possible economic, social, and political interventions to facilitate the sustainability transition in the OPEC+ energy sector and concurrently liberate their economy from heavy reliance on exporting crude oil is necessary to fulfill climate treaties targets. It can also contribute to United Nation sustainable development goals (SDGs), in particular, SDG 13 (Target 13.2) to combat climate change drivers in developing countries and SDG 7 (Target 7.2) to shift from fossil fuels to renewable energy carriers.

The central theme of this study is to develop renewable-oriented energy transition policies based on the OPEC+ state's current socio-economic and socio-ecological status to replace oil with other more secure and clean energy carriers using integrated assessment modeling and Hofstede cultural dimensions assessment.

Due to the negative impacts of ongoing GHG mitigation treaties and COVID-19 pandemic on the economy of petroleum-based countries, OPEC+ members have limited time to move from oil dependency to ensure their stability, secure inclusive economic growth and the decent job market for their young population. Therefore, the first objective of this research is to investigate the feasibility of the transition of OPEC+ members' economy and energy market from oil based on SDG 7 (Target 7.2).

Toward advanced and cleaner fossil-fuel technology, this study also aims to design a comprehensive framework to measure the efficiency and sustainability of the downstream oil of the OPEC+ members to deal with the existing imbalance in their domestic petroleum products market in particular gasoline and also investigates the reasons of the inefficiency of their petroleum refining sectors in line with SDG 7 (Target 7.a) and SDG 12 (Target 12.a). Finally, this study develops the Shared Socio-economic Pathways (SSPs) to frame all possible contingencies in OPEC+ countries to show how current interventions shape the possible futures.

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Fairness in Enhancing Compliance under the Paris Agreement: Lessons from the Montreal and Kyoto Protocols and the feasible Path Ahead

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Abstract

Broad participation and compliance are key elements of any successful international environmental agreement (IEA). Notwithstanding the significant participation of countries in the Paris Agreement, the level of compliance still remains challenging. This article investigates the potential role of fairness in enhancing the compliance under the Paris Agreement. It reviews lessons from the Montreal and the Kyoto Protocol which could assist the Paris Agreement to incentivize countries to comply with the agreement. Among different fairness principles, the principle of Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC) is potential to be applied by treaties. However, it is differently operationalized across treaties as it is a broad principle. Carbon market mechanisms and financial supports have been practical approaches towards fairness which are emphasized by the Paris Agreement, as well. To improve compliance with the Paris Agreement and on the path forward, a formulaic approach to define fairness, imposing restrictions on non-compliant Parties, transparent regulations in carbon market mechanisms and a global carbon price could be effective. As a formulaic method towards fairness, adjusting emissions targets based on per capita income is recommended. To impose restrictions, the Paris Agreement appears to need supplementary agreements that can more effectively change countries' incentives. For example, the international maritime organization (IMO) could propose a standard that all international shipping be fueled by liquefied natural gas. Transparent financial programs in IEAs will particularly motivate developing countries to comply more. To this end, it is suggested that developed countries include their financial supports in their nationally determined contributions (NDCs) under the Paris Agreement. Moreover, a uniform carbon price among a group of willing countries and lump-sum transfers among developing countries is considered a fair burden sharing approach. Besides, more research on environmental and health benefits of compliant countries will also create a strong incentive to mitigate emission even if other Parties do not do so.

SDG+Target: The abstract stands in track 4a: Climate change and energy-predictions and responses. The abstract specifically relate to the goal "Environment, economic and social determinants of climate change vulnerability and adaptation".

A brief relation to the topic of the conference: There is no sustainable and decarbonized future without a cooperative behavior. However, we still observe that the submitted nationally determined contributions of countries are not sufficient to comply with the climate goals. To foster international compliance with climatic actions, a rigorous grasp of international incentives among countries are important. This research highlights the past global experience and suggests potential long-term solutions for the future.

4. Climate Change and Energy

4b. Affordable and clean energy

Abstracts

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Assessing the Potential of Hybrid Wind and PV plants across Sweden

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Abstract

Replacing fossil fuels with Variable Renewable Energy Sources (VRES), like wind power and Photovoltaics (PV) power, is key in the transition towards a sustainable energy system worldwide. However, ever since the large-scale commercialization of wind power, scientists and practitioners have been striving to tackle the operational inflexibility and financial risks posed by the inherent, partly complex and unpredictable nature of wind power production [1]. The same problems are present in PV power production, although the characteristics of the solar resource is different from the wind resource. These challenges and disadvantages create negative externalities that translate into grid integration costs for both wind and PV power [2].

In order to reduce the fluctuations in power output of VRES, the ideal would be to combine sites that are anti-correlated, as proposed in early studies by Kahn [3]. This is equal to decreasing the instances of high and low power production by 'smoothing out' power output [2]. As a result, the predictability of the power production may be enhanced, reducing the challenges of grid integration. This problem may be partially overcome by a co-located wind and solar PV park, referred to as a Hybrid Power Park (HPP).

Combining the energy sources have recently shown enhanced reliability and a more resource effective system compared to single resource power parks [4, 5]. A first step in evaluating the feasibility of a HPP is to predict the combined power output of wind and solar PV compared to single resource power parks.

The purpose of this study is to assess the temporal variability of combined wind and PV power plants across Sweden. This will be done by studying the correlation coefficient using the meteorological reanalysis dataset CosmoREA-6. The reason for that is because the wind speeds and solar irradiances are produced in the same physical model as well as at high spatial (6x6 km) and temporal resolution (hourly). The study will also take already existing extensive wind farm infrastructure (equivalent to 12% of power generation in Sweden 2019 [6]) to assess to what extent these may be complemented with PV parks for a resource effective deployment. This study may be used as a tool for preliminary identification

of locations with potential for installing HPPs. Although this study will cover Sweden, there is a possibility to scale the model to also cover Europe and northern Africa as that is the spatial coverage of the CosmoREA-6 dataset.

Existing HPPs in the world are limited and this methodology is a step forward towards showing its potential as it may be applied to other areas than Sweden. The project therefore contributes to the use of existing power infrastructure and to the up-scaling of sustainable energy use in a more reliable, affordable and resource efficient way, in line with Sustainable Development Goal 7 – Affordable and Clean Energy and 13 – Climate Action.

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Energy Poverty and Sustainable Development Goals in Poland and Greece

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Abstract

The seventh goal of the Sustainable Development Goals (SDGs) is dedicated to ensuring access to affordable, reliable, sustainable and modern energy for all by 2030. The Paris Agreement was adopted by 196 Parties at COP 21 in Paris, on 12 of December 2015; according to its goals, global warming should be limited to well below 2, preferable 1.5 degrees Celsius compared to pre-industrial levels. To meet the 1.5 degrees Celsius goal, coal's share in global energy supply should drop between 73% and 97% by 2050. As so, the results of Paris Agreement affect world employment structure; the transition to a decarbonized economy is a chance for further development of the green jobs. To ensure that in the energy transformation processes no one is left behind, "just transition" was included as a part of 2015 Paris Agreement on climate change.

Energy poverty is described as the absence of sufficient choice in accessing adequate, affordable, reliable, high-quality, safe and environmentally benign energy services to support economic and human development. Energy poverty creates additional levels/dimension of poverty. The SDGs emphasize the direct linkage between household energy access and consumption and poverty and development.

Changes in energy production can create 18 million jobs through the world economy. Job creation in the renewable energy sector is an important indicator for assessing the socio-economic impact of implementing energy strategies. These professions influence other socio-economic aspects, such as the eradication of extreme poverty, the standard of living of the inhabitants and the development of the region. Judging from the experience of many countries, the thesis has been confirmed that renewable energy creates the most permanent jobs, evenly distributed throughout the country, and not only in industrial centers.

In both Poland and Greece, there is a significant employment potential in modern and future-oriented branches of the economy related to renewable energy. Still, there is a need for job reorientation and reskilling from the mining industry to renewable energy systems. A good example of a project dedicated to reskilling coal workers for the transition to the RES sector is the RES-SKILL project, in which both countries are represented. The goals of the project are to strengthen VET provision in the energy sector aimed at coal workers for compatible RES sector jobs, increase their reemployment opportunities, and cover at the same time RES sector's skills demand by developing a novel curriculum and tailored training content to facilitate coal workers reorientation to the RES industry. It also aims to support VET providers to integrate the RES-SKILL materials in their VET offerings and to improve the cooperation between VET providers and businesses, as this will provide opportunities for coal workers' transition to the RES sector. Correspondingly, the aim of the paper is to assess the social and economic opportunities and threats of energy transformation in Poland and Greece in light of SDGs.

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Developing an online one-stop-shop for residential buildings retrofitting in Portugal: Key features of “Menu de Renovação Verde” and pathways for future growth in the Covid-19 green recovery

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Abstract

Buildings are the largest single energy user in the European Union. Approximately 80% of existing buildings will still be used in 2050 and 75% of this stock is energy inefficient. Previous research shows Portuguese dwellings’ low energy performance and lack of thermal comfort; current rates of improvement are insufficient. Main obstacles include information barriers, market and financing failures, lack of expertise, and regulatory barriers. The European Green Deal foresees a ‘Renovation wave’, which aims to scale up renovation rates. Energy efficiency one-stop-shops have been highlighted as a key tool to accelerate building retrofitting.

In project PAS2020 (Pan-European Approach on Sustainable Heritage: Regeneration by a retrofitting economy), co-funded by the EIT Climate-KIC, the consortium developed 3 country-specific (The Netherlands, Slovenia, Portugal) online one-stop-shops for retrofitting. The following steps were taken: i) selecting representative building typologies, ii) identifying key features, iii) gathering data on financial instruments, regulations, and technical measures, iv) identifying bottlenecks, and v) mapping local

challenges and growth strategies. In Portugal, based on previous work, the typology of single-family house from Lisbon, built before 1919, was chosen for analysis. Nevertheless, most information available on the Green Menu is also applicable to other similar typologies.

Main results are available online in the country-specific Green Menus with a 3D model representative of the building typology and information on technical measures, financial tools and regulations (Portuguese “Menu de Renovação Verde”: www.menurenovacaoverde.pt). In total, 130 technical measures, tips, points of attention and innovations were selected. User-friendly calculation tools are available for 12 key measures. The platform also contains data on regulations and on 12 Portuguese financing schemes and tax benefits, which are linked directly to the relevant measures.

The Green Menu serves as a one-stop-shop for building retrofitting, closing information gaps, accelerating sustainable renovation, and activating stakeholders. The platform enables access to context appropriate measures, without on-site visits, thus accounting for potential innovative business models and Covid-19 social distancing. Green Menus are available in Portugal, Slovenia and Netherlands, and further growth is anticipated by expanding to other building typologies and other European locations.

In Portugal, the Green Menu roll-out will follow two main strategies: increase the online footprint of the platform and bridge the gap between online and offline. On one hand, additional typologies, measures, financing schemes, regulations, and other relevant information will be continuously updated. Partnerships will be fostered with key stakeholders to reach a growing number of users. On the other hand, although information is an important trigger, building retrofitting demands concrete real-world actions. Thus, the Green Menu will connect with trustworthy facilitators as local authorities, energy agencies, community associations and cooperatives, as well as with businesses that work on retrofitting, renewables, and smart technologies.

This work is directly linked to SDG11+Target:11.1., as it assists in improving housing conditions. It is also related to SDG7+Target:7.3., SDG13+Target:13.3., and SDG1+Target:1.4. One-stop-shops for retrofitting are still in embryonic phase in Portugal. These tools have the potential to increase building renovation rates, enabling wide-ranging positive societal and environmental impacts and contributing to the Covid-19 green recovery.

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The move towards net zero energy buildings: A systematic review of its concept and progress in the 21st century

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Abstract

In today's age of rapid climate change and environmental deterioration, there is an increasing quest for built environments that are climate sensitive and environment friendly. However, climate responsiveness and environmental friendliness should not be limited to building design, rather should be considered at larger scales including at neighbourhood and city level. This study is a part of global ongoing efforts to study climate responsiveness spatially, focusing on passive design strategies for urban neighbourhoods. In recent years, the concept of zero energy building (ZEB) has attracted researchers and policymakers in improving energy efficiency and reducing environmental impacts. The combined challenges of climate crisis, excess energy consumption and increasing energy prices paved the way for exploring ZEBs to achieve energy neutrality and consider environmental impacts. The term ZEB is generally characterized by a very low or almost zero annual energy requirement, substantially fuelled by renewable technologies and sources. To achieve low and zero net energy performance objectives in buildings, designers must make optimal use of passive environmental design strategies based on local climatic conditions. The study investigates the current development/progress of net zero energy building (NZEB) concept across different climatic regions to meet specific sustainable energy goals. The paper provides a systematic review of key design strategies, technology choices and energy

performance mechanisms to achieve net zero energy. The review assesses progressive NZEB literature and existing frameworks to improve efficiency and reduce energy consumption in buildings. It attempts to understand the origin, principles and progression of NZEB concept as a clean, affordable and sustainable energy system. It focuses on varying definitions of NZEB and prominent drivers in practising sustainable development. The study is extended to identifying key policies supporting NZEB development and the possibility of integrating the NZEB concept in climate change action plans. The review provides critical policy recommendations and recognises potential areas of NZEB research towards a low carbon future.

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Life cycle based environmental and economic assessments of PV installations - empirical findings from Hungary

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Abstract

The photovoltaic (PV) based electricity generation is a central element of the sustainable energy transition worldwide. The newly adopted Hungary's National Energy Strategy 2030 targets photovoltaic systems as one of the most promising sustainable and safe power production methods. Recently, the growth rate of total installed PV capacity has exceeded 72.%/year and it is expected that (PV) based electricity generation would reach 6 GW by the year 2030 in Hungary.

The environmental impacts, the sustainability implications, and the full economic costs of renewable energy use are equally important. The aim of this study is to assess and compare the environmental and economic performance of three photovoltaic power plants of differing scales: a household PV system (5 kWp), a commercial PV system (500 kWp), and a large-scale PV system (above 2 MWp). The assessments are based on empirical data from Hungary. The two pillars of the complex, life cycle based assessment are environmental Life Cycle Assessment (LCA) and economic Life Cycle Costing (LCC). LCA is a method to assess the environmental aspects and potential impacts associated with a production system. LCC is an economic approach that sums up the total costs of a product discounted over its lifetime, including investment, design and production costs, operation and maintenance costs, and end-of-life costs. While LCC is originally not an environmental evaluation tool, there are similarities between the two methodologies.

Considering the importance of environmental and economic information in PV-related policy planning and decision making, we develop a common evaluation framework based on indicators derived from LCA and LCC case studies of photovoltaic power plants in Hungary. Our preliminary results suggest that specific production costs (life cycle costs for the production of 1 kWh of electricity) are higher for household-level PV systems than large-scale PV power plants. As for the environmental impacts of the production of 1 kWh of energy, the difference is less significant between the various scale PV systems, possibly because the technology is modular. Other factors might have a greater role in the differentiation of environmental impacts, e.g., the solar panel type or the solar irradiation of the location.

We concluded that an integrated LCA and LCC-based evaluation framework may contribute to regional and national policy-making related to PV utilization. The options for cost effective (in its lifecycle terms) and optimal environmental performance of different size PV installations could be useful in city-level or regional sustainable energy and climate action plans (SECAPs) and urban climate change strategies, as well. The governmental and municipal level financial grant schemes may also apply the results derived from our common environmental and economic evaluation framework for PV) based electricity generation.

Finally, our research properly fits in SDG Target 7.2 by increasing renewable energy in the energy mix. The dual (environmental and economic) optimization of PV installations may also accelerate the sustainable energy transition and implementation of Paris Agreements after the pandemic crisis.

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Hosting capacity scenarios of PV park deployment in a Swedish rural distribution grid using Monte Carlo simulations

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Abstract

Transitioning away from a fossil-based energy system to one based on renewables is one of the corner stones to mitigate climate change, as reflected in one of the Sustainable Development Goals (no 7) of the UN's 2030 Agenda. Photovoltaics (PV) were recently declared by the International Energy Agency as

the cheapest means of power generation in a global perspective. However, in the Nordics, the solar resource is relatively small and a high share of hydro power has kept retail electricity prices low in comparison to most European countries. While the PV market has been concentrated to roof-mounted systems for self-consumption, the continued price drop for PV modules has fostered a growing interest in ground-mounted PV parks. These parks are today on the brink of feasibility, requiring access to suitable and cheap land and that grid-connection costs are kept low. In this study, the so-called hosting capacity (HC) is determined for a Swedish rural distribution grid with a power consumption of about 50 GWh/yr. The HC is the total generation capacity of PV parks that can be allowed without any grid enforcements or other measures, while maintaining an acceptable quality of operation.

A previous study showed that parks >1 MW_p are difficult to implement in this type of grid due to limited availability to sufficiently large land areas and lack of substations that can host the power [1]. Power flow simulations were performed for the entire grid during a sunny summer week and considering land availability for a set of scenarios, using a Monte Carlo simulation with 1000 iterations. A first scenario showed that if parks of 1 MWp are randomly placed in the grid until an over-voltage or over-current occurs, i.e., the HC is per definition exceeded, the HC varies between 0-24%, with an average of 5.5% of annual consumption. The spread indicates the variation in HC between substations. In a second scenario, PV parks were connected incrementally until no substation could host another PV park without exceeding the HC. Interestingly the spread of the HC was 14 to 52% in this scenario, indicating the importance of the order in which PV parks are installed, as some substations have higher influence on the total HC than others. The study motivates introducing incentives for dialogue between the grid operator and the PV park owner when discussing the implementation of parks to make best use of the existing grid infrastructure.

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Capacity building in the fabrication and advocacy of cookstove in Nigeria

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Abstract

The issues of clean and improved energy access for domestic, institutional and industrial usage are of utmost concern to citizens, governments and international organizations globally. On a global scale, half the world cooks with inefficient stoves via wood and charcoal with smoke killing 4 million people a year (IEA, 2017) with high rate of deforestation and global climate change consequences due to lack of access to energy efficient cookstoves by over 2.7 billion global population out of which 657 million is from Africa. In Nigeria, the bulk of energy supply is met from firewood and charcoal which accounts for over 70% of total primary energy supply and about 60% of the final energy demand. In 2010, 40.2% of households used fuelwood as main fuel for cooking, 33.7% used charcoal, and only 18.2% used LPG3 (World Bank, 2015).

On the average, a household in Nigeria uses 1,064.7 kg of firewood and 434.4 kg of charcoal every year. It is estimated that 20 million tonnes of woodfuel are consumed annually by about 80% of the households in the form of firewood or charcoal. If this trend of consumption continues, Nigeria is likely to consume more than 45 million tonnes of woodfuel by the year 2030 (IEA, 2017). The demand for wood puts the country's forests under serious threat with severe consequences for the ecosystem. Deforestation rates in Nigeria are amongst the highest in Africa, with current levels of woodfuel consumption far exceeding forest growth.

Health wise, over 6,500 deaths are attributed to cooking induced illness yearly due to inappropriate cooking technologies as well as the fuel type used. Realistically therefore, there is no functional

“vaccine” against climate change other than to switch to stop felling and switch to renewable energy via capacity building and adoption of Cookstove.

It is on this premise that, the paper posit capacity building program as a diversionary, affordable, clean energy innovation to avert poverty and hunger as well divert the attention of domestic felling away from deforestation. The main objective presents alternative energy sources through the fabrication of energy efficient cookstoves to rural women and advocacy for adoption by food vendors and other vulnerable towards mitigation and adaptation of climate change and GHG effects respectively in the 774 LGAs of Nigeria.

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Solar Technologies Pathways for EU Electricity Generation under Project Drawdown Framework

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Abstract

The emergency associated with the climate crisis demands immediate action. All economic sectors need to decarbonize in order to fight Climate Change. The Power Sector is strategic, whether it be by its

massive contribution to greenhouse gas emissions or for its intrinsic capacity to decarbonize other energy-consuming activities in a transversal way. The Energy Transition era will be filled with various complex and interlinked challenges but, at least in the technological domain, there are good solutions to build a future energy mix that can combine the security of supply, environmental protection, and economic performance both for investors and consumers.

Within the regionalization phase of Project Drawdown in Europe, this work collects several recent projections for the European Electricity generation mix towards 2050, in order to evaluate the contributions of three solar technologies (i.e. solutions) for both electricity generation and avoidance of GHG emissions, using the Drawdown model and methodology. Solar solutions assessed are photovoltaic in centralized scale (U-PV), distributed photovoltaic (D-PV), and concentrated solar power (CSP). This work directly links to targets 7.1.1; 7.1.2, 7.2.1.

To determine the impact potential of each solution requires a forecast of implementation based on estimated electricity generation for the period of study (2020-2050). We use the Drawdown Reduction and Replacement Solution (RRS) model that is an excel-based, bottom-up model, which promotes the comparison between projections of adoption of a given technology, versus using conventional technologies (Coal, Gas, Fuel Oil). The model determines the emissions that would be avoided between 2020-2050 by replacing these technologies with renewable solutions. In addition, it also computes the investment required to implement this solution.

The intent of this work is to report the current range of expectations towards solar energy technologies providing a reference against which current and future assessments can be compared to evaluate solar energy future role. In total, more than 50 reports were analyzed and have produced 37 interpolated annual projections of total EU electricity generation, and 16 projections for each solar technology growth. Techno-economic data of such technologies were also researched assembling a variable meta-analysis result for both solar solutions as well as conventional technologies. Sensitivity Analysis of the model was conducted throughout 72 iterations finding out that First Cost and Fuel Price are the two variables that most impact economic results of solutions.

Results of the analysis suggest that EU electricity generation and solar role by 2050 is still uncertain with a lot of variation depending on the type of studies, models used, and key assumptions (ranging from 3,732 - 10,455 TWh/y), with U-PV adoption of 146 - 2,181 TWh/y, D-PV adoption of 93 - 901 TWh/y and CSP adoption of 33 - 372 TWh/y. Together, solar-based solutions may account for 7% to 33% of total electricity generation in 2050. Over the next decades, solar adoption can avoid 1.32 - 26.31 Gt CO2e of GHG emissions and may require investments in between 233 - 2.230 billion €.

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Is energy poverty the missing link? Exploring the realities of intersecting Sustainable Development Goals with qualitative interviews

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Abstract

Energy poverty (EP) is a problem which can be applied in both the global south and the global north. While in the global south the phrase generally refers to a lack of access to an energy supply in the global north it generally refers to the inability to maintain a “decent” standard of living through the services energy provides. This situation is principally associated with the affordability of energy services rather than access to energy infrastructure. Global SDG 1 seeks to end all forms of poverty, SDG 7 to ensure access to affordable and clean energy and SDG 13 to take urgent action to tackle climate change. At the intersection of these three goals a challenge arises-how do we ensure access to an adequate level of energy services at a fair price without compromising climate change goals?

In Portugal, an impressively high rate of renewable uptake has coincided with a prevalence of the condition of energy poverty in both the winter and summer months. The mitigation of climate change is essential for the health and well-being of the global population, yet in the Portuguese case these broader benefits are obscured by a low capacity for citizens to reach indoor temperature thresholds recommended by global health bodies. This is attested by Portugal having one of the highest Excess Winter Death rates in Europe despite relatively mild winter temperatures. A prevalence of high energy prices, low rates of climatization equipment and a trend of “underconsumption” are further areas of concern. A key goal of the European energy transition is placing consumers at the “centre” of EU energy

policy, yet the future agency of Portuguese energy consumers has been questioned. The integrity of the climate agenda is thus compromised by a perpetuation of the inequalities inherently connected with fossil fuel-based energy systems.

In line with the Paris agreement, Portugal has released an ambitious carbon neutrality strategy for 2050, an important part of this strategy is a renovation of the building stock and the reduction of domestic energy consumption. Despite these policies recognising the need to assess and tackle EP, uncertainties remain regarding how these targets will balance with the mitigation of EP, particularly with reference to the accessibility of costly energy efficiency measures for disadvantaged households. Building on a stakeholder analysis which revealed a misalignment between the interests of the most influential groups in the energy transition with those of vulnerable consumers, this work explores the utility of qualitative interviews to assess areas of synergy and discord between the different stakeholder groups. Through a deeper understanding of the perspectives of these various groups, this research aims to contribute to improved policy alignment in the Portuguese case. Given the increasing interest in realizing the global energy transition this work also aspires to feed into better synergy between the various SDGs at a broader level on the premise that the conflicts identified herein are part of a wider systemic problem rather than being limited to Portugal alone.

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Exploring the Advocate-Journalists Role in Achieving Affordable and Clean Energy Solutions in Global South? The Case of Pakistan

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Abstract

Pakistan had been facing the worst ever electricity supply shortfall in its history largely due to the poor generation capacity from the year 2010 to 2019. To overcome this crisis, a number of solutions were worked out and a few of them were later started enacting in the year 2015. However, despite having a lot of potential to generate power from eco-friendly renewable sources, unfortunately, the decision-makers went for investing mostly in oil, gas and coal-fired power plants.

Between its 'Advocate-journalist' and 'Civic-advocacy' models (Waisbord, 2009), the former one carries an enormous potential to advocate affordable and clean energy systems to stimulate democratic dialogue among the public audience that eventually pushes leadership to pick eco-friendly energy solutions. This study critically analyses the extent of advocacy journalism's support to either dirty or clean energy solutions ***(SDG. Target: 07.02)*** in the editorial contents of mainstream Pakistani newspapers by using the quantitative content analysis method.

Results reveal that all selected newspapers excessively recommended dirty energy solutions to the policymakers. This professional inaptitude can be sensed from the fact that the most suggested and editorially advocated energy solutions were natural gas-based projects, despite the experts' cautions that they are as harmful to the environment as coal. Additionally, all newspapers went for advocating the dirtiest of the dirty energy solutions (i.e. gas and coal-based projects), possibly owing to the fact that the then government had given the highest-ever advertisements to the print media during the years 2015-16; and in the light of prevailing energy crisis, most of such advertisements were containing content to highlight the governmental efforts to address the said crisis. The focus of such advertisements was to assure the much-agitated public that their government is making serious efforts to avail all best-suited options (to the government), particularly the Chinese funded coal projects, gas ventures with Iran, Qatar and Turkmenistan.

An overwhelming amount of scientific evidence informs that Pakistan is among the richest countries in the world in terms of having enough solar energy opportunities. Another study computed the potential for renewable energies and reported an estimated power potential of 169, 15, 13 and 3 Gigawatts (GW) from solar, biomass, wind and small hydro sources respectively. However, the findings of such scientific studies are missing in the contemporary editorial contents of mainstream Pakistani newspapers. This also suggests the inefficiency of the 'advocate-journalist model' and reasons seem to lie either with the political economy of the press or the editorialists' inattention.

In any case, Waisbord's (2009) suggested 'civic advocacy' groups can play a vital role in helping to plug gaps by 1) perusing scientific studies on clean energy solutions from the academic community; 2)

communicating their findings to the advocate-journalists; 3) organizing journalists training workshops on how to use such findings to effectively influence environmental policymaking process; and 4) sharing with journalism academic community to ensure necessary amendments in relevant journalism course contents.

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Full papers

Review on Malaysia's Energy Legal Framework towards Realizing SDG 7 and SDG 13

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Abstract

Since the launch of Sustainable Development Goals (SDG) in 2015, Malaysia has been mainstreaming SDG in its development policies and plans. Among others, Malaysia aims to increase renewable energy (RE) share in its electricity generation mix to 20% by 2025. However, until 2019, RE penetration stood at only 2%. The authors employ a doctrinal research in reviewing energy-related policies and laws in Malaysia to identify the gaps between agenda setting and implementation. The data were gathered from primary sources including national policies and laws. The secondary sources are academic journals from online databases. It reveals that RE share failed to increase significantly after many years of planning. The paper also discovered that Malaysia has been slowed in moving into hydrogen dan fuel cell (HFC) industries despite the current world's trend. This will delay SDG 7, Target 7.2 of increasing the share of RE in the global energy mix by 2030. Further, by increasing the share of RE in its energy mix, this paper also come in line with SDG 13, Target 13.2 in reducing the greenhouse gas emissions. In time of crisis such as COVID-19, the closure of schools has forced the children to have their study at home. Hence, uninterrupted energy supply is crucial in online learning and working.

Keywords: Energy policy, climate change, carbon emission, renewable energy, SDG 7, SDG 13

1. Introduction

SDG has become the 'it' thing ever since it was adopted by the United Nation in 2015. Malaysia, as other countries, is also realigning its development plan to fulfil the SDG. This paper will focus on the aspect of SDG 7, Target 7.2 of increasing the share of RE in the global energy mix by 2030 and SDG 13, Target 13.2 in reducing the greenhouse gas emissions. Meanwhile on SDG 13, will be the effect of increasing the shares of renewable energy and transition towards HFC industries. Malaysia has put a target to have a 20% electricity generated from the RE by 2025. However, as of 2019, the penetration level of RE is only at 2% (Abdullah, Osman, Ab Kadir, & Verayiah, 2019). There is a huge gap there and Malaysia really need to do something about it. Malaysia also is still relying heavily on fossil fuels to as their sources of energy (Hannan et al., 2018). Continuing dependency on fossil fuels will not help Malaysia in reducing its GHG emissions (which resulted in climate change) and achieving energy security for the nation. Hence, this paper will review the policies and laws produced by Malaysia and recommend a way forward.

2. Methods

The paper employed a doctrinal research where the researchers review the energy-related policies and laws in Malaysia to find out what can further be done to achieve its RE target. The researchers obtained the materials for the review from primary and secondary sources. Policies and laws of Malaysia are the example of primary sources meanwhile academic journals and online articles are the example of secondary sources. The materials from primary sources are gathered mostly from official government's website meanwhile the materials from secondary sources are gathered from various databases and public domain such as Web of Science, Scopus and ScienceDirect. These materials were then transferred into a qualitative analysis Atlas.ti 8 software. In the Atlas.ti 8, the materials were 'scanned' using the 'word cloud' feature available in Atlas.ti 8. This is to fastest way to skim through all the materials gathered to determine whether they are relevant for our review. After deciding that they were relevant, the researchers began reading them one by one. These materials were themed and coded using the Atlas.ti 8 feature, according to the energy-related policies or laws in Malaysia.

3. Results

3.1 *Results from running the selected materials into Atlas.ti 8*

Figure 1 shows the word cloud generated from the selected material gathered from various online databases. The size of the words displayed means the frequency of the words appear in the selected materials. The bigger the size of the word, the higher the frequency of such word found in the selected materials. Based on Figure 1, "energy", "policy", "renewable", and "malaysia" are among the biggest in displayed and are relevant for the purpose of this review.

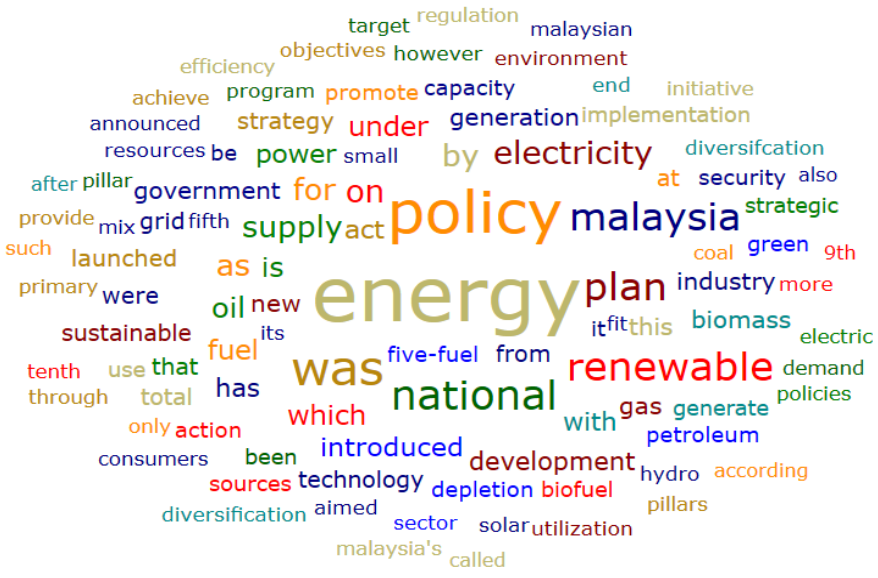

Figure 1. *Word cloud generated from selected materials.*

Figure 2 shows a 'spider-web' generated from the codes that has been put into one group named 'MY Energy Legal Framework'. This presented a nice view where the researchers can see what policies or laws that has been found for the purpose of the review.

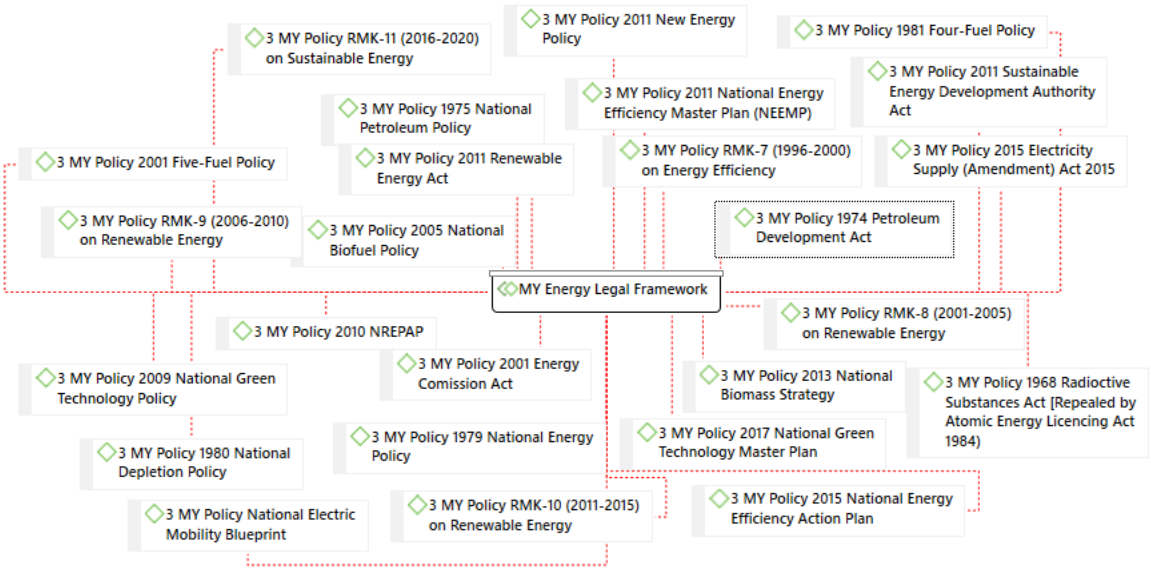

Figure 2. '*Spider-web' generated from selected materials been coded and put in a group.*

3.2 *Historical development of policies and laws related to energy sector in Malaysia.*

This paper will outline the energy-related policies and laws passed in Malaysia in a chronological order to help the readers understand how the energy sector developed in the country. The first energy-related law in Malaysia is the Petroleum Development Act 1974. The Preamble of the Act stated the purpose of this Act which is to provide exclusive rights on exploration of petroleum product in Malaysia to a government corporation named Petroleum Nasional Berhad (PETRONAS). In 1974, the National Petroleum Policy was introduced to ensure the petroleum sector is administered efficiently and to ensure that Malaysia exercise control over its petroleum resources (Jalal & Bodger, 2009).

In 1979, Malaysia produced the National Energy Policy with 3 main objectives. First, the policy aims to guarantee a sufficient, reliable, and cost-effective energy supply. Secondly, it encourages effective energy utilization and avoid wasteful use of energy. Finally, it aims to reduce adverse effects on the environment (Rahman Mohamed & Lee, 2006). The National Depletion Policy was developed in 1980 to ensure effective utilization and extend the lifespan of Malaysia's oil and gas reserves (Ong, Chin, & Yap, 2016).

Realizing that Malaysia cannot totally depend on petroleum, the Four-Fuel Diversification Policy was established in 1981. This aims to diversify Malaysia's sources of energy to gas, hydropower, and coal in its energy mix. Malaysia also enacted the Atomic Energy Licensing Act 1984 to regulate the atomic energy sector in Malaysia. Section 3 of the Act provides for the establishment of a body named Atomic Energy Licensing Board with powers prescribed under Section 8 to advise the government on matters related to atomic energy and to exercise control over the production and the use of atomic energy.

In 1990, Malaysia enacted the Electricity Supply Act 1990 to regulate the sector of electricity supply and all matters related to it. Section 3 of the Act provides for the establishment of a Commission. However, Section 3 has been repealed and the establishment of this Commission was made under Energy Commission Act 2001, named Energy Commission, based on Section 2 of the Act. According to Section 3, the functions of the Commission are, among others, to issue license to electricity provider and to promote efficient use of electricity.

Malaysia further enacted the Gas Supply Act in 1993 to regulate the supply of gas industry and all matter related to it. Section 3 of the Act provides for the establishment of a Commission; however, Section 3 has been repealed when the Energy Commission Act 2001 was passed. Preamble of the Act states that the purpose of the Act is to establish the Energy Commission that will regulate the energy supply in Malaysia and matters relating to it. Section 3 provides for the establishment of a body corporate named *Suruhanjaya Tenaga* (Energy Commission). Section 14 provides for the functions of the Energy Commission which are, among others, to promote efficiency in the use of electricity and gas supplied and to promote the use of renewable energy. ("Energy Commission Act 2001," 2001).

3.3. Support for the Energy Sector in the National Development Plan

Malaysia produces a document called 'Malaysia Plan' which provides a clear direction of the sector that the government will focus for every five-year period. Only in its Seventh Malaysia Plan (1996-2000) Malaysia included the energy efficiency's aspect. Malaysia released its Eight Malaysia Plan (2001-2005) and stressed the importance of diversifying its energy mix and thus plan to include the RE in its energy mix. This plan also proposed for the increase in R&D in the other alternatives energy such as HFC (*Eighth Malaysia Plan*, 2001). In the same year, Malaysia introduced the Five-Fuel Diversification Policy. The 'fifth fuel' introduced in its energy mix is RE. The goal of this policy is to spur the use of RE in its energy mix (Shaikh et al., 2017). The policy aims to have 5% of RE, which is equivalent to 500-600 MW, in its total electricity generation by 2005 (Hannan et al., 2018). However, the plan has failed to achieve its target when only 12 MW of electricity generated from RE was delivered to the national grid (Mekhilef, Barimani, Safari, & Salam, 2014).

Next, in 2006, Malaysia came out with its Ninth Malaysia Plan (2006-2010). This plan is significant as it created a system to support the HFC industries. The Five-Fuel policy is being continued in this plan

(Maulud & Saidi, 2012), while in 2009, Malaysia released its National Green Technology Policy to support the green technology sector. The policy focusses on achieving energy security and encouraging efficient use of energy. It also focusses on environmental protection and conservation, while aiming at using green technology to stimulate economic growth and improve the citizen's quality of life (Yatim, Mamat, Mohamad-Zailani, & Ramlee, 2016). The same year, the National Renewable Energy Policy and Action Plan was released to provide for a sustainable and reliable supply of energy in Malaysia (Mekhilef et al., 2014). It aims at increasing the RE's share in power generation mix and projects that 985 MW of electricity will be produced from the RE sources by 2015 (Foo, 2015). In 2010, Malaysia produced the National Policy on Climate Change. The policy covers both adaptation and mitigation aspects, particularly to reduce the GHG emission.

With a series of energy related policy established within the Ninth Malaysia Plan (2006-2010), the government released the Tenth Malaysia Plan (2011-2015) with a wider focus on the energy sector. The market-price system is introduced in energy pricing to reduce subsidy in the energy sector. The Renewable Anergy Act was passed in 2011 to put in place the feed-in tariff (FiT) system and boost the RE production. Section 23 of the Act provides for the establishment of Renewable Energy Fund, while Section 19 and 20 of the Act provides for how the Fund can be used for the FiT system for solar, biogas, biomass, small hydropower, solar photovoltaic, and geothermal.

In 2011, the government enacted the Sustainable Energy Development Authority (SEDA) Act 2011. Under Section 15 of the Act, SEDA will promote and implement the national renewable energy policy goals while stimulate, facilitate, and develop sustainable energy in Malaysia. 'Sustainable energy' is defined under Section 2 of the Act as energy, which in its generation, provision and use, meets the needs of the present generation without compromising the ability of the future generations to meet their needs, and this includes renewable energy. In 2013, Malaysia introduced the National Biomass Strategy after realizing at the potential of the huge amount waste generated from its agricultural sector, while in 2015, Malaysia launched the National Energy Efficiency Action Plan (2015) with the aim to promote energy efficiency to minimize wastage and encourage productive energy use.

Malaysia released the Eleventh Malaysia Plan (2016-2020) with the same goal of increasing RE shares in its energy mix, establishing green market and sustainable financing mechanism, and promoting low carbon mobility. The agenda for energy efficiency and rationalisation of subsidy continues under strategic thrust 6 that is pursuing green growth for sustainability and resilience. In 2017, Malaysia released the Green Technology Master Plan Malaysia (2017-2030) as a continuation of the National Green Technology Policy 2009. It aims at incorporating green technology in the energy, manufacturing, transportation, building, and waste and water sector. The same year, the Academy of Sciences Malaysia, a government think-tank body, released a document named The Blueprint for Fuel Cell Industries in Malaysia. This signals a new dimension of Malaysia energy sector by encouraging the integrity of the hydrogen infrastructure, fuel cell application, and emerging fuel cell technology. In 2019, the National

Transport Policy (2019-2030) was released to promote the use of cleaner fuels (such as biodiesel and electric vehicles) while reducing the overall GHG emission, while in 2020, the National Automotive Policy 2020 was launched to explore on the development of the automotive technology such as in hybrid, electric vehicle, and fuel cell vehicle.

Discussions

4.1 Effectiveness of the legal framework

To date, Malaysia has formulated and/or enacted 28 energy-related policies or laws from 1974 to 2020 and has been depending on petroleum to support its economic development. Figure 3 shows that petroleum holds 50% shares, followed by natural gas at 44% and coal and coke and hydropower and renewables at 4% and 2% respectively in 1997. The Petroleum Development Act 1974 was passed to signal the beginning of intensive oil and gas exploration by Petronas. Only after five years that the government realised that it should not leave the decision to explore to Petronas alone. Hence, the National Depletion Policy 1980 was introduced to extend the lifespan of Malaysia's oil and gas reserves. The government aware that it has failed to control the tin mining after independence and that has led to the scarcity of tins in the country. Ideally, the policy should be formulated much earlier, but better late than never. The policy was also relevant when the industry was badly affected after the first world oil-crisis in 1973, and the second world oil-crisis in 1979.

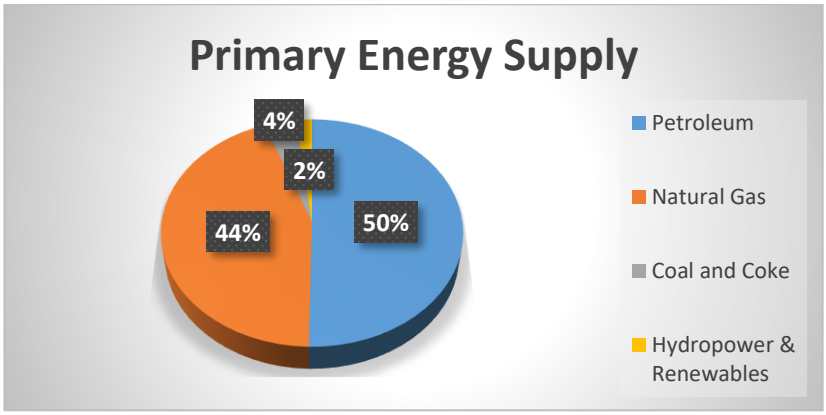

Figure 3. *Malaysia's primary energy supply in 1997 (National Energy Balance 2018, 2020)*

The continuous rising in demand for energy has triggered Malaysia to came out with more policy to diversify its energy generation mix. Malaysia introduced the Four-Fuel Diversification Policy in 1981 by shifting its focus to gas, coal, and hydropower in the energy mix besides petroleum. At this juncture, the phrase 'renewable energy' or RE is still alien to many. Only in the Eighth Malaysia Plan (2001-

2005) the government formally introduced RE as a source of energy in the country. To better execute the plan, Malaysia came out with the Five-Fuel Diversification Policy in 2001 which introduced RE as the 'fifth fuel'. The policy aims to have 5% of electricity generated from RE by the end of 2005, which is equivalent to around 500-600 MW. However, at the end of 2005, only 12 MW of electricity generated from RE was delivered to the national grid. This demonstrates that policy provides a platform for the government to set a certain targets for the sector, but it can only be implemented through effective laws and stakeholders participation (Azni & Khalid, 2021) and Malaysia failed to achieve the target set in the Five-Fuel Diversification Policy.

4.2 Effectiveness of the institutional framework

To regulate its electricity and gas supply industry, Malaysia enacted Energy Commission Act 2001. The Commission has the power to control the electricity and gas supply in Malaysia. In 2011, the Sustainable Energy Development Authority (SEDA) Act was passed to promote renewable energy in the electricity generation. In conjunction with this Act, the Renewable Energy Act 2011 was passed to allow SEDA to employ the FiT system to spur the RE industry. It is worth noting that the RE Act 2011 and the SEDA Act 2011 do not come into existence from thin air. Both laws originated from the proposal made in the National Renewable Energy Policy and Action Plan in 2009. At this juncture, it is safe to conclude that before any laws are enacted, there must be a policy that provide an overarching strategy for effective implementation of the legal and institutional set up that follows.

It is also important to emphasise that the RE 2011 was enacted to increase RE in the electricity generation mix, not the overall energy generation mix. Despite the list of policies and laws introduced thus far, Malaysia effort in increasing the share of RE in its electricity generation mix has not been successful since the RE penetration level is only at 2% in 2019. This is far from 20%'s target set by Malaysia to be achieved by 2025. Bakh et al. (2020) have laid down seven reasons of why the FiT system failed to spur the RE in the electricity generation mix as follows:

i) Increasing production cost for electricity generation;
ii) Loss of confidence among the investors;
iii) Loss of sense of competition among the investors;
iv) High degression rate contradicts the government targets;
v) FiT system ignores the inflation rate;
vi) FiT system does not cover average household;
vii) Long term investment payback.

Besides SEDA, the Malaysian Green Technology and Climate Change Centre (MGTCC) is the main agency that drives the low carbon city initiatives in the country. It has established the Low Carbon Cities Framework (LCCF) to guide local authorities to transform their cities as a low carbon city. However, there is a mismatch or misalignment of jurisdiction or authorities in the present institutional framework. The MGTCC is federal agency that regulate the sector while the funding is given by SEDA. Nevertheless, the LCC is to be initiated by the local authorities in their cities and they are under the purview of the Ministry of Housing and Local Government (MHLG).

Another concern about the implementation in Malaysia is the fact that local authorities operate under the state government. The federal government has made a pledge at the international level to reduce carbon emission by 40%. Questions remain as to how much carbon emission need to be reduced by the state government and eventually the local authorities. In fact, there are vast differences of carbon intensity in a city council and a district council.

4.3 Hydrogen Fuel Cell as a zero carbon energy

In the Ninth Malaysia Plan (2006-2010), finally, Malaysia is looking into creating a mechanism to provide support to the HFC industries. However, in the Tenth Malaysia Plan (2011-2015) and Eleventh Malaysia Plan (2016-2020), HFC is no longer mentioned in these plans (Azni & Khalid, 2021). However, HFC is highlighted in the National Transport Policy and National Automotive Policy 2020. National Transport Policy is looking into reducing the overall GHG emission in the transport sector by using cleaner fuels. Meanwhile the National Automotive Policy is looking at the development of technology's side in the automotive sector.

The world is moving towards HFC industries due to its clean nature where its only by-product is water and due to the vast source of hydrogen that can be found on Earth. As such, Malaysia should also embark into the HFC seriously. Currently, Malaysia only has The Blueprint for Fuel Cell Industries in Malaysia with regards to HFC industries. Even then, this policy came from the Academy of Sciences Malaysia. They are a body created to be the 'think tank' for matters related to science, engineering, technology, and innovation for the benefit of the nation. They are not an even agency under any of the Ministry. As such, although they made a good policy on what needs to be done to spur the HFC industries, if Malaysia did not make this policy as its national policy, HFC industries will never be the priority in Malaysia.

At this juncture, based on the various laws and policies that has been discussed above, it can be safely concluded policy and law are needed to develop any sector or industry. With policy, it will provide the direction of what needs to be done meanwhile with the law, the proper regulatory body can be formed,

sufficient fund can be channelled, and safety requirements can properly establish. Hence, that for the new industries such as the HFC industries to develop in Malaysia, it needs a proper policy and subsequently a law to better regulate the industries. This is crucial because HFC industries are not meant for electricity generation only, but for the whole energy sector. Thus, proper legal framework is needed.

By developing the HFC industries also, it will create a domino effect where the RE sector also will be expanded. This is because, if Malaysia is serious into fulfilling SDG 13, Target 13.2 in reducing the greenhouse gas emissions, the hydrogen to be used in the fuel cell, need to be a green hydrogen. Green hydrogen is a hydrogen that is produced from the renewable sources. As such, if investors are investing on the green hydrogen production, it will, in a way, be an investment in the RE sector also. This will further spur the RE sector. The increase of RE production in the energy mix will be in lined with the SDG 7, Target 7.2 of increasing the share of RE in the global energy mix by 2030.

4. Conclusions

Since the Eleventh Malaysia Plan, Malaysia has planned to increase the share of RE in the energy mix, create a sustainable financing system and establish green market, promote law on carbon mobility, continue subsidy rationalisation and energy efficiency agenda. These are bold step towards moving into affordable energy for all under SDG7. These agenda were put in strategic thrust number 6 which is pursuing green growth for sustainability and resilience. This will support implementation of the previous National Green Technology Policy, National Renewable Energy Policy and Action Plan, National Policy on Climate Change, National Biomass Strategy, and National Energy Efficiency Action Plan. However, the percentage use of green technology and RE remains low. Malaysia's energy mix is still dominated by fossil fuels, where it is the sources of GHG emissions. Since the fossil fuels are finite, it means that Malaysia still has not achieve a sustainable energy sector. More need to be done in term of streamlining the legal framework with the implementation agency on the ground. Only then the policy can be crystallized in a more effective and efficient manner.

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Life cycle assessment and life cycle costing of unitized regenerative fuel cells: a literature review

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Abstract

The design of a Polymer Electrolyte Membrane Unitized Regenerative Fuel Cell (PEM-URFC), a compact version of the regenerative PEM fuel cell with a single electrochemical cell, is one of the competent technologies for reducing fossil fuel consumption and greenhouse gases emissions linked to energy power production and energy storages issues. A URFC can produce hydrogen fuel, storing the excess energy produced (e.g., from renewable energy systems, solar plants) and electric energy in a fuel cell mode to meet the energy demands of a specific sector. Life Cycle Assessment and Life Cycle Costing are useful methods to evaluate the potential energy-environmental-economic benefits of these technologies, identifying the main hotspots and comparing them with traditional ones. The research here presented aims to analyse the state of the art of the application of the two methods, LCA and LCC, to the URFC, to verify what is already present in the literature to determine the research trend over the years. A systematic protocol has been chosen as the research method to provide a complete and minimally biased in defining the sample on the life cycle of the PEM-URFC and its components. Then a bibliometric and network analysis is carried out. Regarding the results, the review allows to obtain an overview of the materials and energy flows accounted for in the reversible operation of the device under consideration (i.e., the use of capable bifunctional electrocatalysts, prototypes, etc.) and of the resources and environmental, energy, and economic impacts. Results highlight that there is significant variability in the results, given by the selected boundary systems, the final users (e.g., industry, buildings, vehicles, production of electricity and hydrogen), and the steam reforming of the systems. Regarding the

technological features of components, no consensus was reached on the power, materials, and life cycle phases. The analysis highlights the need to have more scientific studies on LCAs and LCCs applied to PEM-URFC systems for evaluating the economic and environmental performances of the emerging technologies. Furthermore, in general, when these methods are combined with an energy model, the mandatory parameters of the life cycle approach are neglected or omitted, reporting limited information on the materials of the prototype studied or environmental /economic datasets. This paper reports the preliminary results of the literature review conducted. The full systematic analysis and methodological issues of the approach applied to the papers selected will be the object of future publications.

Keywords: unitized regenerative fuel cell (URFC), polymer electrolyte membrane (PEM), Life cycle assessment (LCA), Life cycle costing (LCC)

1 Introduction

In the last decades, the European Commission has proposed different energy plans for reducing Greenhouse gas emissions by 2030 to at least 55% compared to 1990, increasing energy efficiency and the use of sustainable energy sources (European Union, 2018). One of these is the new hydrogen strategy set by the European Green Deal (European Commission, 2019) that pushes towards the development of new sustainable hydrogen technologies. In this contest, one of the most relevant efforts into the implementation of hydrogen economy could be focalized on the Proton Exchange Membrane Unitized Regenerative Fuel Cell (PEM-URFC). Its original shape was called Discrete regenerative fuel cell (DRFC) that instead used the electrolyser and the fuel cell technologies separately into the same system. One of the main energy advantages of the URFC system is the possibility to increase self-consume of energy produced by renewable systems in building sectors, converting renewable electricity into hydrogen fuel and the fuel stored in electricity when required. This technology combines the functionality of both electrolyzer and fuel cell in the same bifunctional cell. However, due to the high cost of its main components, it is not still used for the building sector, but only in the military and aerospace fields (Wang et al., 2016; Dutta et al., 2017). To assess the potential energy-environmental-economic benefits of these technologies, Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) are useful methods. They allow to identify the main hotspots and to compare new technologies with conventional plants during their whole life cycle: from raw materials extraction to end-of-life treatments (ISO, 2006a, 2006b). Many researchers carried out a literature review on life cycle thinking approaches applied to both electrolyzer and fuel cell (Longo et al., 2017; Masoni & Zamagni, 2011; Abdelkareem et al., 2021). Based on the authors' knowledge, the available literature reviews on PEM-URFC focus only on its energy, economic and technological aspects, identifying that this system still requires additional optimization (Gabbasa et al., 2014; Millet et al., 2011; Paul & Andrews, 2017). Furthermore, these studies do not apply analysis to the entire life cycle of technology.

Concerning this research gap, the present study aims to evaluate the already existing knowledge on LCA and LCC applied to PEM-URFC and other PEM devices, highlighting the emerging research trends and any good practices and/or critical issues and gaps. In particular, the research questions addressed in this paper are: "What are the emerging research trends in PEM-URFC systems?" and "Which are the most relevant studies on LCA and LCC of PEM devices?". The objectives of this study are pursued by applying a systematic protocol for defining the sample of papers. Then, a bibliometric analysis is carried out to evaluate the trend of this research field. The results can assist efforts aiming at presenting knowledge on URFC economic and environmental performances and to identify patterns between authors, keywords, and subject area.

The paper is structured in 4 sections. After the introduction in which the contest and aim of the research are reported, the second section describes the methods applied for conducting the literature review. The third section presents the results and discussion, focusing on presenting the research trends, synthesizing bibliometric findings, and pointing out the main features of PEM devices. Furthermore, the last section remarks on the conclusion and future research perspectives.

2 Methods

A literature review of scientific articles is carried out to analyse the research trends of LCA and LCC studies applied to URFC, focusing on PEM devices. The systematic protocols used consists of 4 steps: i) identification of all the papers that contain specific words in the title, abstract, and authors' keywords; ii) application of screening processes to papers (fistful only on the title and abstract and then on full text); iii) collection and management of data; and iv) synthesis of quantitative and qualitative results in graphs and tables.

To identify the scientific literature, a search query was used which consisted of terms related to LCA, LCC, URFC, PEM, and other systems with similar technological properties (i.e., *fuel cell (PEMFC)* and *electrolyzer (PEMWE)*). The words were selected after a previous search on unitized regenerative fuel cells, briefly summarized into the results section, to provide an overview of the emerging research trend of the technology. The papers were collected by the Scopus database, limiting the analysis to English peer-reviewed articles. Instead, all the other documents, such as conference proceedings, book, review, and grey literature were excluded from the analysis. After the double screening process, the sample includes only papers published before February 2021 that respect the following eligibility criteria: i) the paper reports complete LCA and LCC studies and ii) focuses on PEM devices.

For each of the selected papers, bibliometric and technical data were collected. The bibliometric data includes data on authors, abstract, keywords, affiliations, journal, and year of publication. These data were analysed using two bibliometric platforms: "Analyse search results" function in Scopus and SciVal for statistical analysis (Elsevier, 2021). Both provide results in terms of the number of reports,

author institution, country. Furthermore, the latter tool allows to observe the research and keywords evolution into the last decades and to analyse the topics and subject area of the research, limiting the analysis to a declared period of publication (such as 2010-2019, 2015-2020, etc.). In addition to the statistical analysis, it was possible identifying the networks between bibliometric data through VoSviewer. Then, a discussion of the main technical features of case studies is proposed using the technical data. They were collected from the full-text interpretation to point out useful information on data assumptions for phases, datasets, lifespan, and features. The synthesized results could be used for improving life cycle thinking modelling for future research on hydrogen technologies and develop more feasibility studies.

3 Results and Discussion

3.1 URFC and Life cycle approach research trends

The URFC is an electrochemical device that converts electricity in hydrogen and hydrogen into electrical energy using a bifunctional electrochemical cell (Lucia, 2014; Wang et al., 2016). The bifunctional electrochemical cell combines into a single device the functions of fuel cell and electrolyzer components. Although the materials, design, and energy performance of URFC systems were analysed in literature by Gabbasa et al. (2014), the application of LCA and LCC analysis still needs to be investigated as demonstrated by the keyword search conducting in Scopus in February 2021.

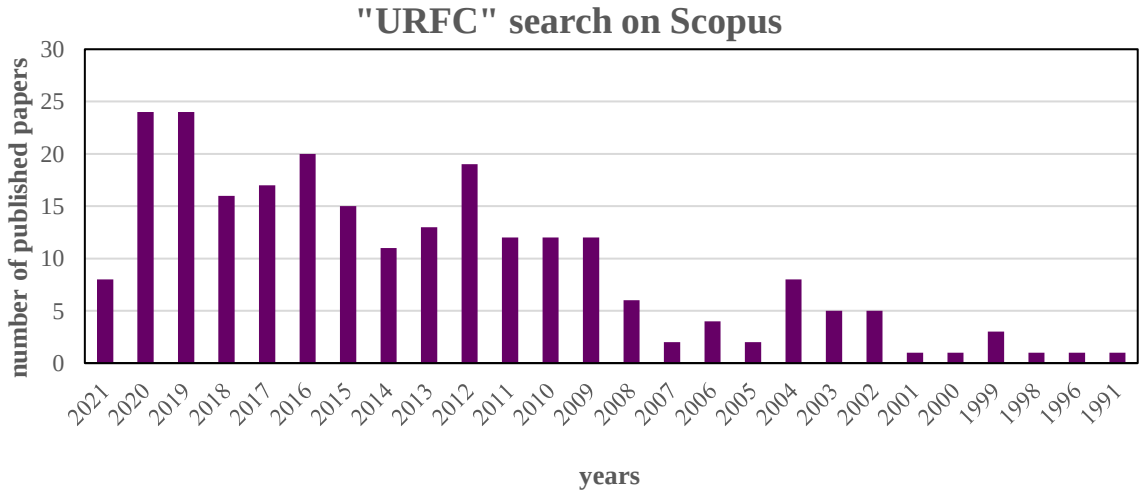

Figure 1 *Yearly trends of published papers on URFC systems*

The resulted sample was characterized by 243 documents that include the words URFC or "Unitized regenerative fuel cell" in title, abstract, and keywords, excluding articles that are related to the biological field. It was observed that the first documents on URFC systems were published in 1991 and 1996 (Chmielewski & Pyle, 1991; Murphy et al., 1996). Since that date, the interest in this technology has

grown exponentially, as reported in Figure 1. Concerning the documents published between 2015 and 2021 (123 papers), the main subject area involved in the research field is energy, chemistry, materials science, and engineering, working on topics such as electrolysis, regenerative fuel cell, and alkaline water (biggest green bubble) (Figure 2).

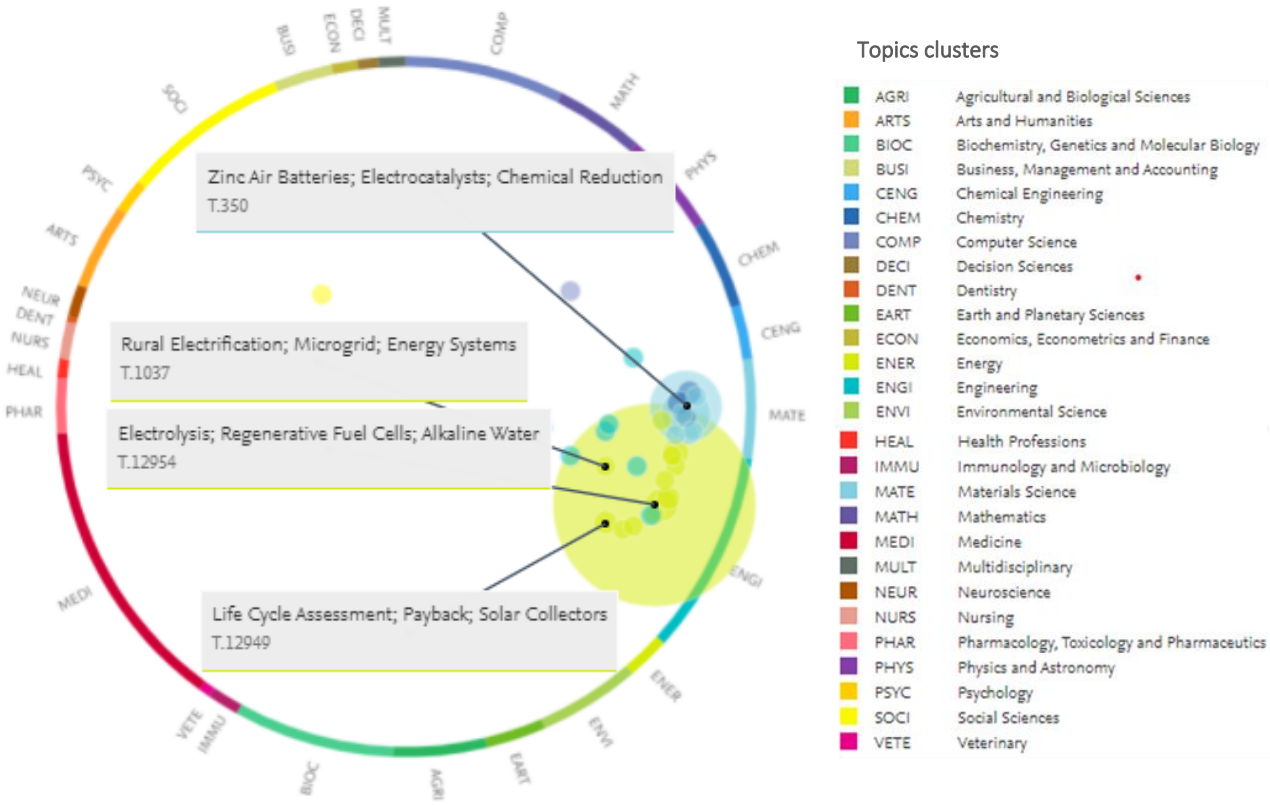

Figure 2 *Topics analysis of articles that report the keyword "URFC" in articles' title, abstract, and authors keywords - Year range: 2015 to 2021 Data source: Scopus, up to 19 May 2021*

Instead, others are clustered on topics linked to the energy vectors produced in URFC systems, such as hydrogen, electricity, and renewable energy. In other cases, the URFC system is associated with similar energy sustainable effects to batteries (small blue bubbles), accounting for both technologies that could be accomplished to renewable energy plants (e.g., wind turbine, photovoltaic panels, etc.) and storing energy vectors.

However, only a few documents are clustered in the life cycle assessment topic. Introducing the keywords "life cycle assessment" or "life cycle costing" the sample is reduced from 243 to 4 documents. Finally, adding the words "Proton Exchange Membrane" and/or PEM into the search queries, the sample includes only one peer-reviewed paper (Mendecka et al., 2020) and 2 conference articles. For that reason, to collect more reliable information on PEM device processes, such as costs, raw materials extraction, or recycling treatment as well as environmental datasets, the keyword search was expanded to fuel cell and electrolyzer as well as to regenerative fuel cell.

The latter search queries allowed to identify 80 documents, of which 45% were excluded because they do not respect the above-mentioned eligibility criteria and 1% was not available for the full-text screening. In the end, the sample includes 44 English peer-reviewed papers published from 2001 to 2021, confirming an increase of interest also in studying the PEM devices through the life cycle thinking approaches (Figure 3). While the field is still in an early growth stage, it has been rapidly evolving with exponential growth in the number of academic publications in the field in recent years. Instead, 78% of the sample has been published during the period from 2017 to 2021.

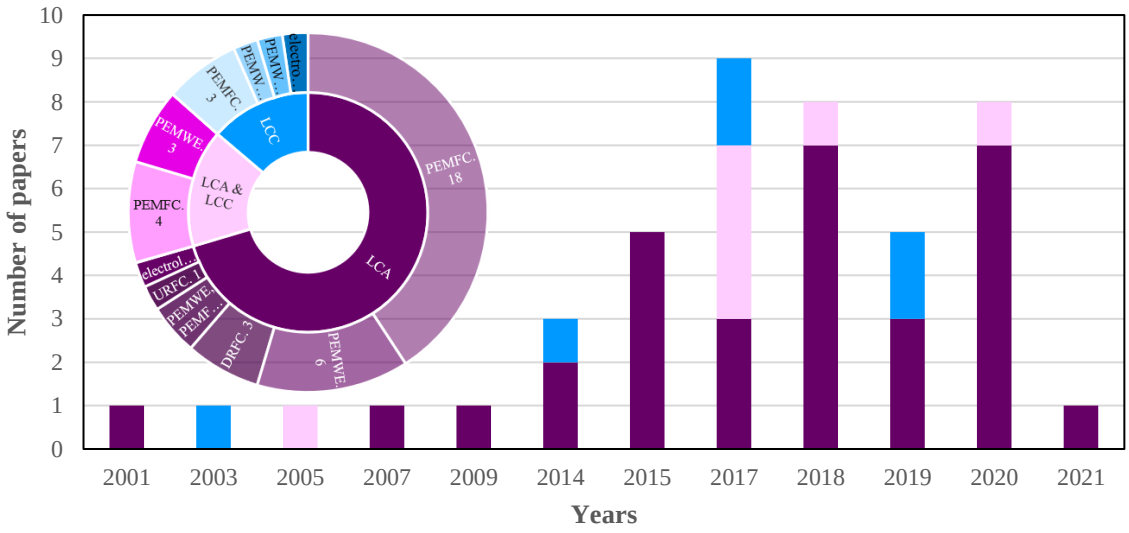

Figure 3 *Research trends of Life cycle thinking approach applied to PEM devises*

Concerning the final sample, several papers (31) applied LCA to different systems, followed by 7 papers that applied LCA and LCC to PEMFC and PEMWE. Finally, only 6 papers studied the PEM devices through LCC. Contrary to LCA (Masoni & Zamagni, 2011), standardized LCC methods or guidelines for the hydrogen sector are still missing, especially for PEM devices. As above mentioned, only one paper applied LCA to URFC. This paper aimed to evaluate the potential environmental benefits linked to a system that integrates a solar plant to the hydrogen technology of 100 kW usable for satisfying the commercial building needs (both electric and thermal loads) (Mendecka et al., 2020). In addition, the main goals of the other papers regard the evaluation of environmental and/or economic impacts, with the scope of identifying the main hot spots, optimizing the systems, and comparing the emerging technologies with conventional ones.

3.2 Main bibliometric findings

To analyse the most relevant aspects of the sample (e.g., topics, authors' collaboration, country, founding sponsor, etc.), a bibliometric and network analysis was conducted using Scopus, SciVal, and VosViewer tools. In addition, given the novelty of the technology, the temporal range accounted for

this section, according to SciVal, includes the papers published from 2015 to >2020. This helps in understanding the most relevant research in the field of LCA and LCC applied on PEM devices and their main correlations. This filter limited the sample to 36 papers (82% of final sample), excluding the 8 oldest LCA and LCC studies on PEMFC.

According to the first author information of the relevant literature, more than 148 authors and 67 institutions in 24 countries or regions have invested in LCA and/or LCC of PEM devices research. The leading countries in the literature included in the Scopus database are Italy (6 papers, 16.6%), Spain (6 papers, 16.6%), Switzerland (5 papers, 13.9%), United Kingdom (5 papers, 13.9%), Slovenia (4 papers, 11.1%) and others involved for less than 9% (Figure 4).

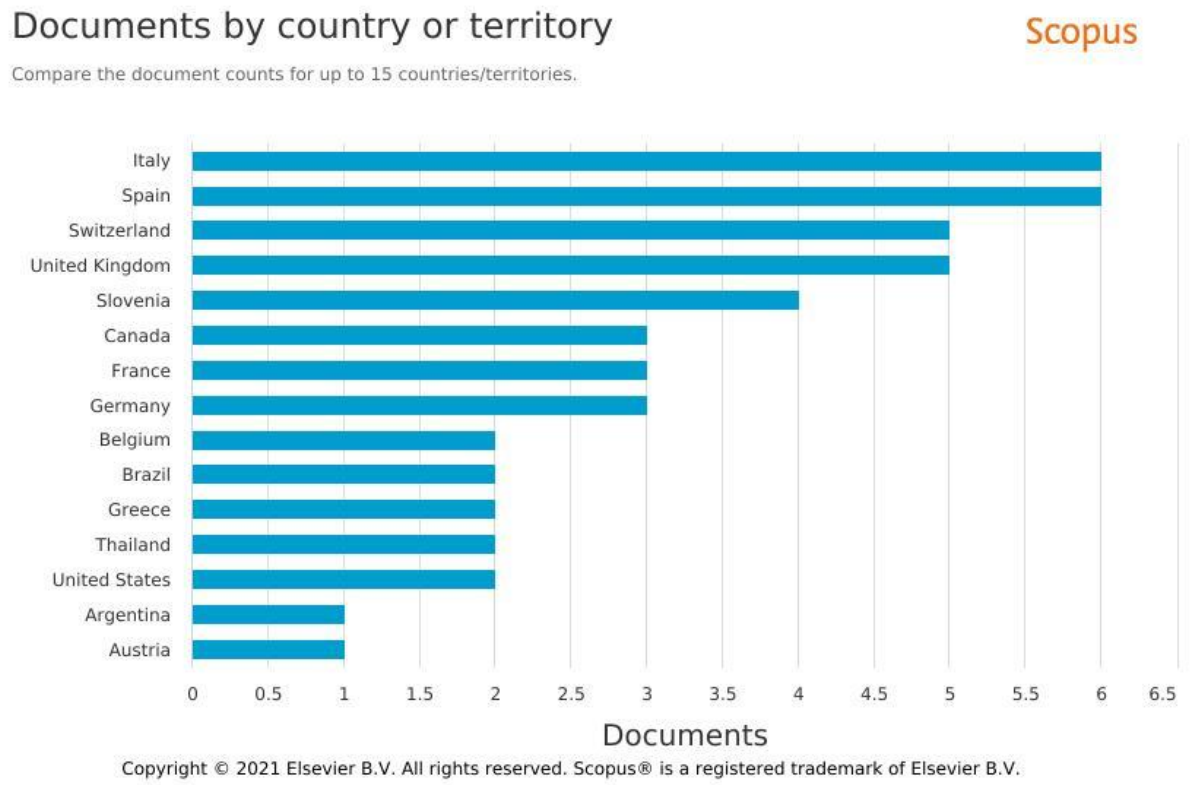

Figure 4. *Documents by top 15 countries involved in the research topic*

The documents are more than 36 because the analysis includes the affiliation country of each of the authors involved in the research collaboration. In particular, the authorship collaboration in the sample is characterized by international collaboration (44.4%); only national collaboration (33.3%); only institutional collaboration (19.4%) and 2.8% are single authorship (no collaboration) (sources: SciVal and Scopus). With VosViewer it was possible to observe the authorship collaboration from different countries. Figure 5 shows a strong collaboration between European countries, especially the United Kingdom that collaborated with Italy, Belgium, Spain, Greece, United Arab Emirates and Denmark.

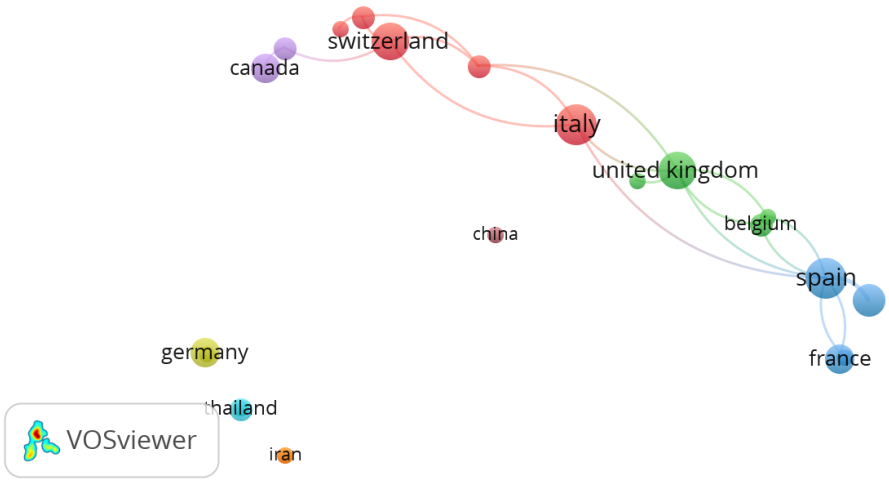

Figure 5. *Documents by the top 15 countries involved in the research topic*

Through Scopus, it was possible to observe which are the funding sponsors more interested in developing new sustainable hydrogen economy strategies and energy technologies. Figure 6 shows that the Fuel Cells and Hydrogen Joint Undertaking is the sponsor of 4 documents, followed by government agencies such as the European Commission, and ministries of the environment.

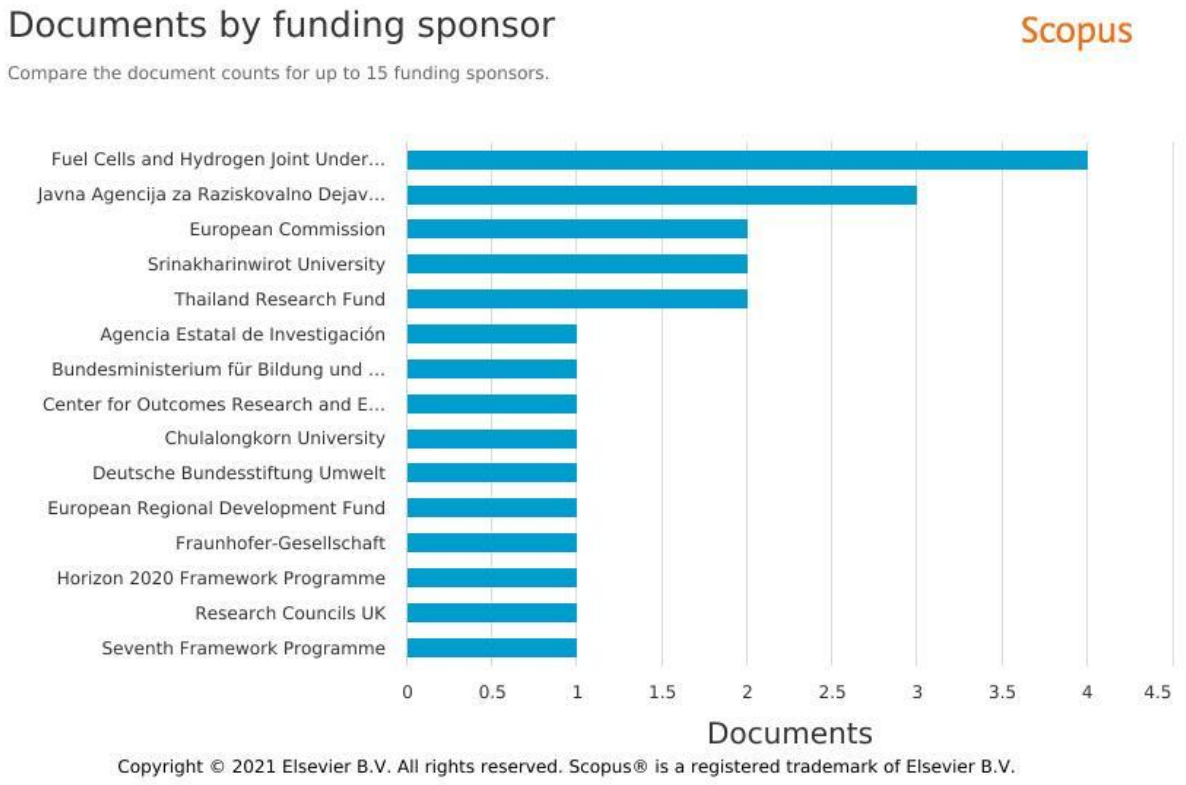

Figure 6 *Documents by founding sponsor (source: Scopus)*

The other sponsors consist of international research centres and universities. The interest of American and European authors is still increasing as shown in Figure 4, where almost 41 documents are linked to Europe and more than 8 with America. Instead, their government agencies are working to identify and develop hydrogen economy plans for reducing GHG emissions and improving the energy-environmental performances of their energy mixes by 2030.

The highest number of papers were published in scientific journals that focus on energy (37.5%), environmental science (20%), engineering (16.3%), and physics (13.8%) disciplines. In particular, the International Journal of Hydrogen Energy is the journal with the highest number of papers (10 papers) on LCA and LCC of PEM devices, followed by Applied energy (5) and Journal of Cleaner Production (3). Figure 7 shows a shift of the thematic of the 36 papers (in comparison to Figure 2) towards life cycle assessment, functional unit, and materials flow topics (second biggest green bubble).

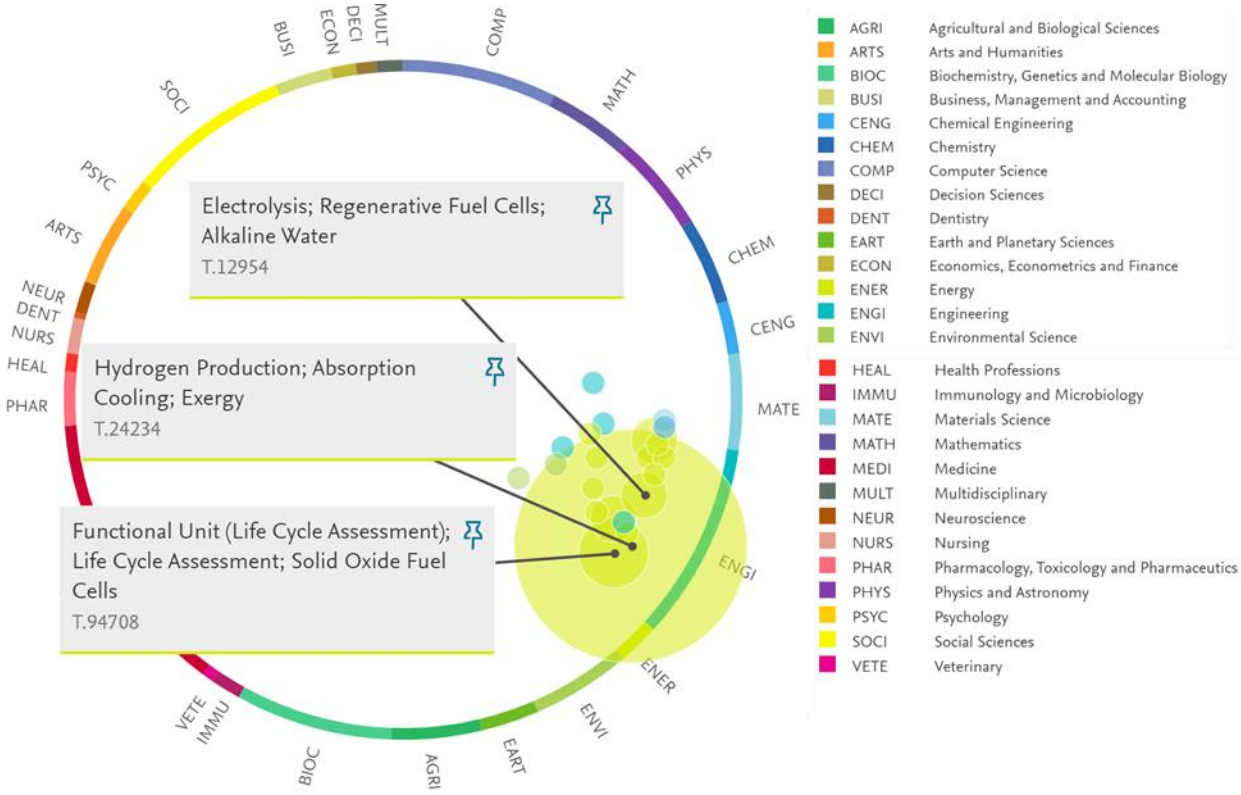

Figure 7 *Topics analysis of 36 articles - Year range: 2015 to 2021 Data source: Scopus, up to 19 May 2021*

Whit reference to the most relevant papers into the field, the SciVal calculated that the top 5 publications in the sample by the number of citations are: Parra et al. (2017) (cited 128 times); Zhang et al. (2015) (88); Simons & Bauer (2015) (67); Evangelisti et al. (2017) (56); Miotti et al. (2017) (53). These papers are the most cited because they report complete life cycle inventory data that are then used in other

literature studies for PEMFC and PEMWE. The fuel cell and electrolyzer have been several analysed in the literature, but the URFC systems have reached only an early stage of technology development.

3.3 Main modelled features of PEM devices

Concerning the main features of PEM devices, only 19 documents (published between 2009 and 2020) report detailed information on life cycle inventory and resource flows. Thus, it was possible to underline the main components of PEM devices as well as their main critical phases or rare materials. Except for the bifunctional cell, that is not yet thoroughly studied, the common components accounted for URFC systems and other PEM devices are: balance of plant, bipolar plates, gasket, gas diffusion layer, catalyst, membrane, and stacks. In addition to them, a storage system is required when hydrogen fuel is produced. Generally, the membrane is realized in Naftion, and the catalyst is commonly prepared in the form of an ink characterized by platinum and iridium. The storage instead is realized in steel and the gas diffusion layer in carbon fiber. The whole life cycle of PEM devices accounts for several phases (Figure 8): fuel/electricity production, manufacturing, assembly, market/distribution, operation & maintenance, end-of-life, and recycling/recovery.

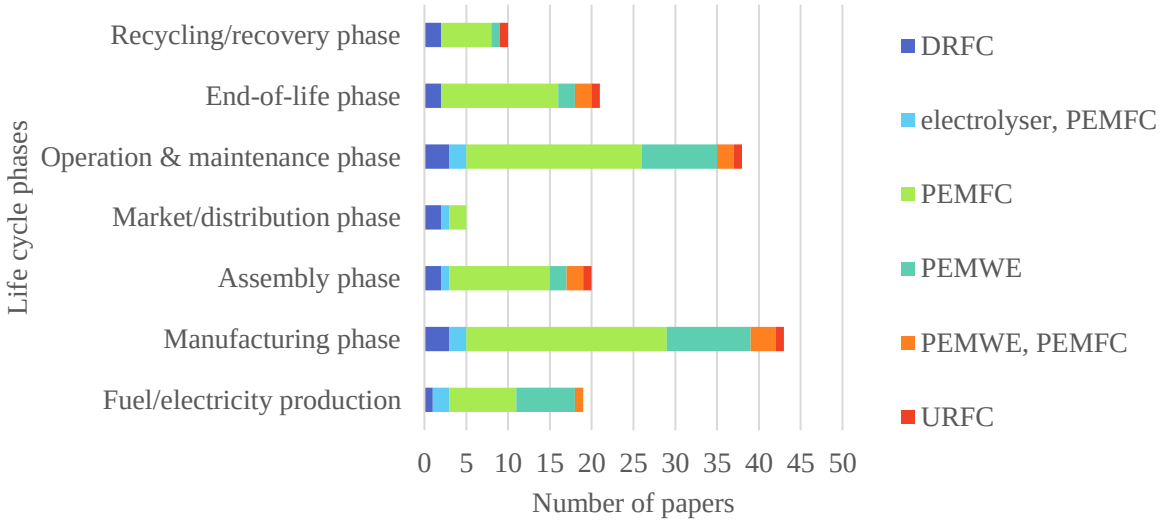

Figure 8. *Life cycle phases analysed for objects of studies*

Figure 7 shows that the most common phases studied are manufacturing (43/44) and operation and maintenance (38/44). To account for the potential recycling and recovery of rare materials, this phase has been accounted for in 10 papers. Furthermore, only 5 papers accounted for the economic and environmental effects connected to the transport, distribution, and marketing of PEM devices.

However, hydrogen technologies could be used for reducing CO_2 emissions in different sectors (European Commission, 2019). This generates greater variability in modelling the case studies. In fact, given the object of analysis, it was possible to cluster the sector of applications of the case studies in

industry (14 papers), power (6 papers), transport (12 papers), building (6 papers), and multi-sectors (6 papers). The papers included in the same categories are characterized by similar functions: e.g., hydrogen produced at a large scale for the industry sector, electricity generation for the power sector, or thermal and electric energy generation for satisfying the building loads, etc. The sector selected is also reflected in the assumptions made by authors on the operation phase, nominal power, and life span of the technologies. Concerning the latter, it was noticed that the life span was assumed to equal 30 years for the URFC system, instead it assumed in a range of 7.5-20 years for the PEMFC and PEMWE. Furthermore, when the PEMFC is used in the transport sector, its lifespan has been measured in kilometres (from 150000 to 300000 km) that change based on vehicle properties as well as life cycles of use. Concerning to whole life cycle modelling of URFC systems, reliable assumptions on co-products allocation, optimal functional unit, reliable economic and environmental datasets should be analysed in deep.

With reference to the environmental and economic impacts, the authors identify that the greater contributes are associated with the manufacturing and operation phase, including the electricity use for water electrolysis. Also, the highest impacts in manufacturing processes are linked to membrane assembly production processes and the raw materials such as platinum, although its small amount is used. Hydrogen production is an environmentally friendly process only if it is produced using renewable energy. However in 2019, about 75% of the annual global hydrogen was still produced by reforming natural gas (International Energy Agency, 2019), this process is considered in several papers that accounted for the hydrogen production in life cycle of fuel cell systems.

Furthermore, to provide additional information on technical variables and applied a multi-parameters analysis, 43% of the sample integrated the LCA and LCC with additional analysis, such as energy analysis, economic analysis, and environmental analysis that does not cover the whole life cycle of the technologies, but allow to estimate the features of their components, the energy efficiency, the energy consumed during the use phase, the environmental burdens, and other relevant data for the case studies. Integrating LCA and economic analysis is essential in some cases for economic allocation of the environmental impacts, especially when physical allocation is not representative of the environmental burdens of elements or co-products (e.g., the case of platinum recycled that represents less than 1% in weight of the technology) (Hank et al., 2019). When energy analysis is accomplished to LCA or LCC, only 4/13 papers report detailed inventory data. Instead, the others limited the data presentation to parameters set as input into the energy simulation tool.

4 Conclusions

This study comprehensively analysed the LCA and LCC of PEM-URFC related literature based on the Scopus database and bibliometric platforms (Scopus analysis of the results, SciVal, and VosViewer),

which present research trends in terms of the number of reports, distribution of countries, institutions, research topics and network between keywords used. Furthermore, a discussion of the technical data was conducted to highlight the main knowledge and research gaps on features and modelling approaches of PEM devices. The articles were selected applying a systemic protocol for avoiding bias and selecting English peer-reviewed papers. The additional eligibility criteria include papers that carried out complete LCA and LCC studies on PEM devices.

The preliminary research on URFC systems reveals that the researchers and developers are still focusing on the optimization of energy performances of the technologies, neglecting the analysis of potential environmental and economic benefits associated with their whole life cycle in comparison to the original plants.

Although guidelines on LCA for fuel cell and electrolyzer were proposed to harmonize the results, it is not still possible identifying guidelines for modelling LCC and LCA of URFC system based on literature knowledge. Although the information on some resources could be assimilated to that of other PEM devices, the life cycle assumptions and modelling aspects should be evaluated in deep with a focus on the URFC systems and their use in different sectors. In addition, during the operation stage, the electrochemical cell produces both hydrogen and oxygen or electricity. The oxygen produced e.g., could be stored, and then used for the inverse electrolyze mode or emitted in the environment. Given the limited number of research, no reliable assumptions, modelling approach or datasets are available for URFC. Future research in this field should focus on critical discussion of the methodological aspects of life cycle studies on the unitized regenerative fuel cell, pointing out the main reliable literature data and available environmental and economic datasets on treatment and manufacturing processes for this type of technology as well as well as identifying the good practices and critical issues.

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Sociotechnical Transitions: Stakeholder Engagement to Sustainable Energy System

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Abstract

The energy industry is highly complex, dependent on significant infrastructure networks, and heavily shaped by policy intervention and regulation. The challenge of decarbonization and pollutions means that we need new policy thinking and market designs that put these challenges at the centre of decision-making across the whole system. The governance of complex processes, such as energy transitions, has hitherto primarily been approached along two lines. On the one hand, there have been calls for a broadening of the knowledge base that informs decisions. There are also calls for additional actors' enrolment than the incumbent policymakers, technocrats, and innovators. In this context, Stakeholder Theory would be the basis for energy transitions towards sustainability understanding, allowing to explore the relationship of multiple actors in the energy system. This conceptual article, based on an integrative literature review, proposes to develop a theoretical background to bring the Stakeholder Theory and Actor-Network Theory closer to the debate on energy transition drawing potential interests and stakeholders in this context. The paper has three parts: In the first, it deals with actors and transitions, in the second, it discusses how the stakeholder theory and the Actor-Network Theory complement each other; the third deals with the discussion and potential contributions as to which Actor is an Interested Party in Energy Transitions. This study based its analysis on a pragmatic perspective. In this sense, the influential actor will manage the critical relationships. In the Stakeholder Salience stakeholders can be considered from three different attributes: Power, legitimacy, and urgency. According to the performed discussion, it is possible to categorize the energy sector stakeholders in four different groups, namely: i) Market and Financial Resources; ii) Value Chain; iii) Political and Institutional; iv) Organized Civil Society. These four categories consent creating social, environmental, and economic value for the organization, to the extent that its interests can be made compatible with the organizational goals. As for how this contribution relates to the acceleration of SDG in times of crises, it addresses the importance of stakeholder theory to enhance cooperation regarding clean energy research and technology. It is recommended to deepen the research on energy transitions, drawing an overview to understand relations with stakeholders in the energy transition to a more sustainable system.

Keywords: Energy Transitions; Sustainability; Sociotechnical Transitions; Stakeholders; Actor-Network Theory.

1. Introduction

Sustainability confronts managers with tensions between complex economic, environmental, and social issues, requiring new coping strategies (Hahn et al., 2014; Almeida et al., 2015; Subramaniam et al., 2020; Alkon & Wong, 2020). The conceptual idea of sustainable development emphasizes the need to address economic, social, and environmental factors, preserving the needs of future generations (Matos & Silvestre, 2013). Current environmental problems, such as climate change, loss of biodiversity and depletion of resources (drinking water, fossil fuels, food, forests, etc.) bring with them social challenges (Geels, 2011). Sustainable development is a perennial process of progressive social change (Kemp et al., 2007).

Regarding sustainable development linked to the energy sector, the transitions to a low-carbon future are not only technical and economic, but also deeply social (Delina & Janetos, 2018; Subramaniam et al., 2020; Berry, 2020; Lieu et al., 2020; Alkon & Wong, 2020). Companies have limited space for unilateral manoeuvres in relation to the multiple factors involved in these transitions (Berkhout, 2002).

Changing existing configurations to more sustainable ones is one of the wishes of contemporary times (Berkhout, 2002; Smith et al., 2005; Burch, 2010; Geels, 2011; Silva et al., 2019). Organizations and technologies are incorporated into broader social and economic systems, so that sustainable development requires changes in socio-technical systems and social transformations in beliefs, values, and governance - which evolve with technological changes (Rip & Kemp, 1998; Kemp et al., 2007; Burch, 2010).

Addressing such problems requires profound structural changes, the so-called sociotechnical transitions, which can only be conducted with the involvement of multiple actors (Geels, 2011). Energy supply is an important sociotechnical system, with great impact in social development and quality of live. The interactions between planning and transitions involving sustainability are notably interdisciplinary (Carroli, 2018). Intensified by the release of the Brundtland Report (1987), sustainability thinking related to organizations and their impacts has evolved and several theories have been proposed seeking to explore this relationship. As examples, the following can be mentioned: Institutional Theory; Agency Theory; Ecological Theories; Corporate Social Responsibility, Corporate Sustainability and Stakeholder Theory (Dimaggio & Powell, 1983; Srikantia & Bilimoria, 1997; Jensen & Meckling, 1979; Scott, 1987; Chang et al., 2017). It should be noted that institutional sociological theory appears in many studies related to organizational changes and is concerned with the way organizations seek legitimacy from isomorphism (Dimaggio & Powell, 1983; Srikantia & Bilimoria, 1997; Tolbert & Zucker, 1999; Doh & Guay, 2006; Markard et al., 2012).

Valkenburg & Cotella (2016) say that the governance of complex processes, such as energy transitions, large infrastructural projects, or comprehensive spatial planning issues, has hitherto primarily been approached along two lines. On the one hand, there have been calls for a broadening of the knowledge base that informs decisions. There are also calls for additional actors' enrollment than the incumbent policymakers, technocrats, and innovators.

Stakeholder Theory is a large body of knowledge that focuses on simultaneously considering the interests of various stakeholders (Freeman, 1984; Donaldson & Preston, 1995; Frooman, 1999; Berman et al., 1999; Choi & Wang, 2009; Parmar et al., 2010; Barnett et al., 2020). In this context, the Stakeholder Theory, associated with Actor-Network Theory (ANT), would serve as a basis for understanding sociotechnical transitions towards sustainability in the energy sector, allowing to explore the relationship of multiple actors.

This paper proposes, based on an integrative literature review using the SCOPUS, Science Direct, ISI and AOM bases, the development of a conceptual framework to bring the Stakeholder Theory and Actor-Network Theory (ANT) closer to the debate on energy transition drawing potential interests and stakeholders in this context, presenting a theoretical contribution to academia (Whetten, 2003). The term “integrative” comes from the integration of opinions, concepts or ideas from the research used in the method (Botelho et al., 2011).

An integrative review summarizes the past of empirical or theoretical literature, to provide a more comprehensive understanding of a particular phenomenon (Broome, 2000; Whitemore & Knafl, 2005). As inclusion or exclusion criteria, articles that included the descriptors "stakeholder theory" or "Actor-Network Theory" or "ANT" were considered, since the proposal was for researchers to connect both. Above all, research written in English was considered. Conference papers were excluded, but books published on ANT were later integrated. We sought to use papers from peer-to-peer review journals, with major scientific attention according to SCimago classification.

After the selection of theoretical articles, papers on socio-technical transitions and energy transitions were added, to emphasize the importance of the multiple actors of these processes. Theoretical synthesis provide support to researchers to draw inferences on the topic. In the present case, we sought to relate studies on stakeholder relevance with the notion of actors extracted from ANT.

2. Actors and Transitions

The field of transition studies examines the transitions of the entire economy and the sector, as in the sectors of energy, transport, chemicals, manufacturing, agriculture, and tourism (Bergh et al., 2011). No social change happens randomly or linearly. It tends to be a multidimension and multifactor process. Transitions are fundamental changes that take place in the social system. In

our current era, transitions are theorized as fundamental changes in the social system to solve problems (Frantzeskaki et al., 2012). Sectors such as energy supply, water supply or transport can be socio-technical systems (Markard et al., 2012). To promote socio-technical transformations, there are a series of structural, financial, regulatory, economic, and informational barriers that need to be overcome (Martin & Rice, 2012).

A technological regime is the set of rules incorporated into a complex of engineering practices, technologies of production processes, product characteristics, skills and procedures, ways of dealing with artifacts and relevant people, ways of defining problems; all these elements instilled in institutions and infrastructures (Geels, 2004). Sociotechnical regimes are path-dependent, with strong historical and institutional influences (Geels, 2011; Hynes, 2016; Carroli, 2018). These elements are reproduced, maintained, and transformed by actors such as firms and industries, public policy makers, politicians, consumers, civil society, engineers, and researchers (Geels, 2011).

Societal transitions therefore involve multiple actors, changes in their institutions, values, technologies, interactions in various sectors and scales (Holtz et al., 2015). Actors play their role in changing scenarios. It is necessary to separate who the actors are and what their nature is for the best combination of interests to be made in favor of the objective to be achieved.

Stakeholders, understood as capable of influencing goals, can be categorized into primary and secondary, as owners and non-owners; as holders of capital or intangible assets; agents or acted; rights holders, contractors, or influencers. They may relate voluntarily or involuntarily to the organization; be their resource providers or economically depend on their activity (Mitchell et al., 1997).

The primary ones would have control over resources, in general, while the secondary ones cannot directly influence, but they must undertake collective actions to influence companies (King, 2008; Soule, 2012; Barnett et al., 2020). Freeman's (1984) initial work introduced the central problem of Stakeholder theory, but the conceptual contribution of Donaldson and Preston (1995) structured much of the discussion by introducing the normative domain, which concerns the way managers must deal with interested parties (Berman et al., 1999).

The theory goes beyond the purely descriptive observation that organizations have stakeholders (Donaldson & Preston, 1995). Studies have successfully shown that paying more attention to stakeholders improves an organization's performance (Berman et al., 1999; Hillman & Keim, 2001; Choi & Wang, 2009). This theory originally focused on managerial aspects, and subsequently evolved and branched out in different directions, including business ethics, strategic management, finance, accounting, marketing, and administration (Parmar et al., 2010). In the information age,

secondary stakeholders are increasingly empowered to publicly pressure organizations and politicians to adopt, for example, more sustainable attitudes (Grégoire et al., 2015).

The participation spaces of various stakeholders can be analyzed in relation to the functions they fulfill, such as co-producing knowledge for action, understanding contemporary transitions and exploring sustainable solutions for transitions (Frantzeskaki & Rok, 2018).

The future of energy is not free from cultural, political, and, economic influence, therefore, must be approached with cosmopolitan and plural lenses (Delina & Janetos, 2018). Different actors play roles in this transition scenario and there are power imbalances (Frantzeskaki & Rok, 2018). The energy transition is a fertile ground for exploring climate justice and equality issues, as energy policy is often approached from a technocratic point of view, without adequate addressing important social issues such as inequalities of power linked to policy and public policy making (Lieu et al., 2020).

In addition, energy consumers themselves have raised expectations of how they should be recognized by the energy company, especially regarding reciprocity, being stakeholders to be considered in this context (Olkkonen et al. 2017).

It is estimated that cumulative investments of more than fifty trillion US dollars in energy supply and efficiency will be needed by 2035 to achieve the goal of keeping global warming below 2 ° C - which suggests the importance of different traditional financing agents for investments in infrastructure, such as governments, private banks and other financial institutions, capital market investors (IEA, 2014; OECD, 2015a). Capital allocation and commitment decisions in the energy sector are increasingly shaped by government policy measures and incentives. In many countries, governments have a direct influence on investment in the energy sector, for example, through the maintenance of oil and gas reserves or the control of power generation capacity by state-owned companies (IEA, 2014).

In this scenario, it is worth highlighting the role of activists and the media as critics (Matos & Silvestre, 2013), as well as the interest of the whole society in the transition to a low carbon economy, since the best mass transportation in cities can reduce the congestion and air pollution, improving its quality for all; distributed renewable energy infrastructure projects can improve access to energy in developing countries ; in addition to stimulating innovation through technology transfer and international cooperation (OECD, 2012; OECD, 2015b). Biodiversity is also affected by the negative externalities of emissions of gases into the atmosphere (OECD, 2012), so that non-governmental organizations committed to preservation ideals have legitimate interests in the energy transition process.

Actants may indicate human and non-human actors, and in a network take up its silhouette by virtue of their relations with one another (Latour, 2012). It is important to establish among all actors involved who are the main stakeholders, the ones whose interests can foster or block transition processes. The analysis of the interests of the various stakeholders can be used to link political rationality to technical rationality, so that resources can be mobilized for effective progress, helping to solve complex problems (Bryson et al., 2002).

For all the above, assuming that all actors matter and should be considered, assuming, in addition, that there are the dimensions of interest and influence, the problem that presents itself, under ethical bases (Donaldson & Preston, 1995) - taking into account that no manager has inexhaustible resources and time and no organizational theory offers, in isolation, systematic answers to questions about identification and relevance of transition agents (Mitchell et al., 1997) -, it concerns the way of identifying stakeholders, defining their attributes and mapping them in the context of sociotechnical transitions towards sustainability in the energy sector.

3. Stakeholder Theory & Actor-Network Theory: How do they complement each other?

It is fair to argue that all actors are potential stakeholders. The Stakeholder Theory reasons that all people or groups with legitimate interests that participate in an organization do so to obtain benefits and that, a priori, there would be no primacy of one set of interests and benefits over another (Freeman, 1984; Brenner & Cochran, 1991; Donaldson & Preston, 1995).

The word "stakeholder", as used now, appeared in an internal memo at the Stanford Research Institute in 1963 (Parmar et al., 2010). The foundation of the theory can be extracted from two basic questions, namely: What is the purpose of the organization? And what are your responsibilities to stakeholders? (Freeman, 1984; Freeman et al., 2004). These questions lead managers to articulate how they want to do business. It is a managerial theory, as it reflects and directs the action of managers. It is an idea about how business really works. It provides that for any business to be successful, it needs to create value for customers, suppliers, employees, the community, investors, shareholders, banks, and other people who hold capital. All together are responsible for something that none of them can create alone. You cannot view each stakeholder in isolation. The manager's job is to see how all these interests can be reconciled and conducted in the same direction, whether they are shareholders or non-shareholders of the company (Freeman, 1984; Bryson et al., 1985; Blair & Stout, 1999; Freeman et al., 2004; Sachs & Maurer, 2009).

Donaldson and Preston (1995) state that the Stakeholder Theory can be, and was, presented and used in several very different ways, involving very different evidence, criteria, and evaluation methodologies. There can be no confusion between the nature and purpose of the theory. These authors understand that each of the uses of the theory has its value, but that this differs depending on the

approach. There would be three different approaches or aspects in the light of the Stakeholder Theory, namely: Descriptive, instrumental, and normative.

The descriptive aspect of Stakeholder Theory reflects and explains the past, present and future states of organizations and their stakeholders. It is a simple description (Donaldson & Preston, 1995; Kaler, 2003). Brenner and Cochran (1991) use the Stakeholder Theory to describe the nature of the organization.

The instrumental aspect, from the point of view of Donaldson and Preston (1995), suggests implications from adhering to the principles and practices of interested parties for the purpose of achieving conventional corporate performance objectives in contrast to rival approaches, that is, if they pay attention the way in which support to the interests of stakeholders can meet the interests of the organization itself. And, in this sense, they indicate that a good part of the instrumental approach studies is of a quantitative nature, based on statistical data (ex.: Barton et al., 1989; Preston & Sapienza, 1990). The normative is the use of stakeholder theory to say what the "function" of companies should be and the "moral or philosophical guidelines" that they must follow in relation to their "operation and management" (Kaler, 2003).

The three approaches are not mutually exclusive, but they are aligned and can be supported (Kaler, 2003). For Donaldson & Preston (1995), the descriptive precision of the Stakeholder theory presupposes the truth of its central normative conception since it presupposes that managers and other agents consider the intrinsic value of the interests of the stakeholders. And the recognition of these moral values and obligations would provide the management of interests with their fundamental normative basis. The three aspects outlined by Donaldson & Preston (1995), being the central normative. Reflecting on the study by Donaldson & Preston (1995), Freeman (1999) states that his idea is rooted in a century-old philosophy of science, in which descriptive theory tells us what the world really is (in a sense of "it really is"). Descriptive stakeholder theory would describe how organizations manage or interact with stakeholders. The instrumental approach concerns the utilitarian view of means and ends, and the normative, in turn, translates a "must be", it would prescribe how organizations should treat each of their stakeholders.

In this 1999 article, Freeman (1999) states that the premises of his work “Strategic Management: A Stakeholder Approach”, from 1984, were built on instrumental bases. For the author, stakeholder management is fundamentally a pragmatic concept. Regardless of the merit, the content of the organizational objectives, the effective company will manage the relationships that are important to it (Freeman, 1984; Freeman, 1999). For Freeman (1999), more instrumental and less theories are needed that declare merely managerial duties based on general principles. The costs of resolving conflicts involving stakeholders can be very high for the organization (Bettinazzi & Feldman, 2019). Within this pragmatic perspective, we see the need for a tool that allows us to identify which interests deserve to be the object of management. Mitchell, Agle & Wood (1997) work offers a solution.

In the Stakeholder Salience (or relevance) model proposed by Mitchell, Agle and Wood (1997), Stakeholders can be identified and considered from three different attributes, namely: Power; legitimacy and urgency. First, the authors describe the types of stakeholders that emerge from various combinations of the three listed attributes.

They claim that the Agency's economic theories, Resource Dependence and Transaction Cost Theory are particularly useful in explaining why power plays such an important role in the attention managers give to stakeholders (Mitchell et al., 1997). The power attribute can be divided into coercive (physical strength); utilitarian (material resources, financial resources, investments) and normative (symbolic resources).

The attribute of legitimacy in management, in turn, can be understood, in short, as the public perception about the actions of a certain organization or entity. Suchman (1995) identifies three primary forms of legitimacy: pragmatic, based on the public's self-interest; moral, based on normative approval; and cognitive, based on the scope of actions and assumptions. Moral legitimacy is connected to the strength of the arguments for adopting actions (Habermas, 1984).

The urgency, in turn, concerns, according to Mitchel, Angle & Wood (1997), those whose demands are immediate, but only this emergency need is not enough to pressure the manager. From the combination of the three attributes (power, legitimacy, and urgency), seven categories can be logically analyzed. Not all combine the three attributes. Of the seven categories, three have only one attribute, three with two attributes and one with all attributes. With limited time and resources, managers cannot take care of the interests of those who do not have more than one attribute, since sometimes they cannot even identify them (Mitchel et al., 1997).

Regarding the maintenance of a close relationship with stakeholders, Jones et al. (2018) provide a model that illustrates, given a particular context and firm specific conditions, the incremental benefits of a close relationship capacity that may exceed the costs of a strategy used to develop and sustain this. A close relationship is a rare resource, difficult to imitate.

Verbeke & Tung (2013) propose adding a temporal dimension to stakeholder management theory and assess the implications thereof for firm-level competitive advantage. The authors point out distinct stages in a firm’s life should be considered and that content and salience of stakeholder’s claims may change over time. Effective stakeholder management must adapt to changes. A close relationship may help (Jones et al., 2018).

Concerning changes, social determinism arguments that technological changes and influences could be explained by social categories. Actor-Network Theory expands this understanding, affirming that any isolated perspective tends to fail. Not just social determinism, not just technological. What seems totally social is partly technological and vice versa. As can be seen, the interest of the stakeholder research resides, above all, in the organizational actors (collective persons) and human (individuals), although

the interference of several other elements in the paths taken by the socio-technical transitions is not unknown.

The Actor-Network Theory (ANT), in turn, presents itself as a good framework for analysis and discussion of the findings, since it is based on the perspective of Sociotechnical Systems (Socio-technical Systems or STS). ANT defends the free association of elements that are socially aggregated, whether social or technological (Latour, 2012).

The main feature of ANT is its focus on inanimate entities and their effects on social processes. For ANT, it does not matter whether the intervener is human or non-human. It has its origins in feminist-based studies in the field of medicine, which criticized and moved away from historically inherited dualisms, such as gender and professional interests. It became evident that the implicit recognition that artifacts are participants in social interaction did not become theoretically explicit. Non-humans need to be actors, not mere symbolic projections (Law, 1992; Prout, 1996; Latour, 2012).

The definition of an actor, in the light of ANT, is the source of an action, regardless of his human status or technological artifact (Cresswell et al., 2010). Thus, not only who chooses technology, but the technology itself can be considered an actor - for its handling features, or for the cost, it is selected and positioned. This intriguing notion admits that the artifact can exercise agency (Prout, 1996; Berg, 1999; Cresswell et al., 2010). The ANT brings a particular epistemological and ontological position, essentially considering a universe made up of networks, which can include humans, things, ideas, concepts, and all are considered actors in the network (Law, 1992; Prout, 1996; Cresswell et al., 2010; Latour, 2012).

As Stakeholders can be defined as a group or individual that can affect or is affected by the achievement of an organization's objective (Freeman, 2010) and this influence can be exercised in different ways, such as through the control of organizational resources, social movements, and even private policies (Barnett et al., 2020), the ideas from the ANT carry forward some concerns. How do we identify actor in the sociotechnical transition process – and specially in the energy transition process? Can any actor be a stakeholder in this context?

4. Discussions and Contributions as to which Actor is an Interested Party in Energy Transitions

To provide some answers to the questions above, we start by addressing stakeholders and discussing the Mitchell, Angle & Wood (1997) salient model. Adopting a pragmatic perspective of stakeholder theory, we argue that the influential actor will manage the critical relationships.

The authors assume that the relevance of interested parties will be low, where only one of the attributes - power, legitimacy, and urgency - is perceived. The importance will be moderate when two attributes are perceived by the managers. And it will be high, in turn, when the three attributes are present. Thus, in the first case, there are Latent Stakeholders (Asleep; Discretionary and Demanding / Demanding); in the second, the Expectants (Dangerous; Dominant, Dependent) and, finally, the Definitive (Mitchell et

al., 1997). The table below summarizes the content of each typology, according to Mitchell, Agle & Wood (1997).

Typology	Attributes	Features
Sleeping Stakeholders	Power	They have the power to impose their will, but they have no legitimacy or an urgent demand. It is difficult to predict when they may become relevant.
Discretionary Stakeholders	Legitimacy	Their claim has legitimacy, but they do not have the power to interfere, nor an urgent demand. Without power or urgency, there is no pressure on managers to meet their demands.
Demanding / Demanding Stakeholders	Urgency	Irritating, but harmless. They have urgent demands, but the noise of urgency is not enough to remove management.
Dominant Stakeholders	Power and Legitimacy	They have legitimate demands and the power to act on their behalf. They can be expected to have some formal mechanism to provoke management (eg, influence on the Board of Directors; good relations with the government and control bodies).
Dangerous Stakeholders	Power and Urgency	They have no legitimacy or formal intervention mechanisms, but their power may be manifested in a coercive manner, which is dangerous for the organization (eg strikers, protesters).
Dependent Stakeholders	Urgency and Legitimacy	The power in this relationship is not reciprocal, but, given the legitimacy and urgency of the demands in question, it can be obtained through the intervention of another stakeholder or through the appeal to the organization's internal values.
Definitive Stakeholders	Power, Urgency and Legitimacy	Priority for the organization. When the demand of a stakeholder with power and legitimacy is urgent, the tendency is to immediately attend to their request, therefore, they are the definitive stakeholders.

Table 1 - Typologies and Characteristics of Stakeholders
Source: Adapted from Mitchell, Agle and Wood (1997).

Also, it is relevant to mention the investigation of Bocken et al. (2013) on how companies can create balanced social, environmental, and economic value through the more sustainable integration of sustainability into the core of their business. In their results, the authors introduce three forms of value - value captured, value lost (destroyed or wasted) and opportunities for value creation - and four main groups of stakeholders (environment, society, customers, and network actors). Considering that the literature tends to focus on one of the interested parties, neglecting others, to facilitate a view of the value of the various stakeholders, the authors present a tool with five concentric circles segmenting the various interests.

The circular shape proposed by Bocken et al. (2013), provides a systemic perspective of organizational value, encourages the consideration of the interests of multiple stakeholders, as well as the interrelation between those interests. Each segment represented in the diagram represents a group of stakeholders. The same tool was also presented in a simplified version, which groups the value of the lost or destroyed type and allows greater flexibility in mapping stakeholders.

From these premises, it is possible to start a discussion about stakeholders in the context of socio-technical transitions towards sustainability in the energy sector. The elaboration of a transition management strategy involves multiple actors (Loorbach & Rotmans, 2010). Once a general model has been established for assessing the relevance of interests and mapping stakeholders, it is important to contextualize this model for the study environment, namely: sociotechnical transitions towards

sustainability in the energy sector. From the categories addressed in the discussion of the problem brought up in section 2 of the article, in a pragmatic perspective (Freeman, 1999), considering the mapping of value from Bocken et al. (2013), the typologies extracted from Mitchell Agle & Wood (1997) are framed.

In transition processes, pioneers are actants needed operating within and outside existing power structures. A transition arena, in general, is a network in which a collective process takes place informally, unexpectedly, and unplanned. The precise identification of these actors takes place based on the concrete analysis of the strategic organizational objective to be achieved, the challenges that arise and interests combined in each process (Matos & Silvestre, 2013).

A possible representation of stakeholders would be a plan with the following configuration: At the top level, there would be the definitive stakeholders, the latent ones with power and the most relevant expectants since they boast power among one of their attributes (power and urgency or power and legitimacy). At the bottom, there would be latent stakeholders with only one attribute (urgency or legitimacy) and expectants with urgency and legitimacy - noting that the urgency of the organization does not always coincide with the urgency of its stakeholders.

According to the definitions of Power, Legitimacy and Urgency extracted from the literature (Mitchell et al., 1997; Suchman, 1995) and based on the engagement of the stakeholders that emerge from the theoretical review presented, it is possible to categorize the stakeholders of organizations operating in the energy sector in four different groups, namely: i) Market and Financial Resources; ii) Value Chain; iii) Political and Institutional; iv) Organized Civil Society. These four categories allow the creation of social, environmental, and economic value for the organization, to the extent that its interests can be made compatible with the organizational objectives. Each of these groups is divided into several interested parties, which are illustrated in figure 5, below.

It should be noted that in the first group, it is possible to include competition, banks and other financial institutions, majority shareholders, members of the board of directors and investors in general. As a value chain, there are corporate customers, their representatives and captive consumers, employees, employers and professional unions, suppliers, business partners and the scientific community itself. In the political and institutional category, government authorities, regulatory bodies, parliament and political parties, international institutions and the press are classified as stakeholders of companies in the energy sector. Still, in the group of organized civil society, there are social and territorial entities, such as NGOs and foundations, traditional communities, local community, community leaders and opinion makers, as well as educational institutions in general.

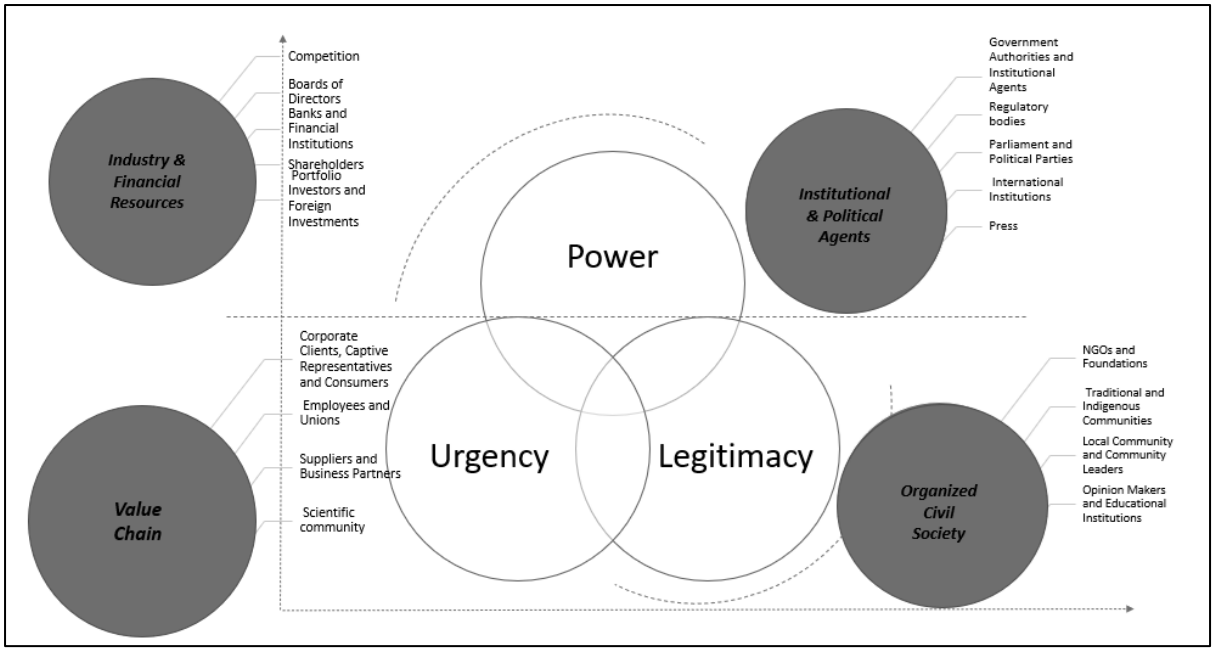

Figure 1 - Stakeholder classification
Source: The Authors (2020), based on Mitchell, Agle and Wood (1997).

It is possible to consider Latent Stakeholders as a group of secondary stakeholders in relation to the organization's objectives and Expectants and Definitors as primary Stakeholders. It is evident that such actors will be different depending on the context and the moment considered. In this sense, a possible categorization of typologies, based on the considerations above, would be exemplified in the table 2:

Typology	Stakeholder
Asleep	Banks; Development Banks and other financial institutions; International Markets
Discretionary	NGOs; Foundations
Demanding/ Demanding	Scientific community; Educational Institutions in general
Dominants	Government authorities; International Institutions; Regulatory bodies; Press; Industry; Energy generating companies in the traditional model.
Dangerous	Contributors; Unions; Corporate Customers and their representatives; Competition.
Dependents	Captive consumers; Traditional Communities; Local Communities; Community leaders; Opinion Makers; Niche Innovations (e.g.: new technologies or business models).
Definitive	Shareholders; Administrative Council; Investors; Institutional Agents in the Energy Sector.

Table 2 - Types and Categories of Stakeholders
Source: The Authors (2020), based on Mitchell, Agle and Wood (1997).

Due to the complexity of the context, it is inevitable that the different stakeholders have different interests (Freeman et al., 2004). Congregated objectives and different relationships can be driven by management, to create shared value, in a systemic way (Boken et al., 2013). Stakeholder involvement can contribute to the identification of problems not perceived, a priori, by the organization, as well as to offering creative solutions to these problems.

While it may sound controversial, ANT allows us to consider niche innovations as stakeholders in the transition process. Considering that the technology itself exerts an agency, it could exert pressure towards one or the other path to be adopted, either because it is better in qualitative terms, easier to implement or low cost, for example. Considering, however, that the level of niche is pressured by the

dominant technology, represented in the case of electricity by energy generating companies in the traditional model, niche innovations may have merit, that is, legitimacy in their positioning, but will depend on the power of another agent that drives them.

As the Mitchel, Agle & Wood (1997) Salient Model was built upon Stakeholder Theory, it does not consider point-blank a possibility of including non-human actors in each of the typologies. And, honestly, we suggest a further deepening of this theoretical approach that we sought to make in order to affirm that, for example, a certain innovative technology behaves as a dependent stakeholder and another that is already institutionalized as dominant.

5. Conclusions

The Stakeholder Theory associated to ANT provide enough substrate for assessing the fabric of socio-technical transitions in the energy sector, since this process is complex, requiring the involvement of multiple actors with different interests. It is understood that the objective was achieved from the dialogue of the academic literature.

Not all actors are considered stakeholders at all stages of transition process. The involvement of the organization's stakeholders in the establishment of operational strategies is important, as it allows the company to anticipate problems that may arise when implementing its projects. The first step towards the success of an engagement strategy is the mapping of stakeholders. It is necessary, however, to consider that organizational objectives need to be prioritized. Not every interest can be equally addressed by the company.

This study based its analysis on a pragmatic perspective. The attributes of power, urgency and legitimacy make it possible to establish the relevance of stakeholder interests with the company's objectives as the focal point. It must be said that the theoretical model presented is not static. Considering that the business environment is dynamic, a company will need to constantly evaluate the scenarios and their relationships to reposition the stakeholders and make decisions based on the present moment.

It is important to point out that the stakeholder theory focuses on human actors and the actor-network theory allows us to consider non-human actors. In the case of technological and social transitions, this perspective is extremely relevant. A non-human actor can prove to be a real obstacle to the continuity of a certain process, especially when its functioning differs from what was initially envisaged or desired.

Regarding the limitations of the study, it is pointed out that with more time it would be possible to further characterize the typologies now launched. As a suggestion for future research, it is recommended, in the field of quantitative studies, the development of a study based on descriptive statistics to empirically verify the typologies presented in this research and validate the theoretical framework of the categories that emerged in this framework.

In the field of qualitative research, it is highlighted that the study of relations with stakeholders can benefit significantly from the analysis of cases, able to provide details of the dynamics present in a situation. For future studies it would be important to further deepen this relationship between human and non-human actors. In addition, even the prospect that a non-human actor could solve a social problem, however to what extent human actors would allow potential replacement of the role previously played by them? Thus, it is recommended to deepen the research on energy transitions in the real contexts, drawing an overview to understand the role of relations with actors in the process of transition to more sustainable energy models, also, to identify, specifically, which actors present themselves as stakeholders at each moment.

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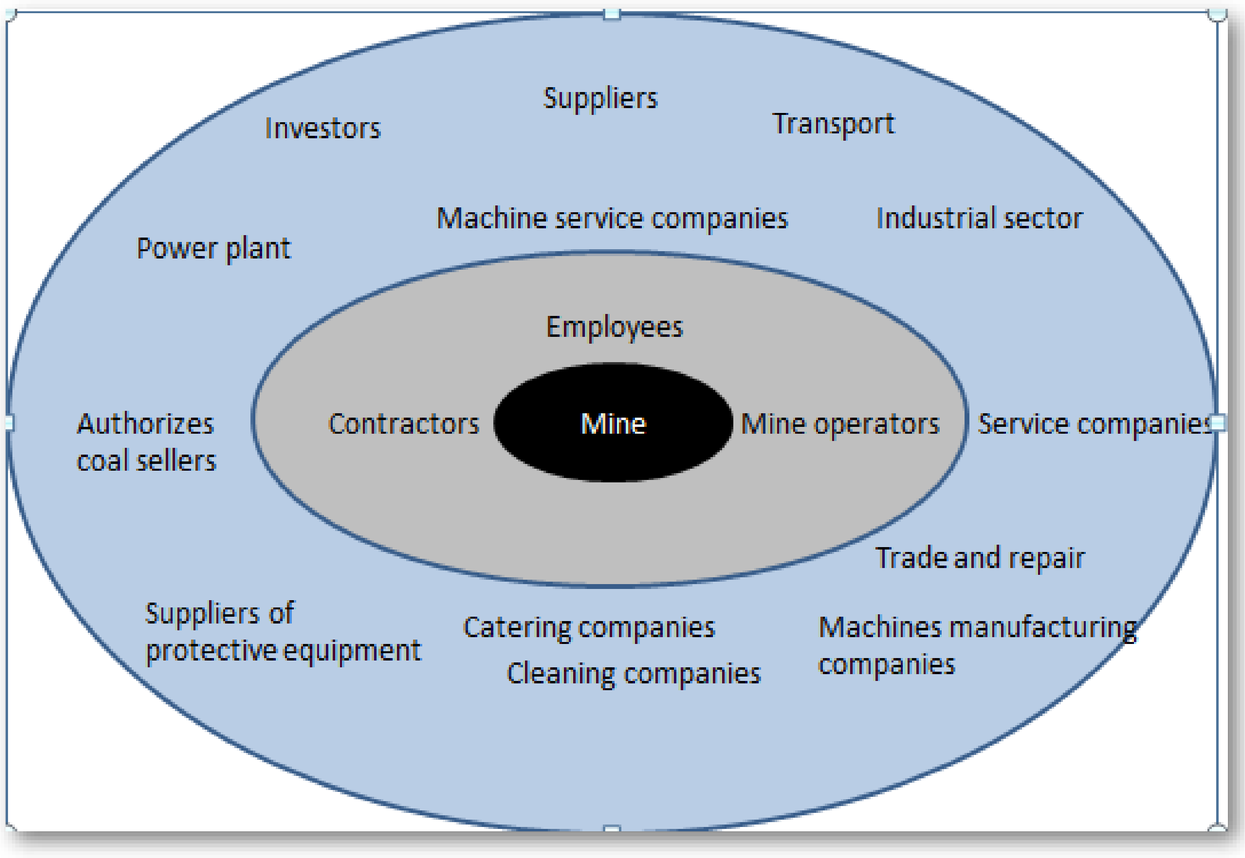
Posters

The 27th International Sustainable Development Research Society Conference
13–15 July 2021
Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis
Mid Sweden University
Virtual Conference, Sweden
Mittuniversitetet
MID SWEDEN UNIVERSITY

dr Olga Janikowska, Mineral and Energy Economy Research Institute of the Polish Academy of Sciences, Cracow, Poland
prof. Joanna Kulczycka, AGH University of Science and Technology, Faculty of Management, Cracow, Poland
dr Nikos Tsianos, Vasileios Koutsogiannis The Hellenic Society for the Promotion of Research and Development Methodologies, Athens, Greece

Energy Poverty and Sustainable Development Goals in Poland and Greece

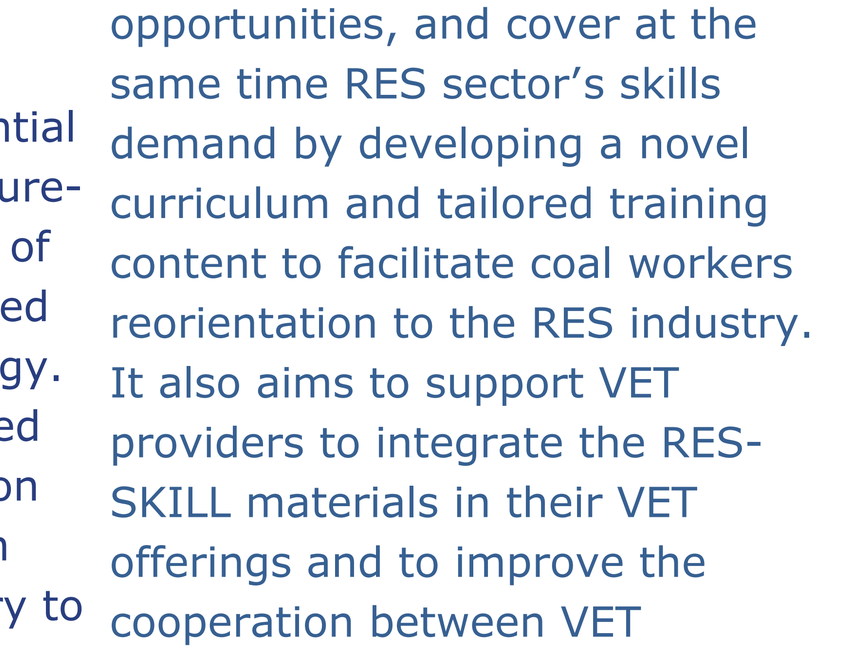
Energy poverty is described as the absence of sufficient choice in accessing adequate, affordable, reliable, high-quality, safe and environmentally benign energy services to support economic and human development. Energy poverty creates additional levels/dimension of poverty. The SDGs emphasize the direct linkage between household energy access and consumption and poverty and development.



In both Poland and Greece, there is a significant employment potential in modern and future-oriented branches of the economy related to renewable energy. Still, there is a need for job reorientation and reskilling from the mining industry to renewable energy systems.

A good example of a project dedicated to reskilling coal workers for the transition to the RES sector is the RES-SKILL project, in which both countries are represented. The goals of the project are to strengthen VET provision in the energy sector aimed at coal workers for compatible RES sector jobs, increase their reemployment opportunities, and cover at the same time RES sector's skills demand by developing a novel curriculum and tailored training content to facilitate coal workers reorientation to the RES industry. It also aims to support VET providers to integrate the RES-SKILL materials in their VET offerings and to improve the cooperation between VET providers and businesses, as this will provide opportunities for coal workers' transition to the RES sector.

The seventh goal of the Sustainable Development Goals (SDGs) is dedicated to ensuring access to affordable, reliable, sustainable and modern energy for all by 2030. The Paris Agreement was adopted by 196 Parties at COP 21 in Paris, on 12 of December 2015; according to its goals, global warming should be limited to well below 2, preferable 1.5 degrees Celsius compared to pre-industrial levels. To meet the 1.5 degrees Celsius goal, coal's share in global energy supply should drop between 73% and 97% by 2050. As so, the results of Paris Agreement affect world employment structure; the transition to a decarbonized economy is a chance for further development of the green jobs. To ensure that in the energy transformation processes no one is left behind, "just transition" was included as a part of 2015 Paris Agreement on climate change.



Digital one-stop-shop for residential buildings renovation in Portugal: “Menu de Renovação Verde” (The Green Menu)

www.menurenovacaoverde.pt

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Introduction

- Buildings use 40% of energy in the European Union (EU) [1].
- Approximately 80% of existing buildings in the EU will still be used in 2050 and 75% of this stock is energy inefficient [2].
- Heritage residential buildings (built before 1945) account for 23% of the EU’s building stock and retrofitting them is a particularly complex process where multiple levers of change need to be in harmony [3].
- Building renovation is a key area for the economic recovery from COVID-19 and current renovation rates are very low (around 1%) [2].
- Main barriers to renovation include information and market failures, lack of expertise, small-scale of projects and regulatory barriers [2,4].
- The European Commission has launched a ‘Renovation wave’, where worst performing buildings and energy poverty are key challenges [2].
- Previous work shows Portuguese dwellings’ low energy performance, lack of thermal comfort and energy poverty vulnerability [5].

Methods

In Project PAS2020 (Pan-European Approach on Sustainable Heritage: Regeneration by a retrofitting economy), co-funded by EIT Climate-KIC, the consortium developed country specific online one-stop-shops for building renovation – The Green Menus.

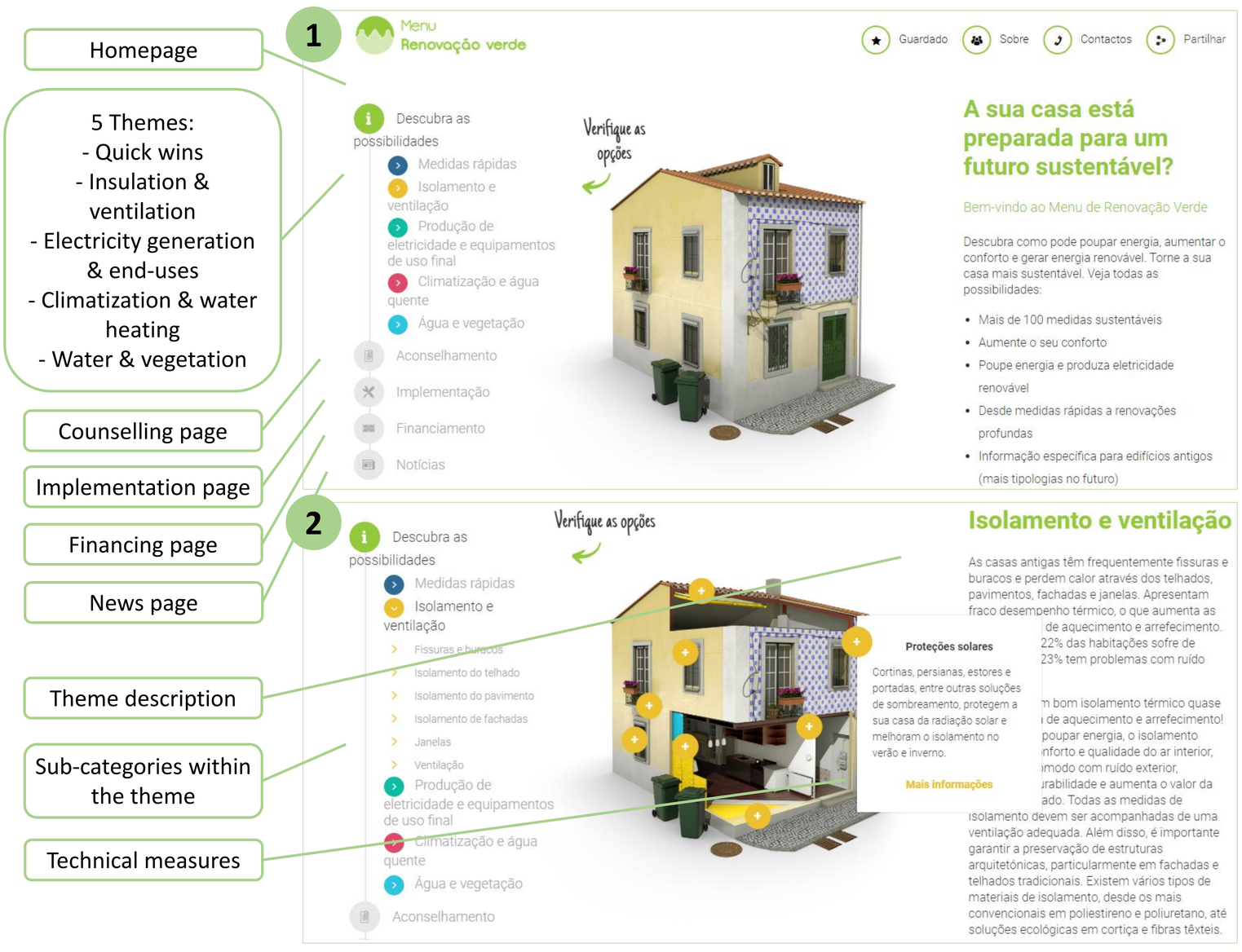
In Portugal, an iconic building typology from Lisbon was selected as a showcase of the process. Technical measures, financing tools and regulations were detailed using the existing Dutch Menu, previous work on PrioritEE project [6], and others (*e.g.* [7]).

Results

Main results are available online in the Portuguese Green Menu. A guided tour of the platform can be watched here: https://www.youtube.com/watch?v=zqZLRoVGHJA

In “Menu de Renovação Verde”, Portuguese citizens can find:

- 3D model for a traditional house from the Lisbon region
- Around 130 technical measures, tips, innovations and points of attention
- User-friendly calculation tools for 12 key measures estimating costs and savings
- Detailed information on 12 Portuguese financing schemes and fiscal benefits
- Relevant regulations and limitations for each renovation measure



Conclusions

The Green Menu provides a digital one-stop-shop for building renovation, closing information gaps, activating stakeholders, and accelerating heritage renovation. The platform enables access to context appropriate measures, without on-site visits, thus accounting for new business models and Covid-19 social distancing.

Green Menus are available to partner countries and further growth is anticipated by expanding to other building typologies and locations. In Portugal, the roll-out will follow two main strategies: increase the online footprint and bridge the gap towards real-world actions.

CENSE center for environmental and sustainability research

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In collaboration with: De Groene Grachten, ezavod

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5. Production, Consumption and Innovation

5a. Corporate Sustainability and CSR

Abstracts

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Revealing the discrepancies between idealistic role expectations and the 'lived' experiences of sustainability professionals in the construction industry

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Abstract

Despite high sustainability ambitions among companies, sustainability work is often decoupled from organizations' core operations. This is particularly challenging for the project-based environment in the construction industry, where the long term challenges of sustainability are not always coherent with the precise objectives and the time bound activities of construction projects. It is known that the success of implementing a sustainability agenda is dependent on how sustainability professionals and their practices are legitimized and given agency to act. However, although knowing the importance of clarity in roles and practices, surprisingly little research focus on the professionalization of environmental sustainability. Under the assumption that less tension between environmental practices and traditional building practices would lead to a faster transition towards sustainable cities and communities, the aim of this research is to identify discrepancies between idealistic role expectations and the lived experiences of working with sustainability. Preliminary findings are based on two data sets; 1) 163 sustainability job advertisements collected between October 2018 and June 2020, and 2) in-depth interviews with 30 sustainability professionals conducted between March 2019 and February 2020. On the basis of professionalism as a knowing-in-practice, and that professional practices are necessarily institutionalized (represented in discourses), the two data sets were compared and analysed using discourse analysis. Key terms describing either the idealistic role (job advertisements) or current work (interviews) were identified in each data set and thereafter compared. Preliminary findings show how organizations take generalized concepts of sustainability and comprise these into supportive compliance and control functions, which do not align with what is typically associated with sustainable development, such as transformational change and visionary work. For sustainability professionals, this creates ambiguous role expectations while having to manage contradictory identities of being both generalist and specialist depending on situated practice. Moreover, supporting across multiple organizational levels and disciplines create lock-in effects, where sustainability professionals lack a stable platform and agency to induce change over time. By marginalizing the role into a control function there is a risk that sustainability remains symbolic and ceremonial, which may lead to that no one takes responsibility for the transformative change that is needed to realize the SDGs. This study contributes to an emerging field of research on the professionalization of environmental sustainability roles in construction management. To practice, the study contributes by problematizing sustainability professionals' ability to drive and sustain a strategic and long-term sustainability agenda. Further, the study contributes to the SDGs by emphasizing the role of professionals in realizing sustainability Goal 11: Sustainable cities and communities, and sustainability Goal 17: Partnerships for the goals.

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Covid-19 impact and influence on environmental innovation efforts in manufacturing firms

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Abstract

Abstract

Many firms and their innovation activities have suffered from the consequences of the Covid-19 pandemic (hereafter called covid), and in this study we examine how covid has affected environmental innovation in manufacturing firms.

More specifically, we study how much impact covid have had on the firms, if and what kind of changes the firms have done due to covid, and environmental innovation efforts before and after covid. In order to examine these topics, we conduct a quantitative analysis based on data gathered through a questionnaire from N=526 Norwegian manufacturing firms. K-means clustering and OLS regression were used in the analysis process.

The findings reveal that negative impact from covid has a strong influence ($p>0.01$) on the overall innovative actions conducted by the firms. Next, we find that environmental innovation before covid is strongly related to environmental innovation during covid ($p<0.01$). Interestingly, negative impact from covid have a negative influence on the environmental innovation during covid ($p<0.01$) whereas general innovative actions conducted due to covid have a positive influence on environmental innovation during covid ($p<0.01$). Firms involved in environmental innovation before the pandemic thus continue to do this despite the circumstances, and actively innovating firms do indeed prioritize environmental innovation. Lastly, we differentiate less innovative and more innovative firms in terms of their pre-pandemic environmental innovation. The findings show that there are several distinctive differences between the groups, including that negative impact from covid has less negative influence on environmental innovation for already more innovative firms. Finally, we discuss implications of the findings both theoretically and practically, in light of how crises such as covid affects environmental innovation and why more innovative firms seem to be less affected by the pandemic.

SDGs

Since we study environmental innovation our paper relates to several of the SDGs including: 6. Clean water and sanitation (target 6.3), 7. Affordable and clean energy (target 7.2, 7.a), 9. Industry and infrastructure (target 9.4), 12. Responsible consumption and production (target 12.2, 12.4, 12.5), and 13. Climate action (target 13.2).

How the contribution relates to the conference “Accelerating progress towards SDG’s in times of crisis”

Since we study how environmental innovations efforts are affected by covid-19, we think that our paper fits perfectly into the theme of the conference.

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Incumbents in sustainability transitions in the context of transitioning economy: an onlook of incumbent actors' initiatives

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Abstract

Incumbent actors are becoming more prominent topic in the current scientific research of sustainability transitions. They are most known for their role as opponents of sustainability transitions; however, this notion is shifting and their role as promoters is being discussed more often. Nonetheless, geographical perspective might reveal how different regions respond to the issues of sustainable development. This abstract investigates current situation on incumbents in sustainability transitions in the context of post-soviet transitioning economy using scientific literature review that is illustrated with five sustainability-oriented examples of incumbencies in Lithuania. Objective of this research is to explore the initiatives of incumbent actors in sustainability transitions in transitioning economy. Research question: what initiatives do the incumbent actors in transitioning economy take in sustainability transitions?

The research method is deductive, derived from interesting information gathered from a research on tensions in organisations in sustainability transitions in Lithuania. Five examples of incumbent-like actors were selected to visualise the role of incumbent actors in sustainable transitions in a transitioning economy. These examples provide insights on initiatives that organisations that are already interested in sustainability take to promote sustainability ideas and be active members of the transition themselves, supporting the contemporary view of incumbents as agents of sustainable transitions.

The incumbent actors' examples of the transitioning economy reveal that there are organisations interested in a more sustainable society promoting sustainable decisions and influencing other actors of their environment to participate in the sustainable transitions, challenging the notion of incumbents actors as inhibitors of transitions towards sustainability.

This abstract relates to the SDG's Targets 8.3, 12.6, and 12.8, encouraging enterprises, especially large ones – incumbent-like actors, to actively promote sustainable development, build awareness, participate in policy and decision making, creating a more sustainable environment. This abstract looks at how incumbent organisations promote sustainable development, encourage their stakeholders to be more sustainability-oriented, how they act themselves, thus accelerating the progress towards SDG's in the crises of the modern world, such as climate change, diminishing natural resources, and the pandemics.

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A study on impact of Covid19 on CSR activities of select Indian companies

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Abstract

The paper explains the description of CSR activities undertaken by the selected Indian companies categorized under their respective industries. The paper further discusses the CSR activities undertaken in response to Covid19 along with its expenditure in comparison to previous year and the year of pandemic. The industries selected for the study are FMCG, Automobile and IT Sectors. The companies respectively under the selected industries are Dabur Ltd, HUL Ltd, Tata Ltd, Maruti Suzuki Ltd, Bajaj Auto Ltd, Mahindra & Mahindra Ltd, Wipro Ltd, Infosys Ltd and HCL Ltd. The paper analyses the prescribed and actual amounts spent by the select companies for its CSR activities. The paper also discusses how much and in what way these companies have contributed towards facing the pandemic.

The paper summarizes the CSR activities undertaken by the selected companies before the pandemic and the new CSR activities initiated during the pandemic. The paper also summarizes the amount spent on such activities by these companies for the past 3 years and discusses the activities and spendings done since the time of the pandemic. The paper compares the CSR performance between the select industries and its select companies and have been ranked on the basis of their percentages between prescribed and actual spendings. The paper comprises of findings and conclusions based on immense research of the facts published by the companies and various articles and literature. The paper also includes an in-depth descriptive statistics analysis combined with t-tests, taking into consideration the recent past years, evaluating the percentage change in the expenditure on CSR activities by the selected companies. This helped in understanding the impact Covid19 had on CSR activities since the inception of the pandemic and how the companies have modified their spendings according to the situation. The paper is helpful to understand the kind of change the pandemic had brought in, in regard to company's CSR activities.

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Corporate Sustainability of Indian Automobile Firms

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Abstract

Sustainable Development has emerged as global concern, being the key driver for government policy and corporate strategy. In this regard, nations had first agreed for millennium development goals (MDGs) and subsequently sustainable development goals (SDGs). Firms, too, found that to be sustainable, they need to incorporate the sustainability goals in their strategy. Hence, the relatively new

concept of Corporate sustainability (CS) was born. It has been gaining importance though the concept and its meaning is not yet well defined (Montiel, 2008 and Aras & Crowther, 2008). There is no widely accepted definition for CS today, however, several terms such as corporate sustainability, corporate social responsibility (Srivastava & Sahay, 2004 and Bhattacharya & Sahay, 2008) corporate citizenship, and stakeholding firm (Valor, 2005) have been coined. Further, the financial or nonfinancial-based approach of firms for sustainability is yet another important issue for CS debate. According to Salzmann et al., (2005), Weber (2008) and Schaltegger et al. (2012), numerous recent studies have focused on the business case of CS where corporate environmental and social efforts have been observed to enhance corporate financial performance. Dyllick and Hoeckerts (2002) found that some works went beyond the business case by highlighting the need for a new theory to merge environmental and social aspects with financial ones. Lozano et al. (2015), criticized the classical view emphasizing financial aspects of firms, by stating that many of these theories fit into the strategic management of firms rather than solve actual sustainability problems.

In this context the authors have undertaken the study of the sustainability reports of the Indian automobile companies. Though Government of India (GoI) has made corporate social responsibility (CSR) report mandatory, sustainability report is still voluntary. Automobile firms, however, are regularly making sustainability report, mostly following the GRI format. Though these companies are connected with many of the SDGs directly or indirectly, the focus of the study is on SDG 12. The inclusion of transparency underlying in the target 12.6 of the SDGs have encouraged these firms to adopt sustainable practices and integrate sustainability information in their reporting which had helped the firms to communicate and manage their contributions to the SDGs. However, there exists a dilemma about whether the sustainability practices adopted by the automobile companies result in better performance, especially with regard to profitability and customer satisfaction. This study, therefore, evaluates the influence of Sustainability Reporting on firm's financial and Customer satisfaction/delight performance but is limited to the listed Indian automobile manufacturers of passenger cars and two wheelers only. For measuring the financial performance, the secondary data was taken from the annual financial results, company websites and Securities and Exchange Board (SEBI) of India. For Customer satisfaction/delight performance Perceived Service Quality survey research was conducted on the existing and prospective customers of the selected organizations.

The existing theories like resource-based theory, stakeholder theory, knowledge based theory and legitimacy theory will be used to understand the promotion of economic, social and environmental response of the firm by adopting sustainability practices and providing a truthful sustainable report.

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Revisiting the relationship among corporate reputation, CSR engagement and CSR transparency

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Abstract

Findings from previous literature about the impact that CSR disclosure has on Corporate Reputation are mixed, although it is well documented that many stakeholders are reluctant to believe in this kind of initiatives. Nevertheless, literature suggests the key role that companies´ CSR engagement. On the one hand, it helps to build or maintain Corporate Reputation but it is process which requires long time. On the other hand, companies' irresponsible behaviours will have such as a consequence a quick and immediate destruction of Reputation.

Therefore, it is convenient considering both, CSR engagement and CSR disclosure, at the same time in research which tries to explain Corporate Reputation. Particularly, it is really helpful to understand if stakeholders perceived CSR disclosure such as a way of green-washing or an attempt of improving legitimacy (Symbolic Approach) or a reflection of their commitments (Substantive Approach).

Despite previous research, there is a lack of literature which try to explain changes in Corporate Reputation based on CSR engagement or disclosure. Therefore, the main aim of this manuscript is to analyse if changes of Corporate Reputation are explained by changes in CSR engagement and disclosure levels of companies.

The sample was composed of 150 listed firms which Corporate Reputation data available for years 2017 and 2018. Recent research on the topic suggests the convenience of not using a one-size-fits-all approach in order to overcome the heterogeneous results, so that companies of the sample are grouped. Corporate reputation data are based on the RepTrak provided by the Reputation Institute and collected manually by researchers from the reports available online. CSR engagement as well as CSR disclosure (measured by CSR transparency) data were based on data available on Eikon Thomson Reuters. CSR transparency variable was designed such as an index of content based on the variables reported by Eikon Thomson Reuters in order to be able to complement the CSR engagement level.

SDG+Target: 16.6

Companies accountability is key to accelerating the progress, particularly, in times of crisis

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Further evidence on the influence of corporate governance mechanisms on CSR: the role of CSR committee

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Abstract

Although there is a large body of literature on the impact that different Corporate Governance (CG) mechanisms have on the CSR commitment of companies, the role that CSR Committee plays in this relationship has not been studied in depth. At this regard, it is necessary to point out that most of the recent research on this topic usually includes the existence of a CSR committee as an explanatory variable for CSR company behaviour. However, the analysis has been stopped at this point and it has not gone further in the analysis of the characteristics of this Committee as well as of the characteristics of the Directors which belong to it.

Nevertheless, this topic of study is particularly relevant since the main functions of this Committee are usually linked with making recommendations to the Board of Directors about the promotion, development and implementation of a CSR strategy as well as they are in charge of the Sustainability/Non-Financial report. The lack of empirical evidence could be understood due to the recent creation of this kind of Committee in many companies.

Since the number of companies with a CSR committee has increased in the last years, the aim of this paper is to take a close look to the impact of CG mechanism on CSR by the study in depth of the CSR Committee characteristics.

The sample was composed of 104 European listed firms. The CSR committee data were available on Boardex Database although Corporate Governance report of companies have been analysed for filling missing information. Some of the characteristics analysed were CSR committee size, percentage of independent director on the CSR Committee, Gender Diversity on the CSR Committee as well as the fact that the existence of a Chairwoman on the Commission, and the presence of company CEO or Chairman on the CSR Committee. CSR data and control variables were available on DataStream. The period of the study was from 2014 until 2019. The data are statistically analysed considering Data Panel methodology, and later fixed or random effects are chosen depending on Hausman test.

SDG+Target: 16.6

Companies CSR commitment is key to accelerating the progress, particularly, in times of crisis. It depends on the Corporate Governance mechanisms of each company.

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Internal carbon pricing as a tool for corporate sustainability – does practice measure up to theory?

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Abstract

Internal carbon pricing as a tool for corporate sustainability – does practice measure up to theory?

Addressing the issue of climate change is a key component of the sustainability strategy of most companies today. The management tools applied in this area have greatly evolved in recent years, starting with the simple measurement and reporting of greenhouse gas emissions and progressing to accounting for carbon emissions across entire value chains, to setting quantified – and recently, even science-based – emission reduction targets, to assessing and disclosing financial risks associated with climate change. Another relatively new element in this arsenal of climate change-related management tools is internal carbon pricing. According to CDP, globally around 1300 companies are currently engaged in setting internal carbon prices.

These can take various forms, including shadow prices (hypothetical prices) used in the assessment of their operations and future investment plans, and internal fees which are actually charged to business units within the company based on their carbon emissions. Internal carbon pricing is mainly adopted by companies in order to increase resilience in the face of future climate-change related regulations including mandatory carbon pricing policies, and/or to help achieve internal emission reduction targets. For this reason, companies' internal carbon pricing strategies are closely linked to their expectations regarding the evolution of carbon pricing regulations. Such regulations, in the form of carbon taxes or emissions trading systems are increasingly prevalent across the world with scope as well as prices expected to increase continuously. As yet, however, most of these mandatory systems use carbon prices that are significantly below the recommendations of climate economists.

The aim of this research is to compare the assumptions, methods and actual prices used by companies in internal carbon pricing with theoretical and policy approaches to establishing a carbon price. Internal carbon prices as available in the database of the CDP will be used for the comparison alongside the carbon pricing database of the World Bank - these prices will be compared to the prices found in the theoretical literature on the social cost of carbon and the shadow price of carbon, as well as to "official" carbon prices used in policy analysis in countries where these exist.

Since the expectation is that mandatory carbon prices will increase in the future to more closely align with theoretically recommended prices, and the main aim of internal carbon pricing is to prepare companies for these changes, it is worthwhile to examine how the internal prices applied by companies today measure up against the theoretical recommendations. In addition to the risk management perspective, such a comparison may also help to assess whether internal carbon prices as currently

applied represent a sufficient contribution by these companies to sustainable development with regard to climate change.

SDG+target: 9.4. Carbon pricing (both external and internal) can be a powerful tool in encouraging innovation and putting economies and companies on a low-carbon development trajectory – however, a comparison with theoretical prices is needed to assess whether the prices applied under these systems today sufficiently encourage progress.

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Enhancing Environmental Management Strategies and Competency in Small and Medium Enterprises: Exploring Collaborative Systems Approaches to Support Sustainable Development

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Abstract

Small and medium enterprises (SMEs) may have smaller environmental footprints in comparison with larger firms, yet they represent a substantial proportion of the industrial sector, and are collectively responsible for significant impacts on the environment as well as society. Based on their aggregate contribution to the overall burden on the environment, SMEs can be a major factor in moving society toward environmental sustainability and in achieving global goals for sustainable development. Yet many are not positioned to do so.

SMEs in the supply chain are under increasing pressure from industrial customers and other stakeholders to demonstrate sound environmental management and sustainable practices, often through implementation of environmental management systems that conform to internationally recognized standards, such as ISO 14001. Yet these smaller firms face particular challenges and constraints in implementing formalized systems to improve environmental performance. While ISO 14001 is promoted as a management solution to enable firms of any type or size to achieve environmental goals in support of sustainable development, there are asymmetries in system implementation and resulting performance in organizations that adopt the Standard. Given the resource constraints experienced by smaller organizations and the cost, effort, and competencies required for system implementation, it may offer limited value at a high price, with minimal improvement in environmental performance.

This research focuses on collaborative strategies to enhance environmental management competency in SMEs, as a means to support sustainable development. Considering the potential benefits of a management systems approach in enhancing environmental performance as well as global supply chain pressures for ISO 14001 adoption, the paper focuses on partnerships to enhance environmental management and management systems competency in smaller firms. This includes opportunities for leveraging supplier networks as well as academic and private partnerships. The study is exploratory, and draws from the results of ISO's 2013 survey of ISO 14001 users as well as multi-disciplinary literature and case studies that involve cooperative strategies and outreach to build capabilities and competency for sustainable development.

In terms of broader impacts, this research can enable deeper insights on the factors and challenges that affect environmental management efforts in SMEs, as well as how various stakeholders, including academic institutions and industrial customers may be positioned to contribute toward innovative and collaborative solutions. This can benefit SMEs in developed as well as developing countries directly through value creation and capture associated with effective and efficient environmental management, and can ultimately benefit society through collective environmental performance improvement.

The research relates directly to Sustainable Development Goal 12, *Ensure sustainable consumption and production patterns*. It connects to a number of the related targets indirectly, but connects in particular to targets 12.4, for environmentally sound management of chemicals and wastes, and 12.a, to strengthen capacity to move toward sustainable production in developing countries. To an extent, this work also relates to Goal 17, *Partnerships for the goals,* and target 17.16, to enhance the global partnership for sustainable development, through sharing of knowledge and expertise to support achievement of the goals.

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The impact of CSR initiatives on consumer's attitudes and perceptions towards retailers' products

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Abstract

This research aims to analyze how retailers' endorsement of socially responsible and sustainable practices impact consumers' attitudes and perceptions towards retailers' products and its consequent adoption. Despite the apparent strong commitment by both retailers and manufacturing organizations on the development of sustainable practices, little is known to what extent these actions really have an impact on consumers' perceptions towards companies and its products. This is a critical and highly relevant issue, since reaching a common understanding about the need to improve global well-being is also dependent on consumers' proneness to adopt products that follow socially responsible and sustainable practices. Living in an era where global well-being is at the heart of policy making and is shaping businesses' operations, this research analyzes how retailers' endorsement of socially responsible and sustainable practices impact consumers' preferences at the point of sale.

Two experimental studies in which CSR practices were manipulated, revealed that in general, CSR practices have a positive impact on consumers' perceptions towards the retailer. However, findings indicate different impact, depending on the type of CSR initiative that consumers are presented with. With these findings we expect to contribute to a better understanding on the type of CSR initiatives that companies should communicate to consumers to leverage its adoption of sustainable products.

Study 1 followed a 2(CSR initiative type: philantropic, environmental) x 2(green consumption values: average, high) between subjects design. Results suggest that consumers' willingness to pay extra for products is higher for environmental than philanthropic initiatives. Further analysis, this time considering consumers' green values, indicate that high green consumers seem to infer higher product quality when retailers engage in environmental initiatives, while average green consumers seem to anticipate higher shopping experience when presented with an initiative of philanthropic nature.

Study 2 followed a four group between-subjects design (CSR initiative type: control, social, environmental, philanthropic), with the *green consumption values'* moderator assessed as a measured variable. Results further reinforced previous findings. A multiple regression analysis was conducted and an interaction effect was found for the quality perceptions dependent variable but also on the purchase intention for the product sold by retailer, indicating an overall preference for initiatives of environmental nature.

Overall, findings reveal interesting insights, highlighting how different CSR initiatives may have different impact in terms of product quality, willingness to pay, purchase intentions and shopping experience perceptions.

The present research, with its strong focus on understanding consumers' reactions and preferences towards different CSR initiatives aims to encourage companies to adopt sustainable practices that indeed have an impact on contributing to a better world, relating with SDG 12.6- "Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle".

Full papers

Sustainability Strategies of Social Enterprises

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Abstract

For a social enterprise, creating a social impact and ensuring financial viability are inseparable. It embraces this duality and towards that end, forever, there is a hanging sword by their neck. It is a challenge for a social enterprise to create social value while keeping the financials in place. There have been many studies that have talked about socio-economic tensions and conflicting logics arising out of this duality but what comes as a red flag because of this dual nature of the enterprise remains relatively less explored. This duality of balancing its social and economic mission poses a threat to the sustainability of the enterprise. As a consequence, social enterprises use different strategies and enablers to achieve their sustainability. Our study focuses on the little explored area of social entrepreneurship (SE) literature, i.e. how does a social enterprise achieve sustainability and what are the strategies it adopts to fulfil its socio-economic mission? In this regard, we followed a narrative approach to capture the essence of the strategies that the two social enterprises; JanaJal and Goonj, adopt to ensure enterprise sustainability. Our study reports legitimacy and rhetoric as primary enablers that help the two social enterprises achieve sustainability. Since SE literature is itself in an evolving stage of being understood and conceptualized, this study intends to contribute to a better understanding of the ways in which social enterprises are ensuring their sustainability and the strategies they are adopting to remain sustainable.

Keywords: Social Entrepreneurship, Social Enterprise Sustainability, Legitimacy, Rhetorics, Sustainability Strategies

1. Introduction

'Sustainability' is a broad field of research spreading across multiple scientific disciplines. In this study, we take a firm-level perspective and use the term to mean the sustainability of an enterprise/firm having a key focus on a social mission while creating economic value. Such an enterprise is defined as a 'social enterprise' (Mair and Marti, 2006*)*. Hence, 'sustainability' in this study is limited to ensuring the existence of an organization while it strives to fulfil its mission. Sustainability at the firm-level was initially about 'double bottom line', which extended into the 'triple bottom line' concept. Triple bottom line is defined as having social, economic and environmental attributes (Peredo and Mclean, 2006). In social enterprises, sustainability is not limited to only the financial dimension, but concerns entrepreneurial sustainability (Huckle, 2006), economic sustainability (Alter, 2007) and social sustainability (Hood, 1991) as a whole. Burkett (2010) believes that sustainability for a social enterprise has two sides; the financial sustainability aspect which ensures corporate endurance over a period of time, while the other aspect is related to the social impact it creates to achieve its social missions. Sustainability is a challenge for a social enterprise right from the time of its inception, owing to the very nature of a social enterprise (SE) that combines conflicting social and economic objectives. Social Enterprises are sustainability-oriented models, mission driven businesses, social businesses or hybrid models (Borzaga et al, 2014). Thus, there is constant tension within the organization threatening its survival. Peredo & McLean (2006) indicate that there are hurdles and obstacles that social entrepreneur's face which often hinders new social entrepreneurial ventures from coming into the fray. Sustainability of a social enterprise is achieved by applying right strategies, its effective communication and contextualization for sustainable development (Bull and Crompton, 2006). Social enterprises have played a key role in the grassroots level economic activities in both developed and developing countries. Owing to its complexity of operations, there remains a challenge to its long-term sustainability because of dual objectives (Moizer and Tracey, 2010). Because of the paradox wherein they compete for revenue-generating contracts and engage in revenue-generating activities while at the same time prioritizing social value creation, SEs are assumed to be financially viable organizations but nothing can be farther than truth. Mason (2012) critiqued this assumed financial viability, and literature indicates that much of SE resilience depends upon their ability to advance both their social as well as economic missions (Battilana and Lee 2014). As Powell and Osborne (2020) articulate, sustainability is a 'balancing grant-free income with expenditure whilst meeting social objectives.' Alter and Dawans (2006) point out that there are other factors, too,

like leadership and culture that are important in order to achieve sustainability of social enterprises. This means that while there are some constraining factors to achieve sustainability like limited resources, non-supportive culture, geographic limitations, there are also some facilitating factors that enable sustainability. As given by Sabella and Eid (2016), enablers exist at three levels, Contextual, Organizational and Individual. While sustainability is a bigger challenge for a social enterprise, there is limited debate on how to achieve it (Sabella and Eid, 2016). The development of sustainable strategies captures the center stage in contributing towards sustainable development goals. It is, therefore, crucial for the researcher to identify which aspect of the enterprise serves to ensure sustainability of the social enterprise and helps the social entrepreneurs in doing successfully what they intend to do (Parrish, 2010). The research question for our study is: ***how do social enterprises achieve sustainability and what are the strategies they adopt to fulfil its socio-economic mission?*** The process of achieving sustainability comes out as a multidimensional practice but only a few studies have been able to address what a social enterprise is and what contributes to its entrepreneurial (Huckle, 2006) and social sustainability (Sabella and Eid, 2016). The two social enterprises taken up as part of our study; JanaJal and Goonj, use different enablers to ensure sustainability of their enterprise. While JanaJal uses 'Legitimacy' for achieving sustainability, Goonj uses 'Rhetoric.' Our study intends to fill the gap in understanding how social enterprises achieve sustainability by using legitimacy and rhetoric as enablers in the social entrepreneurship process.

2. The Theoretical Background

Social Enterprise Sustainability

Social enterprises resort to commercial market oriented activities to sustain themselves (Dees 1998). Subhanjan Sengupta, Arunaditya Sahay and Robert D. Hisrich (2020) in their study bring out how research on social enterprise is moving beyond duality revealing social entrepreneurship as a phenomenon that embraces social and market as an articulated whole. They proposed a framework wherein a social enterprise exhibits single logic and process, of social value creation – market orientation overlap. They carry out entrepreneurial practices that are more business focused or market inclined (Diochon and Anderson 2009; Mair and Marti 2006). These enterprises practice commercially driven sustainability oriented activities to ensure not only a sustained social impact but their own sustainability as well (Doherty et al 2014). Sharir et al (2009) proposed a theoretical framework for social enterprise sustainability that proposes that the long term sustainability of such social ventures depends on how they are able to acquire and generate resources, remain legitimate, foster collaboration between

institutional networks and at the same time also develop organisational capabilities. These factors collectively became key drivers of social enterprise survival. Hynes (2009) reiterates that it is important to apply a strategy in order to achieve dual social and economic goals of a social enterprise. Laville and Nyssens (2001) state that long-term sustainability of a social enterprise depends on their remaining as they are; dual and hybrid drawing equally upon market and non-market factors. Startan (2017) revealed through their study that the factors that ensure sustainability of the social enterprises include strong leadership, motivation and commitment of all stakeholders; financial sustainability; legal environment; people's expertise; use of resources; business model; innovative ability and local community involvement.

Why Sustainability?

Roy et al. (2014) advocated that a social enterprise has potential for enhancing health and well-being in our societies. By offering innovative and sustainable solutions, social enterprises provide a trustworthy mechanism in overcoming social challenges (Gutterman, 2020). Catching up with the growing momentum, the social enterprise sustainable entrepreneurs are now actively promoting entrepreneurial sustainability efforts (Gutterman, 2020). Simultaneously it was also being witnessed that many of the social enterprise were not able to sustain itself for various reasons. Those reasons could be regarding ineffective leadership, lack of resources, no long term strategy, scaling up or failure in creating an impact. It has been recommended that a sustainable strategic approach is required by organizations that wish to be sustainable (Johansson and Larsson, 2015). (Moreau et al., (2017) rightly points out that the typical linear relationship between production and consumption in the past is no longer sustainable and hence companies are now getting more inclined towards promoting their social or environmental efforts and thereby embrace a social enterprise entity (Mac Cormac et al., 2012). According to Chan et al. (2017), social enterprises will always find it challenging to attain financial sustainability due to their activities and location in marginalized communities. Therefore there is a need for sustainability concept to be broadened to include social, environmental and economic goals (Ridley- Duff and Bull, 2016). In support of this argument, Doyle (2019) opine that social enterprises' sustainability should not be limited to financial terms but to the extent to which a social enterprise achieves its social, financial and environmental sustainability, where social sustainability is the realization of its social mission; financial sustainability is meeting its operational costs and environmental sustainability is doing activities without any negative environmental impact.

Rahdari et al (2016) in their study shared how social enterprise can serve as a tool for achieving sustainability and also pursuing sustainable development. Their findings were based on moving from social entrepreneurship to 'Sustainability Canvas' which connects distinct yet related concepts like social entrepreneurship(SE), Corporate SE, Corporate Social Responsibility and sustainable development in a way that lays the foundation for fulfilling SDG goals and achieving collective sustainability.

Social Enterprise and Legitimacy

Social enterprises primarily work for the benefit of the deprived section of society (Kroeger & Weber, 2014), and their entrepreneurial activities often depend upon the flow of resources from their environment (Dacin & Dacin, 2011). In order to draw support from the environment, the activities, structures, and strategies of the social enterprises must be in accordance with what is legitimate (Maggio & Powell, 1983). Organizations are deemed legitimate only if they follow institutional regulations running in their field of operations (Deephouse, 1996). Social enterprises are having a peculiar organizational form, and this hybrid form of organizing poses conflicting institutional logics and difficulty in gaining legitimacy due to its dual structural complexity (Battilana & Dorado, 2010). Social enterprises gain legitimacy by two bodies, the external stakeholders, such as state organizations, companies, banks and the internal stakeholders such as employees, managers, and employee representatives. "A subject becomes legitimate when it is connected to legitimate others" (Deephouse & Suchman, 2008). When an enterprise makes efforts to reach out and form ties with other very legitimate social actors and partners in society and the world outside, they are working towards establishing more credibility for their social enterprise and at the same time, forming legitimate ties with these partners (Bitektine, 2011). Such alliances that lend legitimacy to a social enterprise give it better access to market, availability of important resources, hiring of suitable competencies - all aimed at creating product or service of great social value (Smith et al., 2014).

Social Entrepreneur and Rhetorics

Rhetorics is the art of effective or persuasive speaking or writing, impressing upon a language designed to persuade (Green, 2004). It is especially aimed at bringing about a fundamental shift (Suddaby and Greenwood, 2005). To be able to prevail over an existing norm, a more skilled and crafted approach is required to drive home their mission and vision (Battilana et al., 2009) through other stakeholders. Rhetorics comes in as a useful tool to formulate and conceptualize the existing problems and vocalize the promise the enterprise holds for them. It gives a voice to its chosen alternatives (Vaara et al., 2004), influences opinions (Meyer and Hollerer, 2010), and encourages others to participate (Green, 2004). In other words, Rhetorics is "all about using

language to persuade others (and oneself), and not just validate specific arguments we wish to put across but also to persuade them of our personal validity, credibility and worthiness" (Watson, 1995). Researchers have used rhetorics in various forms, as a metaphor (Tienari et al., 2011), as analogy (Battilana et al., 2009), rationalizing, and appealing (Hartz and Steger, 2010); and evaluative statements (Ruebottom, 2013). In his work on rhetoric-orientation view of social entrepreneurship, Yanto Chandra (2016) presented eight rhetorical orientations used by social entrepreneurs to influence stakeholders and to facilitate social change. To bring about a systemic change in the existing, the status quo, it is imperative for a social entrepreneur to give sense to others, to see the necessity of the new idea and the transformation it will bring about. This sense-giving is one of the ways a social entrepreneur can influence others to view the world as they wish them to. In that sense, rhetoric becomes a sense-giving process, and the things that social entrepreneurs pay attention to (Ocasio, 1997).

3. Methodology

Using a qualitative approach, we took up JanaJal and Goonj, the two social enterprises to explore the phenomenon of social enterprise sustainability. Such instrumental cases inform us better on a phenomenon being studied (Harling, 2012). The cases demonstrate how the social enterprise use legitimacy and rhetorics as enablers to ensure sustainability of the enterprise. The research was based on primary data, collected by conducting a series of semi structured interviews with the social entrepreneurs. We analysed the narratives (Polkinghorne, 1995) to come up with rich descriptions narrated in a story like fashion to express data in its true form.

4. Analysis and Findings

Utilizing legitimacy as an enabler to enterprise sustainability: a Case of JanaJal

Strategic cooperation between organizations for establishing legitimate ties (Bitektine, 2011) or "institutional linkages" (Baum and Oliver, 1991) aimed at developing effective partnership collaboration is considered to be an effective strategy to gain external legitimacy. Drori and Honig (2013) state that external legitimacy, as an external stakeholder, stamps recognition of your correct practices and organizational values which in turn resonates with your internal legitimacy. External legitimacy is to address the inherent constraints and gain more acceptability in the market and counter its hybrid nature. Internal legitimacy reaffirms and ensures external legitimacy. Internal legitimacy is something that a social enterprise has to keep a check on so that better collaboration can take place.

JanaJal is a social enterprise in India aimed at making safe drinking water available to millions of people in a sustainable manner. With its flagship project of water ATMs (Automated Teller Machines), Janajal has impacted lives of people at the base of pyramid, especially in the rural

communities. For its sustainability efforts and initiatives, JanaJal's founder Dr. Parag Agarwal has been awarded with an Honorary Doctorate for Social Work and Impact, Global Corporate Sustainability Award, and for contribution to SDG6 an Agent of World Benefit, 2019. As a proud part of government of India's Swachh Bharat Abhiyan (Clean India Campaign), JanaJal has now become India's first social enterprise delivering quality drinkable water at affordable cost. During the course of our discussions, it was found that the social entrepreneur claimed to have seen legitimacy as an opportunity to create greater social impact.

He states *"very early in life, I realized that to fulfil my dream of making drinking water affordable and available to all, I will require external validation from credible institutions and I can turn to my advantage unlike others."*

He further shared, *"a thorough understanding of on the ground situation helped us maintain unity of purpose and action with all the stakeholders. It is a mutually beneficial relationship where all serve each other. And the relationship only gets better as time passes".*

He found that such a social endeavour would not be possible without a collaborative approach that brings together multiple stakeholders and pools in their unique capabilities. Towards this end, they started building networks and relationships. With strenuous efforts over a period of time, he formed '*Blue Sky,'* a unique consortium of Italian and Indian companies supported by Government of Veneto region. The consortium had big and small organizations like Montana, Cococola, REGIONE de VENETO, Essar, Vedanta, Indian Railways, GMC, GDA, UIT, UPICO, Hindustan Zinc and The HANS FOUNDATION. As a result of such partnerships, mega projects were implemented. In partnership with IRCTC (Indian Railway Catering and Tourism Corporation), JanaJal installed and is presently operating 101 water ATMs across various railway stations in the city of Mumbai and across the Indian state of Maharashtra, which caters to 7.5 million commuters daily. In collaboration with Konkan Railways, JanaJal installed 61 water ATMs extending from Maharashtra up to Goa and Karnataka. This cluster serves over 7 million commuters daily. JanaJal installed and is operating 50 water ATMs in NDMC (New Delhi Municipal Corporation) region, New Delhi under its Smart City initiative. Phase II will see this number increase to 110 water ATMs. Six water ATMs have been installed in Hazira near Surat in Gujarat within the premises of the Essar Group of companies. This cluster caters to 2500 truck drivers, workers and staff members of various companies of the Essar Group every day. JanaJal has installed 100 water ATMs at various Police Stations in Mumbai city in collaboration with Minaxi Mehta Foundation which are not only serving the police personnel, but also its traffic department and visitors.

It came out from the analysis that in order to be able to contribute more effectively to the society, the enterprise should be able to have legitimate support of government authorities and other institutional bodies. Towards that, JanaJal contacted various regulatory bodies and made consistent efforts to make its voice heard. It identified and trained its manpower to develop communication and people skills.

Mr. Parag observes*, "It was important to send the right people for the right job. It would also be important as a leader to identify right man for the right job"*

In due course of time, the social enterprise was able to gain support from Indian Railways, IRCTC, NDMC, GMC, GDA etc. As an example, in collaboration with Lucknow Metro Rail Corporation, JanaJal installed water ATMs at all metro stations in the capital of Uttar Pradesh, Lucknow. And recently JanaJal has tied up with Bajaj Auto for their flagship project Water on Wheels. JanaJal follows an inclusive policy of growth and development providing equal opportunities to all.

"We have a flat hierarchy and we are very secular in our approach. Every team member at JanaJal conducts himself as an "agent of change" once that is understood, there is no compromise. To this effect, we recently adopted the designation of "Impact Catalysts" for all team members". Such has been the psychological evolution of the company".

Rhetorics as an enabler to Enterprise Sustainability: The case of Goonj from social entrepreneur's perspective

As Suddaby and Greenwood (2005) put it, "Rhetorical Strategy" is "the deliberate use of persuasive language to legitimate or resist an innovation, dominant institutional logics, and broader templates of institutional change." At times, the social actors adopt the approach of antagonist and at other times a protagonist, as a part of their rhetorical strategy to give a voice to their value-creating social activity. A social entrepreneur has a story to convey, a social mission to fulfil and at the same time the need to balance out the economic realities of life. In order to develop a logical build up for following the path of social entrepreneurship, a social entrepreneur reflects, interprets and forms an understanding himself and then shows the world what he wants them to see and makes them believe what he wants them to.

Goonj, established in 1999, offers a sustainable economic model for eliminating poverty and related issues. This SE, under the leadership of Mr. Anshu Gupta, the founder, created barter system between the urban surplus and village community labor, thereby triggering a large scale rural development work.

"We, as an institution want to run well, pay well, we want to remain till the time we are needed, but we are absolutely more worried about the ecosystem, and we do challenge the business"

Goonj's model of development inclines towards a more inclusive economic model of having everyone, especially women, as an equal stakeholder in the process.

"We do challenge people into doing social good. Give that women her fair pay because you have taken her land, her farming, give her basic compensation."

Practicing Sustainability, it has been innovatively utilizing old discarded material as a resource for rural development. Through voluntary labour, the rural communities are made to understand their power. They are given usable old material that meets their requirement as earnings for the work done. Its work spans across education, sanitation, livelihood and environmental sustainability, thus, they contribute to various SDG goals, especially SDG 8.

Anshu Gupta says, *"We are very upfront, we took a lot of risk to tell someone that you are not donating, and you are discarding. So basically, you are challenging the very raw material, basics of your own business. But our job is to change the language, that's the language. If that doesn't change, we will keep on struggling."*

Sense-making and Sense-giving are two sides of the same coin. Sense-making is thus a social practice where realities are constructed and created through coherent presentation of prior unorganized thoughts, deeds, activities and processes that intentionally and deliberately so, point towards a suggested view of reality (Maitlis,2005; Weick, 1995). He effectively and actively engages in keeping note of activities employed by people as they make sense of their experiences and aligning it with his own set of agenda he subtly nudges others to adopt a particular 'take' on experience that seems logical, rational and a natural course of action (Golant and Sillince, 2007;). Goonj has been actively playing the role of sense giver in society which evident from Anshu's statement.

"Social change, how do we really measure? This is a mind shift, this is how people take their own ownership. Ownership does not mean only by ruling community but also by becoming a more responsible citizen. How do you really become more responsible towards the society? It's a game of ownership, I will never be able to tell how many minds I have changed. They may change or not, but they should be forced to think that this makes sense."

Social entrepreneurs are change agents. They are the actors and creators of the social entrepreneurship movement, providing solutions to the social problems experienced by the underprivileged (Driver, 2017). To this effect, Goonj has been reaching out to all the stakeholders who are directly or indirectly a part of the entrepreneurial ecosystem.

"It is important to build and maintain a connection of empathy, dignity and valuing between the issues of the poor and the rich. It is important to leverage and empower available resources, wisdom, time, skills and efforts of people. It is required to listen deeply to our rural communities with humility, treating people with dignity and respect".

In the times of Covid19, the rhetorics of Goonj focused on bringing in a ray of hope into the life of migrants.

The Founder points out, *"If organizations would have taken care people not so many people would be on roads".*

He predicts that whenever the industries will open up, the people in the city might still have an opportunity for employment though at its own cost of being exploited but people who have migrated stand no chance.

"People need to fix their priorities. They need to understand that it is because of people who are foot-soldiers, you are what you are. If all would have played their part, the organizations, the contractors, the common citizen, things would not have reached to this point. Lakhs of people would not have been displaced. There are people who reach out to strangers but there are also people who are chucking their own help out of job. Which one are we is what we need to reflect".

He says that it is important to revive the sector. Anshu is disheartened to say that migrants are destined to suffer. He opines that gaining trust of people is crucial to restoring faith in humanity and practicing inclusive growth.

Mr. Anshu Gupta is pained, *"We are on trust deficit". It is unfortunate that people do not trust each other. It is sad that the poor have lost faith in us and the hope to survive. It is tragic that we were not able to inspire their trust in us that we are there, do not worry. It is heart breaking to know that a person had to walk 2800 km on foot for 28 days to reach his hometown. This is our failing as human."* Goonj considers People as strength. *"Covid19 has shown us how much trust deficit is there. People have lost faith in humanity. It is time to restore that trust. It is time to revive the sector"*

The SE ensured that it continued to take care of its own people, the far and near associated with it. They made sure that no one as a Goonj member suffered or walked on road desperate to go home. They looked after safety and security of all its people maintaining strictly all rules and regulations to be followed. They wanted to assure each person with them that the relationship with them was paramount. People were assigned specially to listen to woes of its own people and see to their needs. For example, when Dharavi was locked down, there was no ration, they made sure that the people there could buy locally because they can't move out.

Goonj focuses more on people than processes. They believe that there is no point in helping outside if you cannot support your own people. They even took care of people who would come to them occasionally for a piecemeal work. Adopting social distancing norms, money was paid to them through various modes.

As Goonj puts it across, *"Our focus is on the needles, while the world is focusing on the big machines. Goonj has become a people's movement for development."*

Discussion

Goonj and JanaJal have been carrying out many sustainability practices and initiatives that further strengthens their footing as a sustainable social enterprise working for social good. We found the two enterprises achieving their goal of sustainability in their own unique way. Scott (1995) emphasized that legitimacy is a condition or state that reflects the cultural adaptation, normative conformity, or the matching of relevant rules and laws. Rueede and Kreutzer's (2015) definition of legitimacy identifies it as a response to social judgment by different stakeholders. Lamin and Zaheer (2012) states that legitimacy is not a "monolith concept" but a dual concept for a social enterprise and hence it has to take care of standards of legitimacy for both the aspects, the social and economic and devise appropriate stakeholder strategies. Rhetorics involves influencing the micro as well as macro level discourses that form a part of the ongoing conversations at the societal level and sometimes at the national level too.

JanaJal - the social enterprise consciously took measures to gain approval of all the government authorities and regulatory bodies in order to make itself a recognized and trustworthy social enterprise. They believed that people tend to be more accepting when one has the legitimate authority supporting their cause. As a leader, the founder knew that in order to make this happen, he would need the right kind of people who could communicate in the appropriate manner with the authorities and make their voices heard. The employees were also imparted training and made to undergo development workshops to be able to do their job effectively. JanaJal follows a flat hierarchical structure and all the employees are termed as Impact Analysts. The enterprise is secular and focuses on inclusivity and parity. People of all backgrounds are free to follow their path, observe their rituals and also express their candid feedback related to ground experiences so that corrective measures may be taken. Following this Inclusivity principle, the enterprise remains agile to opportunities and has recently has a major tie up with Bajaj Auto for its Water on Wheels Project. The enterprise is also into expansion and looking for making its imprints abroad. Though they could sense an opportunity in the water sector and at the same time saw that technology for treating water was being

endlessly applied. Being in the sector for more than 20 years, he knew how water changed its composition every few kilometers. So how could one technology cater to different quality of water? Having a competitive edge over others in terms of technological knowhow, they set up their own water treatment plant suiting local water characteristics and also launched water on wheels mobile water service. In this social endeavor, however, they have been facing a huge mindset issue where people feel that selling water is crime. But they firmly believe and share that "Safe drinking water has to be valued as a resource and hence priced. We are constantly challenging this mindset and making progress"

Goonj - follows a humane approach to bringing hope and dignity in the life of all. Applying rhetorics as a reflection of stakeholder engagement, the social enterprise has been actively focusing on the receiver's dignity rather than that of the donor. They encourage circular economy by ensuring that each material is utilized to its maximum capacity. Valuing collaborative efforts with other partner organizations, Goonj has been able to create a much wider ripple of social impact and outreach all over the country and even at places abroad. With a flat hierarchical structure and equal pay concept, Goonj also views every entity as an equal stakeholder in the development process. They believe in creating long lasting relationships with people and work towards earning trust. In the wake of covid19, Goonj has risen to the occasion and come out as an exemplary role model for social enterprises reaching out to thousands of migrants ensuring their food clothing and shelter. Goonj has always been very giving and caring during natural calamities in the recent past including flood and other disasters. Goonj started a new initiative two years back; 'Baithak' to increase social engagement and help people build connections to co-learn and collaborate among other organisations in similar space.

Practicing Sustainability

Zeng (2018) states that Social entrepreneurship is a balancing act of both business purpose and social mission. Practices of social enterprises globally vary as SE is largely a contextual phenomenon (Sengupta and Sahay, 2018). However, the essence of social enterprises remains creating social value and solving social problems (Dacin and Dacin 2011). Let us have a look at the sustainability practices of JanaJal and Goonj.

Sustainability Practices of JanaJal

Detailed in-depth interviews revealed to us, various sustainability oriented activities practiced by JanaJal on the ground that brought around sustainability of the social enterprise. Changing the mindset of people and switching over from a linear to more sustainable use of goods and services, people must alter their consumption patterns for the benefit of the environment (Jackson et al., 2011). JanaJal encouraged people to bring their own containers to collect water

from JanaJal Water ATMS or JanaJal water on wheels. This is done with the aim of reducing cost as well as to avoid using plastic. They call this as the BYOC approach (bring your own container).

"We want to enable safe water for all but in a way that it doesn't create plastic pollution".

They build robust water ATM which could last 10-15years rather than manufacturing machines that had short lifespan and ends up in accumulating more junk waste. Earlier the water ATMs were used less and below their capacity. They now have robust water plants with full capacity utilization being done by refilling JanaJal water on wheels at JanaJal water ATMs.

"This 'capacity utilization' is our way to ensuring long-term sustainability".

Another actionable point that they have undertaken is that they are trying to minimize reject water. The technology that they use differentially according to the water sample ensures that not much water is rejected below drinking water standards. In addition to this, the reject water is also utilized for washing railway tracks and toilets on railway stations.

"We are democratizing water and working to fulfill the right to water laid down in our constitution. We are committed to fulfilling SDG goal#6 of 'clean water and sanitation for all'. Interestingly, *water is an umbrella goal that embraces 9 other SDG goals*".

During the times of pandemic JanaJal has been considerate to its employees working on to develop a sustainable workforce. It has been covering 50% of the cost of any course or certification that the employees undertook related to their professional skills and upgradation. Remaining ahead of the curve, they are exploring partnerships that bring around seamless consumer experience roping in latest technology including advanced IOT for ATMs.

Given below in Figure 1 is the timeline of JanaJal that demonstrates its growth over the years which in turn shows that the social enterprise has been able to sustain itself.

Figure 1- JanaJal Growth pattern- 2013-2020

Time Period	**Initiatives**
2013 - 2015	Began operations
	Sold 450 water ATMs under CSR
	Validation of JanaJal water ATMs with various government bodies and ministries
Late 2015	Secured contract of installing 84 ATMs.
	Using technology as differentiator
Mid/Late 2016	Secured IRCTC (Indian Railways) contract for 39 ATMs

Early 2017	Secured foreign investment from United States of America and Hong Kong
Mid/Late 2017	IRCTC contract for 62 more ATMs
	Found Water on Wheels (WOW) - mobile unpackaged water
2018/2019	Developed IP on IoT controllers, migrated to cloud based technology
	Got IP and Trademarks approved
2019	Launched indoor Ohiya, Water Station
2020	Launched Ohiya, Water Pod for domestic use
	Shifted to 'asset-light scale model' for WOW across SE Asia and Africa
2021	JanaJal WOW selected by Govt. of India for implementation of $50 BN drinking water scheme by 2024 under Jal Jeevan Mission
	Bajaj Auto extends support to JanaJal WOW
	Further expansion in ASEAN, MENA and Africa

With the help of the above analysis, it can be seen that the factors given by Startan (2017) regarding social enterprise sustainability (as previously mentioned) are well demonstrated in this case of JanaJal. Not only did Mr. Parag Agarwal, through his strong leadership skills demonstrate commitment, passion and involvement in the venture but had ability to also legitimately build around collaborations and resources with key people's expertise. Their technological innovation made them the frontrunners in the field of making drinking water affordable and accessible to all. As rightly said in his statement displaying confident leadership *"The longevity of a firm today is determined by the Inclusivity principle; the Planet, Purpose, People and Profit. An enterprise has to remain agile. Innovation and Disruption are survival mantras and organizations that have "one eye in the sky" and "one ear to the ground" shall stand the chance." In a highly competitive and dynamic environment where it is becoming increasingly difficult to gain and maintain your foothold in the market, it is important to be aware of the uniqueness your product offers and use it to your advantage. Devising an operational business model that is in everybody's interests has been our biggest achievement. Technological knowhow and cutting edge AI (Artificial Intelligence) powered technology was our biggest differentiator".*

Sustainability Practices of Goonj

Using urban surplus materials as a powerful resource for sustainable development Goonj works in education, water, sanitation, livelihood, agriculture, menstrual hygiene, and environmental sustainability. GOONJ collaborates with over 250 grassroots organizations and is currently actively reaching out to marginalized communities in 21 Indian states. *"The aim is to build an equitable relationship of strength, sustenance and dignity between the cities and villages using the under-utilized urban material as a tool to trigger development with dignity, across the country".*

They introduced sustainability with handicrafts in the village of Kendrapara district in Odisha. Under Goonj's 'Vaapsi' initiative, the local community of Kendrapara district decided to restart bamboo handicraft making and other livelihood options like tailoring, plumbing and carpet weaving. These items (mainly bamboo baskets) are added to Goonj's relief kits. Goonj also carried out joint efforts of the native families towards community cleaning and livelihood projects to bring about stable livelihood to the local villagers.

"We believe that water has a direct connect with poverty and wellbeing of rural communities. We are targeting localized solutions by reviving already present water bodies like ponds, lakes, check dams etc. We mobilize rural communities to find their own sustainable solutions using local resources and indigenous knowledge. Cleaning water bodies, directing their constructing new water access points and increasing water tables through rain water harvesting activities are some ideas that have emerged locally".

One of the major flagship projects of Goonj 'Dignity for Work' which originally began with 'Cloth for work' is especially running for rural parts of India. Under this sustainability initiative, Goonj consistently take up diverse activities like repairing, rebuilding, reconstructing and revive local infrastructures like roads, bridges, libraries, drainage system and irrigation canals.

"All these works are done but by making people understand their own community power and giving old usable old material as a reward".

Goonj has also been working on sustainability of Livelihood for the underprivileged. 'Green by Goonj' is a brand built around reusing and up-cycling even the last shreds of material that Goonj receives. A range of over 100 different products like purses and fancy bags are made out of torn jeans, obsolete audio tapes etc. This also brings livelihood to thousands of women who contributes to their family income.

Following is the timeline in Figure 2 depicting disaster activities that Goonj has been undertaking since its inception:'

Figure 2- Goonj Disaster Response Timeline

Year	**Initiative**
1999	Chamoli earthquake and Orissa cyclone
2001	Gujrat earthquake
2002	Gujrat riots
2004-2005	Tsunami
2005	Kashmir earthquake
2006-2007	Assam, Bihar and West Bengal (WB) floods
2008	Bihar floods
2009	Aila cyclone in WB
2009-2010	Orissa cyclone
2011	Sikkim earthquake and Orissa floods
2012	Assam floods
2013	Uttarakhand floods, Muzaffarnagar riots, cyclone Phailin in Orissa and Andhra Pradesh(AP)
2013-2016	Drought (Madhya Pradesh(MP) ,Uttar Pradesh(UP), Maharashtra, Chhattisgarh and Karnataka
2014	Hud Hud Odisha, Jammu and Kashmir and WB floods
2015	Bihar cyclone and earthquake and Chennai floods
2016	Vardha cyclone, Andhra Pradesh and Tamil Nadu
2017	Assam, Manipur, Odisha, WB, Rajasthan, Uttarakhand, Bihar, Gujrat floods
2018	North east floods, Kerala floodsTilli, Fani and Gaza cyclones
2019	Fani, Bulbul cyclone Odisha
2020	COVID, cyclone Amphan, in WB, Nisarga in Maharashtra, floods in Assam, Bihar, Odisha, Chhattisgarh, Telangana and AP
2021	Pandemic activities including ‘Rahat’

Goonj contributes to SDG Goals 8, 10, 11, 12, 13 and 16.

Looking at social enterprise sustainability of Goonj, the factors given by Startan (2017) do justice to their social endeavor. The compassionate leadership of Mr. Anshu Gupta treat people as their key resource ad has it in abundance. The motivated employees of Goonj and the passionate commitment of the founder has been instrumental in making Goonj reach where it

is today. Well established for over 20years now, it has heavily invested itself into local community involvement. It has effectively partnered with several institutions cross sectoral and multi-sectoral that Goonj finally has a voice. Focusing on bringing dignity to each life, they have worked upon bringing lot of innovations in their efforts to keep the sustainability of the enterprise going including making its strategic shift from 'Cloth for work to Dignity for work' and the 'Green by Goonj'. Goonj has always treated people as their strength. In the words of a community local involved in the cleaning of Dal lake in Kashmir, the participant *shares "Crores of rupees were spent using machines to clean Dal earlier but all in vain. Goonj has taken a better approach by involving us locals as we have been doing it for centuries. We know how to clean Dal".*

6. Conclusion

A social enterprise is aware of the challenges lying ahead in sustainable societal development (Sabella and Eid, 2016). The social enterprise's sustainability depends as much on the internal dynamics as much as on the external factors. It is unique how different social enterprises express themselves and position themselves to the world at large and use various means to do so. Their choice of expression for example either through legitimacy or through rhetorics as shown in the study is made keeping their mission and vision as the focal point. Such alignment often decides their sustainability. Contl (2002) opines that social enterprises should now be more adaptive in taking up mainstream business practices and tools like technology orientation and legitimacy as with JanaJal or communication and evolving organizational culture as with Goonj. Such forward looking approach sets the tone for long term sustainability of a social enterprise. A culture of inclusivity of employees (Sharir and Lerner, 2006) guarantees sustainability (Bull and Crompton, 2006). A social entrepreneur is indispensable for an enterprise (Tan et al., 2005). As such Yunus (2010) argued that social entrepreneurs are the individuals who possess skills to empathise, communicate, enable, empower, and have a voice that people hear. Martin and Osberg (2007) view social entrepreneurs as the ones who have a mission to create and sustain social value for those who are underprivileged section of society and pursue opportunities to fulfil that mission. For future research, the role of context to social enterprise sustainability can be explored in the wake of stakeholder and relationship orientation as that itself becomes a deep level study. Social enterprises adopt different strategies to sustain themselves and as future area of research, the combination of strategy and the enablers and disablers to that strategy can be explored.

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Footprint of Indian Corporates in meeting Sustainable Development Goals

The Challenges and Opportunities

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Abstract

The paper has examined the footprints of Indian Corporates, in the last five years, in meeting the Sustainable Development Goals, what are the challenges and opportunities. It has analyzed how Indian Corporates are making efforts to alleviate poverty and achieve SDG through various interventions. Our initial observations reveal that –compared to 2016 -17, the CSR spent by the Indian companies has come down by 6% – 7% (overall) though the spent has decreased substantially in a few sectors more than others. Such sectors are – Agro forestry, Animal welfare, gender equality, clean Ganga fund, and a few others. The spent has increased by 3 – 4 % in sectors such as – conservation of natural resources, livelihood enhancement, safe drinking water, setting up orphanages, swachh Bharat, and women empowerment. Further, the study aims to analyze the spent across projects varying in the last 5 years and the factors causing this change.

Keywords: CSR, SDG, Indian Corporates, CSR Spending

1. Introduction

There has been considerable activity since independence in India in the field of economic development. A vast amount of resources (Physical, Human, and Financial) have were utilized by the government and various international agencies like World Bank, UNDP (United Nations Development Programme) Asian Development Bank, DFID (Department for International Development, UK), and others for the upliftment of the poor. And yet, the level of development remains alarmingly low. There is still much poverty, malnutrition, unemployment, and underemployment, especially in the developing economies. In a recent study by Oxford University it has been estimated that the incidence of poverty highest in the World in the seven BIMARU states of India (Bihar, Uttar Pradesh, Rajasthan, Odisha, Chhattisgarh and Jharkhand). Poverty has been augmented by a lack of access to resources by the growing population and inadequate infrastructure, both social and physical.

Accordingly, Govt of India has initiated a lot of programs to alleviate poverty and ensure a just and sustainable society. Social protection and financial inclusion is of paramount importance. NGOs have

been rendering yeomen services to supplement government initiatives. However, it was realized that given the complex situation & diverse socio-cultural conditions, requirement of capital and manpower is imperative. In this context, role of Indian Corporates became significant in accelerating progress towards the 2030 agenda of SDGs.

With the enforcement of Companies Act,2013 on 1st April,2014, India became the first country in the world to make Corporate Social Responsibility (CSR) mandatory. This Act requires large companies to spend at least 2% of their average profits of the previous 3 years on CSR each year. Funds so generated strive to address economic, social and environmental issues which can lead to sustainable development. For survival of human society, sustainability is the key. Gone are the days when sustainability was a small part of Corporate Social Responsibility for business. Sustainability challenges are becoming extremely material globally, reaching thresholds of importance to companies' long-term strategies, their customers, and external stakeholders. Companies are facing a more complex array of trade-offs and risks across their value chains from increasing demand for natural resources to economic disparity to climate change. This paper aims to understand the trends emerging from the CSR and SDG spending by Indian corporates.

2. Literature Review

According to Lindgreen and Swaen (2010), Corporate Social Responsibility (CSR) encompasses a wide range of activities of organizations that ensure their commitment towards economic developments, ethical practices, and improving the quality of life of its employees, the local community as well as the society at large. In recent times, this scope has widened to include addressing social and environmental problems to ensure sustainable development, which has increasingly become important to organizations' long-term strategies and their customers and external stakeholders.

Hence, CSR now requires organizations to choose from a plethora of activities which often create moral conundrums for managers. In order to achieve successful implementation of CSR activities, managers are required to engage with all of their respective stakeholders and build a course of action to achieve a common goal, making it a highly complex exercise. In addition, Wood (2010) argues that there is also a lack of clarity regarding monitoring and evaluating CSR activities from the point of view of authorities, especially in a country like India, which made it mandatory in 2014.

As companies are pursuing CSR actively, Crowther and Guler (2009), attribute this to an increased consciousness among the consumers about socio-economic and environmental issues. They are not only aware of business dealings but are also holding companies accountable for wrongful conduct. This seems to have been aided by the rise of social media and a globalized world. Lindgreen and Swaen (2010) further argue that it is the opportunity to differentiate themselves from competitors, build

consumer goodwill, develop positive employee behavior, and create a competitive advantage that is driving organizations toward CSR. Thus, the general belief is that CSR is good for business and offers a win-win scenario for both the organization and its community.

According to Nair and Bhattacharyya (2019), in India, CSR traditionally relied upon corporate philanthropy of affluent business families and gradually moved towards state-led development initiatives. While CSR activities have generally remained voluntary, India made it mandatory in 2014 through the Companies Act 2013 to invest in CSR actitivites. Companies with net worth of INR 500 crores or more or a turnover of INR 1000 crores or more or a net profit of INR 5 crores or more are required to spend at least 2% of the average net profits the company made during the three immediately preceding financial years.

A report by CRISIL (2019) analyzed 300 firms to understand the CSR spends as a percentage of sales: firms who reported CSR expenses both before and after the CSR mandate were named voluntary spenders, while those firms who commenced spending on CSR after the mandate were named mandatory spenders.

Using the technique of difference-in-difference estimation, the report confirmed that the regulation had an impact on the CSR intensity of firms as both voluntary spenders and mandatory spenders altered their CSR spending as a consequence of the regulation. Although mandatory spenders increased their spending on CSR and voluntary spenders reduced it, the total impact was positive, since the mandatory spenders increased their CSR intensity more than the decrease in CSR spending by voluntary spenders. It was also found that CSR spending increased by a significant 22%, in absolute terms, the total money spent rose by Rs2,500 crore to Rs8,300 crore in FY18.

An analysis of CSR in India by Kumar (2017) found that in terms of 2014 Company rankings, Mahindra and Mahindra were leading while four Tata group companies were in the top 10. GAIL and Bharat Petroleum were the public sector representatives, whereas, no foreign players made it to the top 10 list. In terms of sectors, CSR activities covered the following: Education, gender equality and women's empowerment, combating HIV/AIDS, malaria and other diseases, eradication of poverty, contribution to the Prime Minister's National Relief Fund and other central funds, social business projects, reduction in child mortality, improving maternal health, environmental sustainability and imparting vocational skills.

Another study done by NGOBOX of 100 BSE listed companies in 2015 revealed the some interesting insights – (a) nearly one-fourth (27%) of the companies spent more than the prescribed CSR spend, and about two-thirds (64%) of the companies spent less than the prescribed CSR spend, (b) 2% of the companies spent zero amount from their prescribed CSR spend (Monsanto India Ltd and Nilkamal Ltd)

and 9% the companies spent precisely the same as the prescribed CSR amount, (c) VIP Industries was the best performer as it spent more than double of the prescribed CSR spend, followed by Tech Mahindra Ltd, UPL Ltd., Reliance Industries Ltd. and Godrej Consumer Products Ltd. (d) out of 11 pharmaceuticals sector companies only 5 companies could spend the prescribed CSR amount, (e) only one company managed to spend the prescribed CSR spend among 17 Banking and Finance sector companies, (f) public sector companies have not utilized over half of their funds under CSR allocation and, (g) almost 50% of the companies could not spend even half of the prescribed CSR spend.

Singh and Kaur (2018) looked at 266 companies that did not meet the compliance requirement on CSR expenditure in 2015-16 and found that while 34 firms did not spend any amount on CSR, 170 spent less than half their prescribed amount. Furthermore, several large multinational firms operating in India also failed on that front, including Indian arms of global business giants such as Apple India, Pfizer Ltd, BMW India, and Nestle India, who failed to spend even half their prescribed CSR spend for the year.

On the other hand, NGOBox (2016) reported that certain Indian companies exceeded the regulatory mandate of CSR spend and the activites undertaken therein, for instance - Tata Steel developed a Human Development Index to assess the impact of its work in rural areas in health, education and income levels; Mahindra and Mahindra supported Education of underprivileged girls, offers scholarships to students and also works for causes concerning the environment, healthcare etc. ITC worked towards creating sustainable livelihoods, providing animal husbandry services and developing health and sanitation facilities, while Reliance sponsored many projects for education, employment and training programs. Unilever Limited ran rural initiatives in health and hygiene as well as upliftment of underprivileged women and Wipro spent money on disaster relief and rehabilitation to education, health and wellness programs for the needy, their social initiatives touch every aspect of society.

Ever since the enactment of the CSR regulation, there have also been growing concerns about the sustainability of society, with environmental issues taking precedence in global debates. Even the UN replaced its Millennium Development Goals (MDGs), which were criticized for being too narrow in focus, with Sustainable Development Goals (SDGs), with the aim of tackling issues in depth by 2030. India has also taken up the implementation of these goals by integrating them into its national policies for development. However, India faces a multitude of problems ranging from high poverty, illiteracy and mortality rate to low financial inclusion and poor health, sanitation and waste-management facilities, among others. Thus, a concerted effort by the state and the private sector is required to tackle these issues, which can be done by directing CSR funds towards SDGs.

A study by Poddar et al (2019) of 322 companies out of top 500 companies about sector-wise CSR spend, on various SDGs across states, revealed interesting findings – Banking and Finance companies

had made the highest contribution to CSR spend, followed by FMCG, Consumer Durables, and Oil & Gas, Power and IT.

An interesting observation was that most of the sectors with a high pollution index score (oil and gas, transport equipments, metal, metal products and mining, chemical and petrochemicals, power, transport services, agriculture, and textile) spend more than the prescribed amount required on CSR activities. On the other hand, sectors with a low score on the pollution index (finance, information technology, FMCG, capital goods, consumer durables, media and publishing, and tourism) were under-spending on CSR.

The SDGs which were targeted by the companies were – Education, Environmental Sustainability, Health-care and Gender Equality. However, detailed information about the types of projects undertaken was not given. Besides, the state-wise share to CSR funds revealed that - Maharashtra attracted the highest amount of CSR funds (INR 8,387.03 million) in India, followed by Tamil Nadu (INR 4,006.15 million), which stood second. Among the north-eastern states, only Assam was receiving an investment up to INR 1,065.32 million while states like Meghalaya, Nagaland, Mizoram are attracting around INR 50 million only. Similarly, Delhi–National Capital Territory (NCR) received maximum attention among the union territories compared to others.

It is easy to observe that many companies are still not spending the required amount despite the regulation being in place. Moreover, the CSR spend on SDGs needs a thorough analysis to conclude if the initiatives and intentions are matching and not creating disparities.

Lead authors Robert Shiller has emphasized that there are at least two good reasons to invest in the SDGs: returns to society and returns to shareholders (Shiller, 2013). He emphasized that by investing in the SDGs, investors and corporations can make the world a better place. He particularly advised that Finance and the financial sector have an important social function —namely, steering funds toward the most productive investments, after taking full account of social costs and benefits. (Shiller, Robert J., 2013).

Secondly, it makes business sense to invest in the SDGs, with likely great financial value for shareholders. It entails, investing in companies that provide solutions for and contributions to the SDGs. Such companies tend to be better-positioned for future changes in the competitive and regulatory environments, with lower chances of costly disruption. Of course, the SDGs can pose threats as well as opportunities for companies that can have substantial effects on their prospects and ways of creating value. Such benefits are reflected in the operating and financial performance of companies i.e., companies that adopt responsible social and environmental practices have lower financial volatility, higher sales growth, and higher chances of survival.

It is also said that corporate commitments to and investments in the SDGs appear to attract and retain customers as well as talented employees, as people increasingly look for purpose in a job. For institutional investors such as pension funds, for example, corporate investment in the SDGs can respond to their participants' social preferences. A pension fund in the healthcare sector might prefer to invest heavily in SDG Goal 3, which strives for health and well-being. Eventually, this kind of alignment could become part of an asset manager's fiduciary duty (Ortiz-de-Mandojana, N., and P. Bansal, 2015)

Thus, it is no longer the government's responsibility to implement strategies to achieve SDGs, rather it is every oganization's responsibility to achieve them. The corporate sector can play a huge role in this effort by aligning its strategies and activities to achieve these goals. As seen from above, the scenario in India is chequered towards SDG achievement, thereby generating the need to study the Indian corporates in detail and analyze the patterns thereof. Insights from such studies will help us understand the gaps and provide a deeper understanding of emergent opportunities. Moreover, no significant study has mapped the CSR spend and SDG alignment for a large set of Indian companies, which makes our study more contemporary, relevant, and necessary.

3. Methods

The data was collected from BSE (Bombay Stock Exchange) India. Top 100 companies were selected on the basis of their market valuation, and their CSR spend was tabulated for the last 5 years (2016 – 2020). Further, each company's annual report was studied to understand the nature of CSR spend and what kind of projects and activities they had undertaken. These projects were then mapped to the SDGs. Two experts were used to determine the classification of projects under SDGs.

4. Results and Discussion

The results have been presented in this section, along with the discussion based on our analysis. As mentioned, the data was collected for the financial years FY 15-16, FY 16-17, FY 17-18, FY 18-19 and FY 19-20. As seen from fig.1, the CSR spend has increased from FY 2015-16 to FY 2016-17; it dipped in FY 2017 – 18 and rose by 60% in FY 2018-19, and falling back to 2017-18 levels in 2019-20. This could be attributed to the Demonetisation and implementation of GST by the Indian Government in 2016-17, which could have led to reduced sales and profits in those financial years. However, as the businesses adjusted to GST reporting and the sales picked up, they increased their CSR spending. However, in the FY 2019-20, companies had invested in CSR activities as, despite the regulation, the CSR spend was considered voluntary. Therefore, in 2020-21, the government laid down strict guidelines for adhering to CSR policy. The entire analysis has been divided into three parts -

- Sector Wise allocation of CSR funds
- Main category to which the CSR contribution was made
- SDG which is advanced with these main categories

Section A – Sector Wise allocation of CSR funds

Figure 1: Total CSR contribution of companies in last 5 years

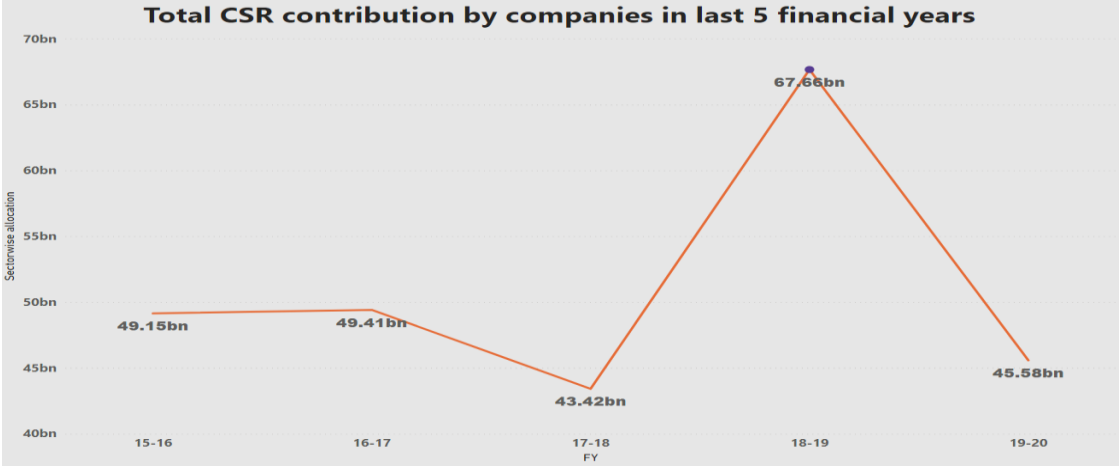
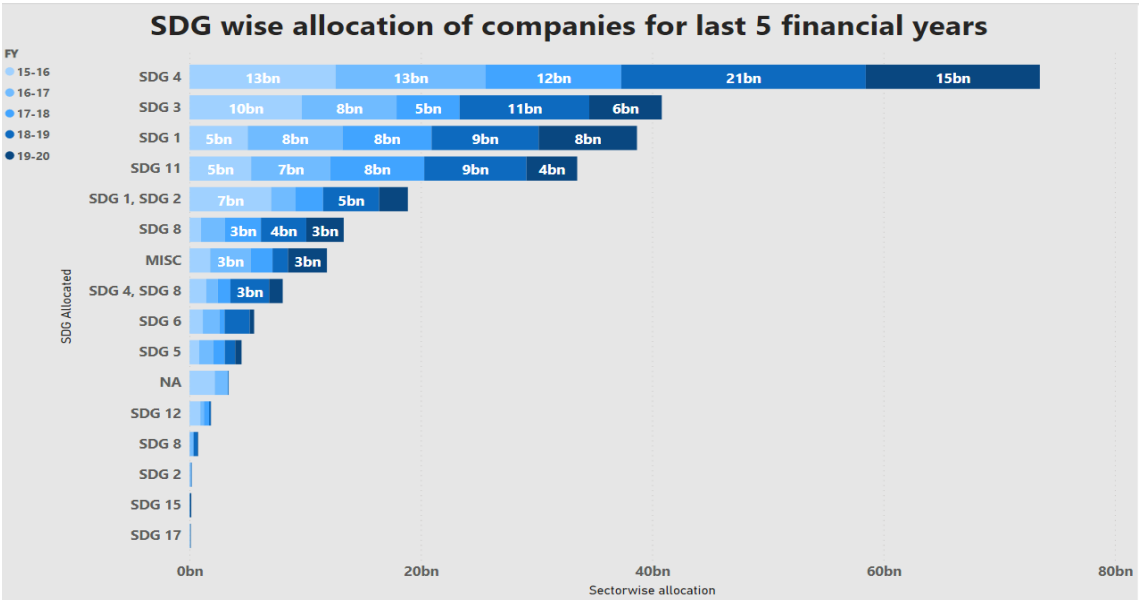


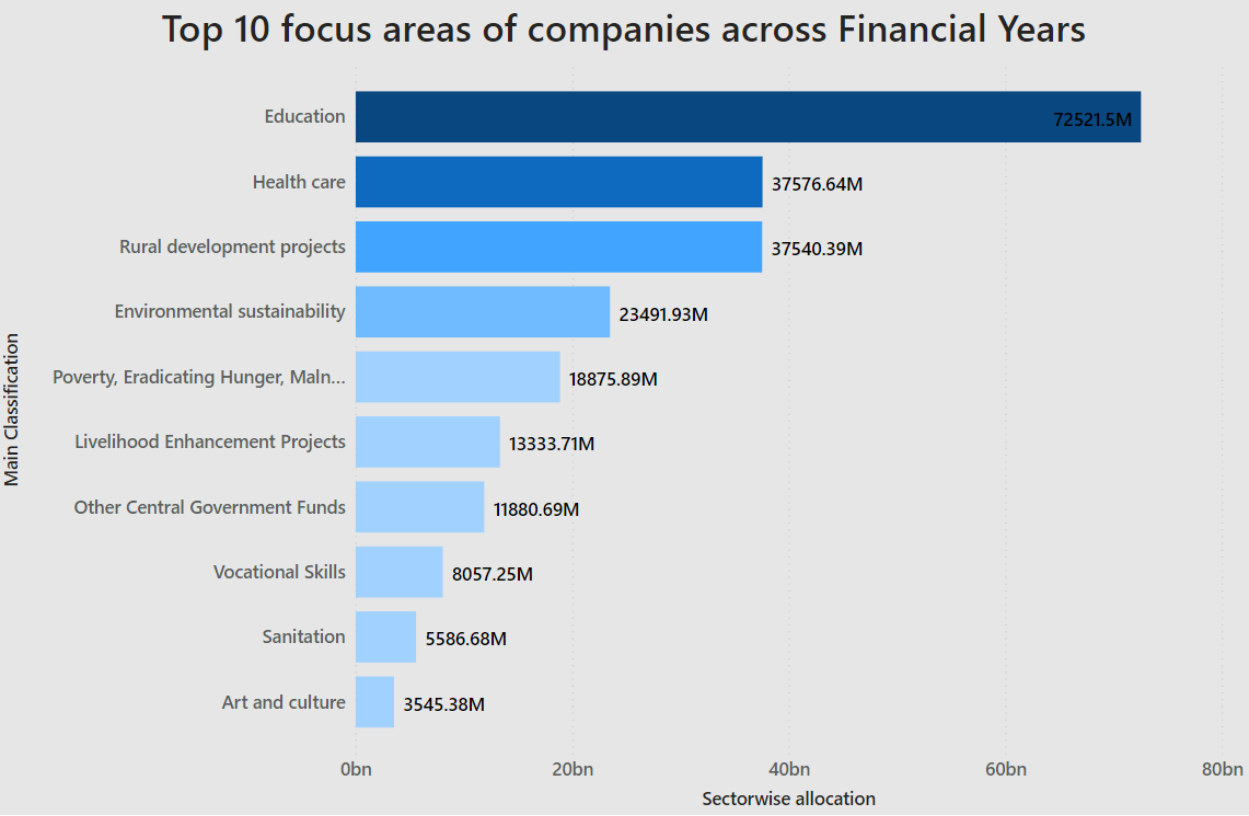
Figure 2: SDG wise contribution of all the companies over the last five years:



As seen from figure 2 above, the major SDG that has seen contribution by the Indian corporates is SDG 4 (Education), followed by SDG 3 (Good health and Well Being), SDG 1 (Poverty Eradication), and SDG 11 (Environment Sustainability). Interestingly, though the companies are focussing on Education, given that the need of the hour is to produce skilled manpower;

investment in vocational training is at the 8th position. A deeper analysis reveals that the companies are spending strengthening primary and secondary Education in the country. The same information has been shown in figure 3, as shown below -

Figure 3: Combining the CSR contribution of companies across all financial years, the maximum investment has been made on Education, healthcare and rural development projects



Moreover, it is interesting to note that investment in SDG 4, 3, 1, and 11 has remained a priority for companies in the last 5 years. Though the percentage of spending might have changed but these 5 goals have remained constant (figure 4).

Figure 4: top 5 priorities of companies across 5 financial years, we can notice that every year, the priorities have remained the same

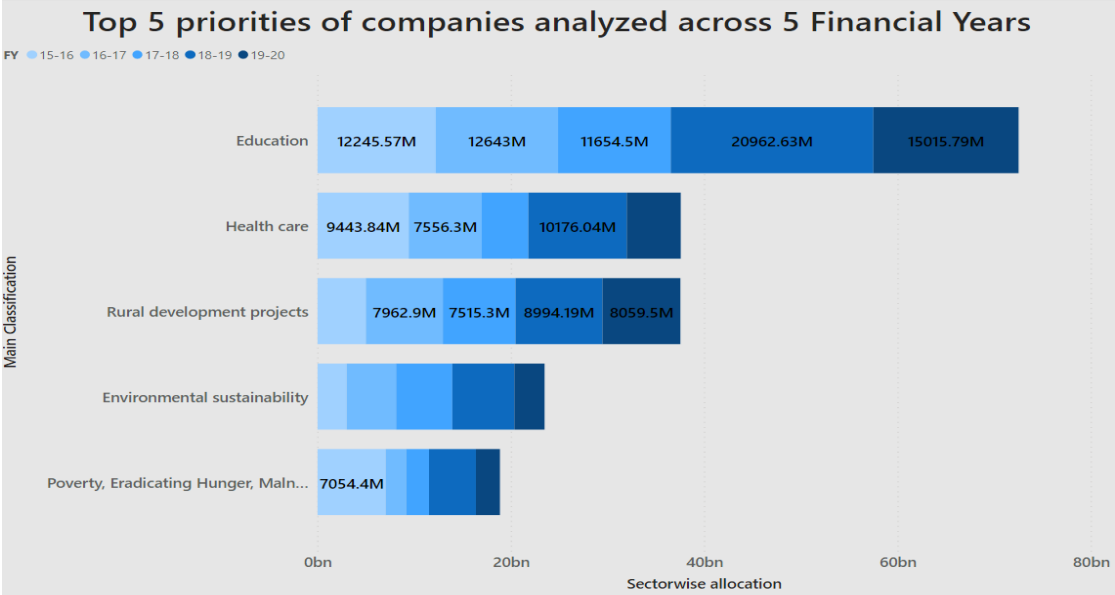
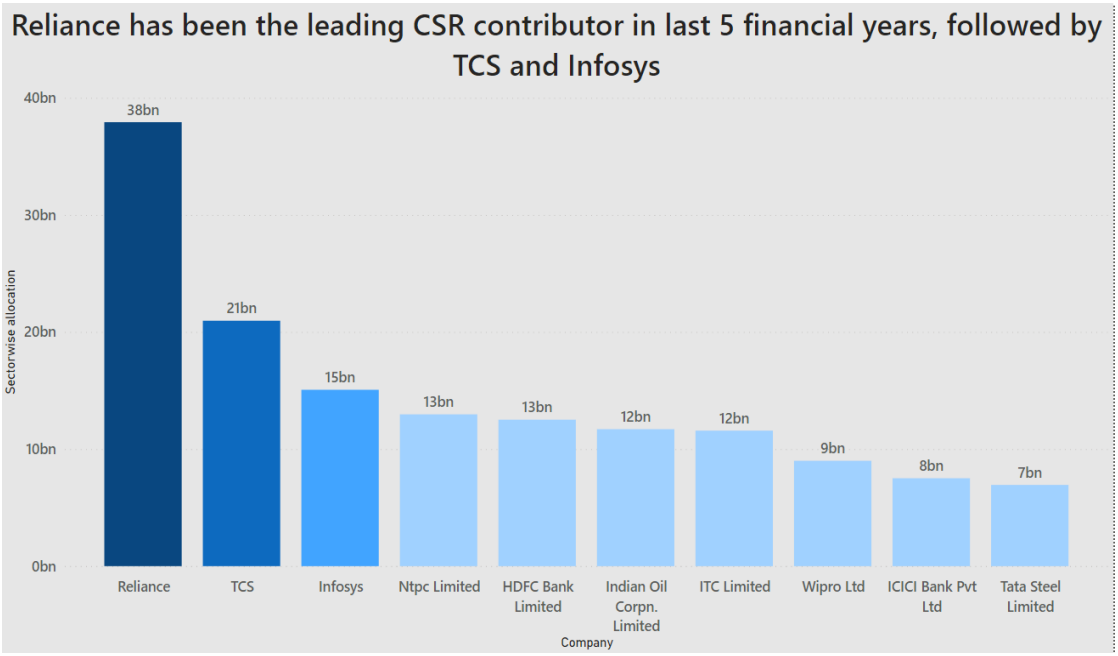


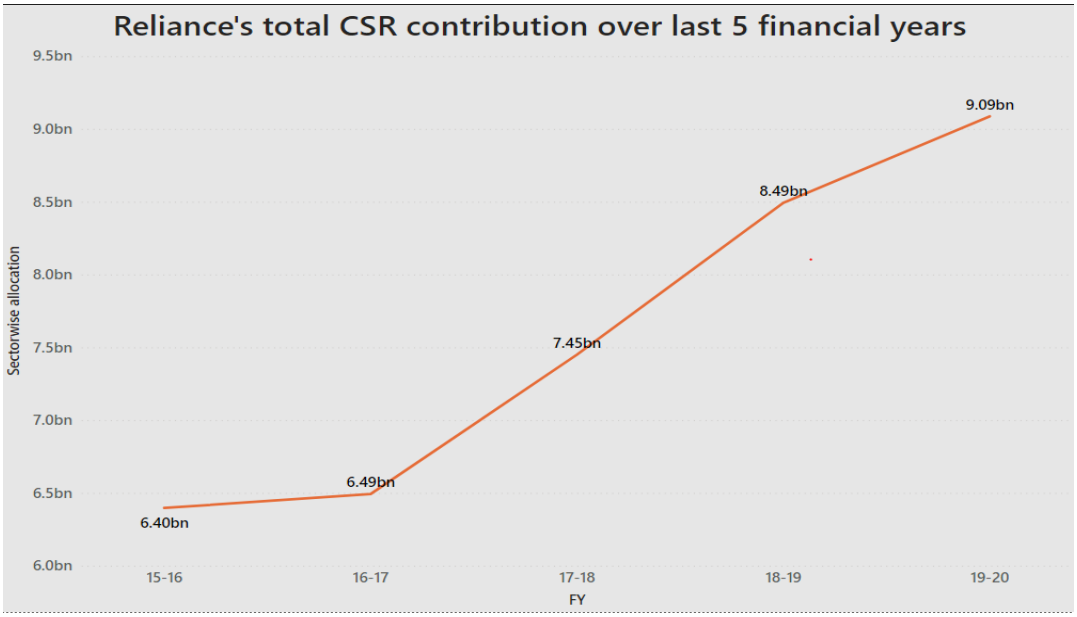
Figure 5: Top 10 CSR contributors in last 5 FYs



Section B – Company wise focus on SDG goals

Further analysis reveals that Reliance has emerged as the top spender in CSR acitvites, followed by TCS and Infosys. Interestingly, among the top 10 companies, there are only two public sector companies – NTPC and IOC at 4th and 6th position, respectively. The top 10 list features 3 software firms, 3 heavy industries, 2 banks and two conglomerates, Reliance and ITC. Also, the top 10 companies contribute almost 58% of total CSR contribution across financial years.

Figure 6: COMPANY 1: RELIANCE | Total Contribution in last 5 FY: 37.92bn



It is noteworthy that, Reliance's CSR contribution has been rising over the last 5 years, which is commensurate with its increasing turnover. As Reliance has been expanding its business and entering high growth industries such as telecom, Education, and retail, its CSR contribution has also been rising (figure 6). What's more interesting is that Reliance has contributed significantly towards eradicating poverty, as seen in figure 7.

Figure 7: Share of SDG 1 in CSR spend of Reliance Industries Limited

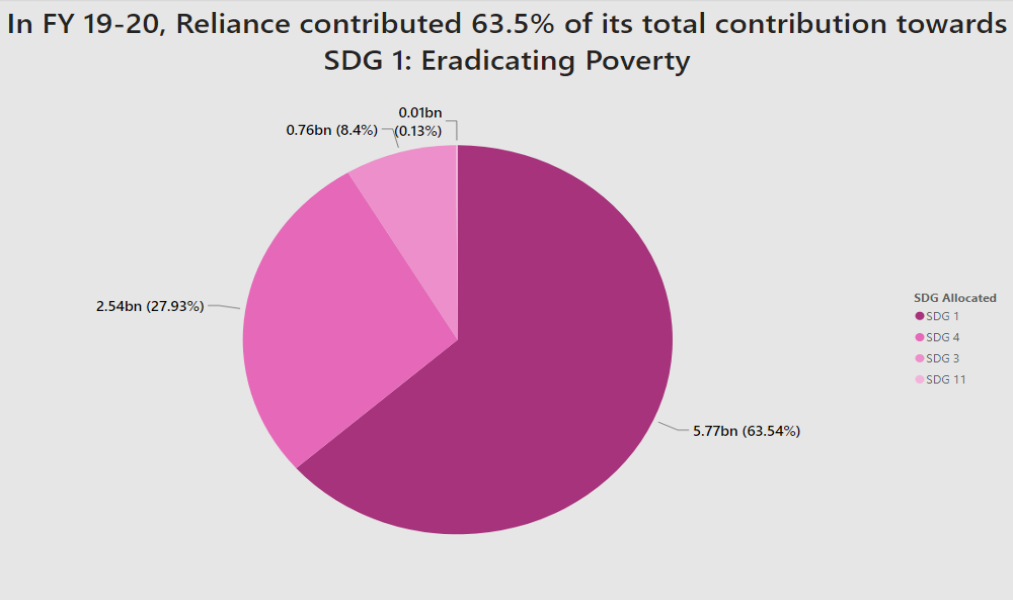
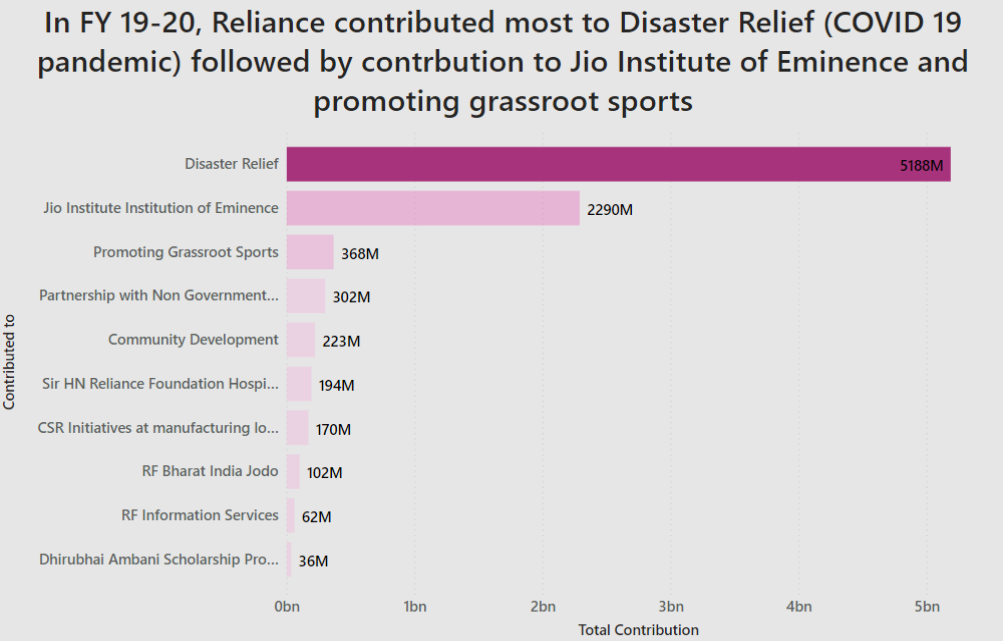
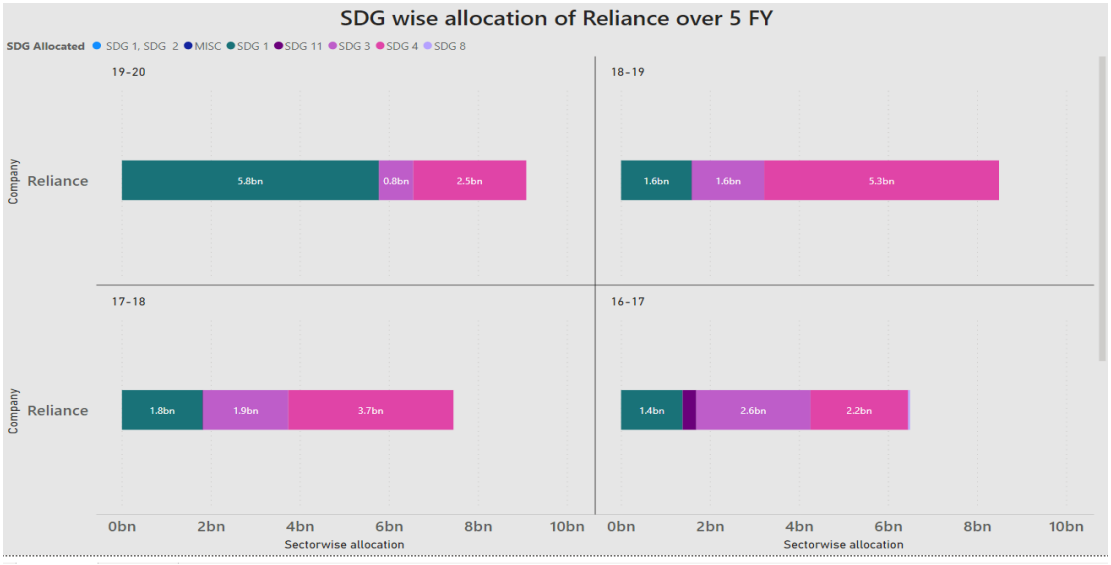


Figure 8: Projects undertaken by Reliance Industries in FY 2019-20



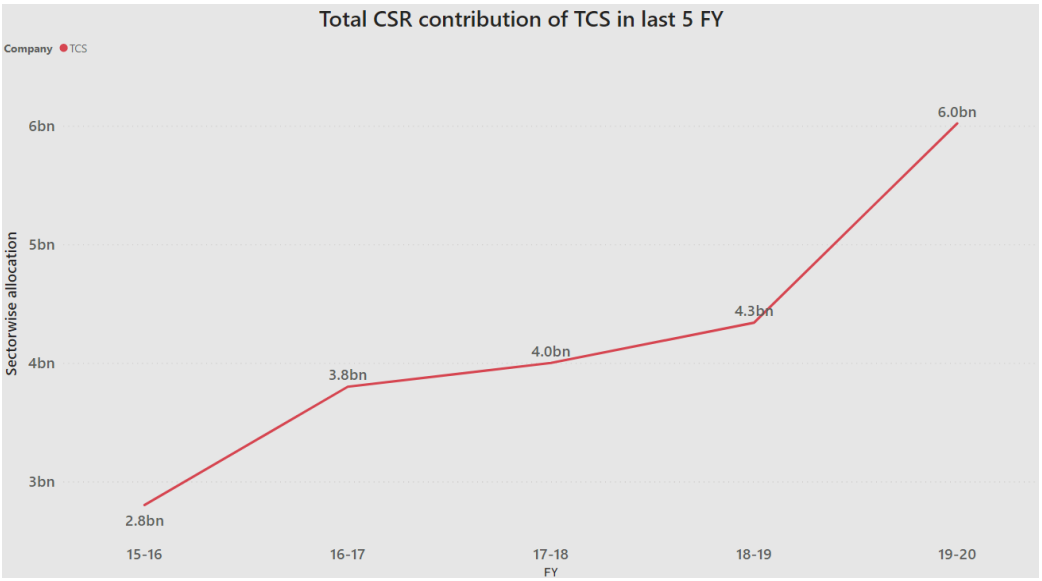
In FY 19-20, Reliance contributed heavily towards disaster relief for mitigating the COVID impact. Reliance donated 500 cr to the PM Relief Fund and contributed to various CM Relief funds towards the end of FY 19-20. Also, Reliance contributed to the Jio Institute of Eminence, which has been classified as an institute of eminence by GoI and was thus classified under SDG 4.

Figure 9: Allocation of funds to SDGs over 5 years by Reliance



Another interesting insight is that there has been a decrease in the contribution of Reliance towards Education after establishing the Jio Institute of Eminence. Most of their funding has been invested in the institute till FY 19-20. Post that, there has been a sudden rise in Reliance's contribution towards SDG 1.

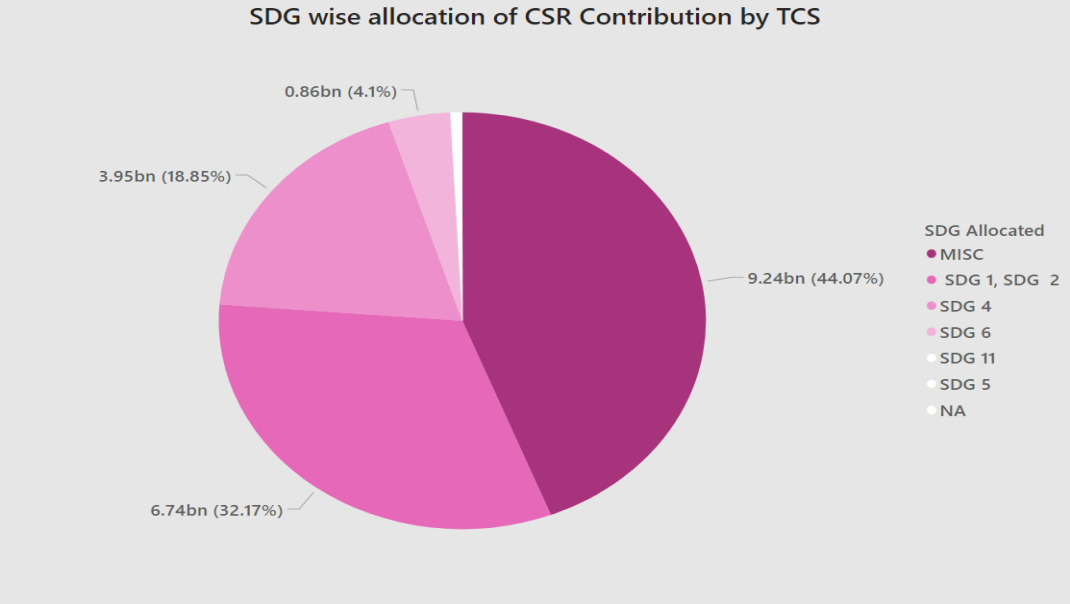
Figure 10: TCS | Total Contribution in last 5 FY: 20.9bn



TCS is a Tata group company; a group known to contribute to India's social and economic development in a huge manner. There has been a consistent rise in the CSR contribution by

TCS. Although the contribution is less as compared to Reliance, however, if we combine all the contributions by Tata Group, the CSR contribution will be higher than Reliance.

Figure 11: SDG wise allocation for TCS



It is seen that, 44.07% of TCS's contribution has been to "Other central Government funds", followed by a contribution to SDG 1, SDG2, and then SDG 4 (figure 11). As per Tata Sons ethos, the companies under the Tata banner contribute to the overall development of society. They contribute whole-heartedly to the causes flagged by the government and also towards immediate relief during disasters.

Figure 12: SDG wise allocation of TCS

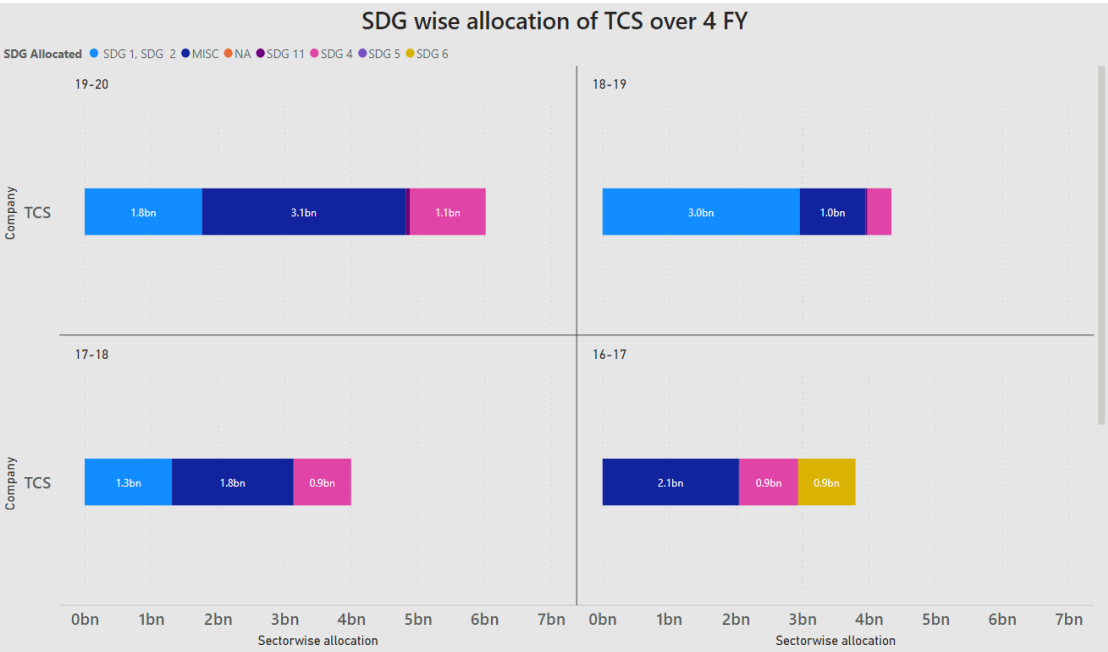


Figure 13: INFOSYS | Total Contribution in last 5 FY: 37.92bn

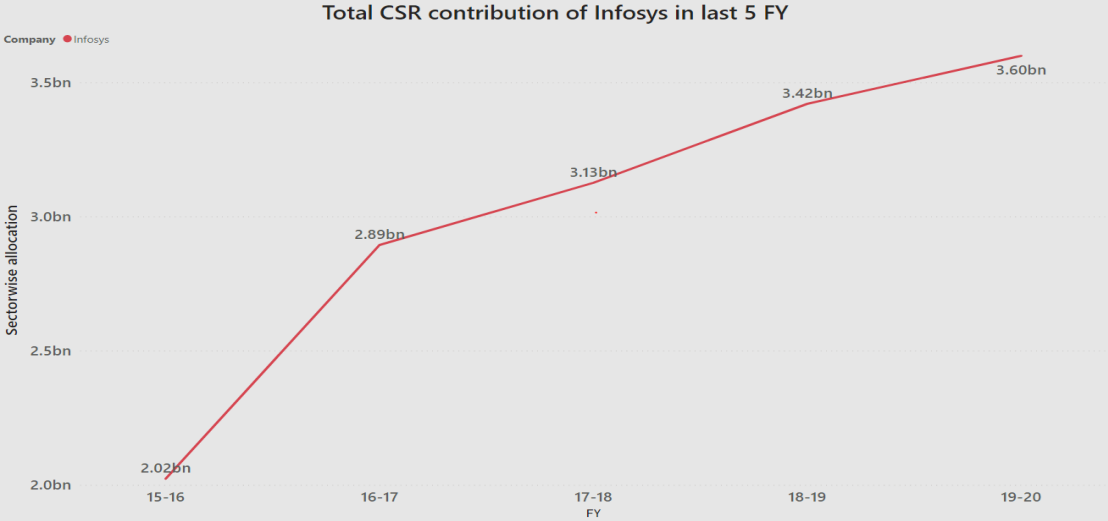
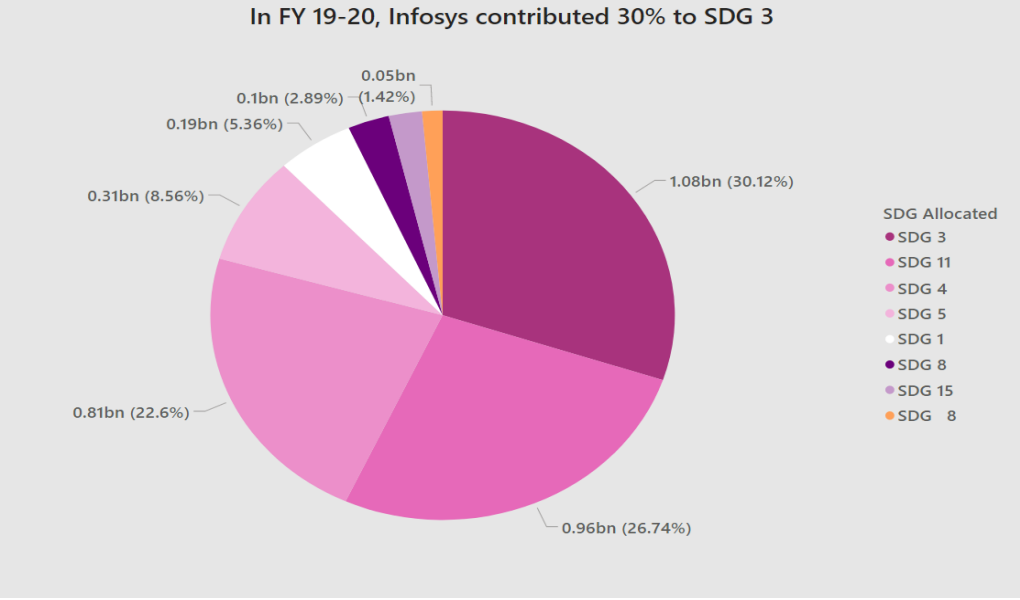


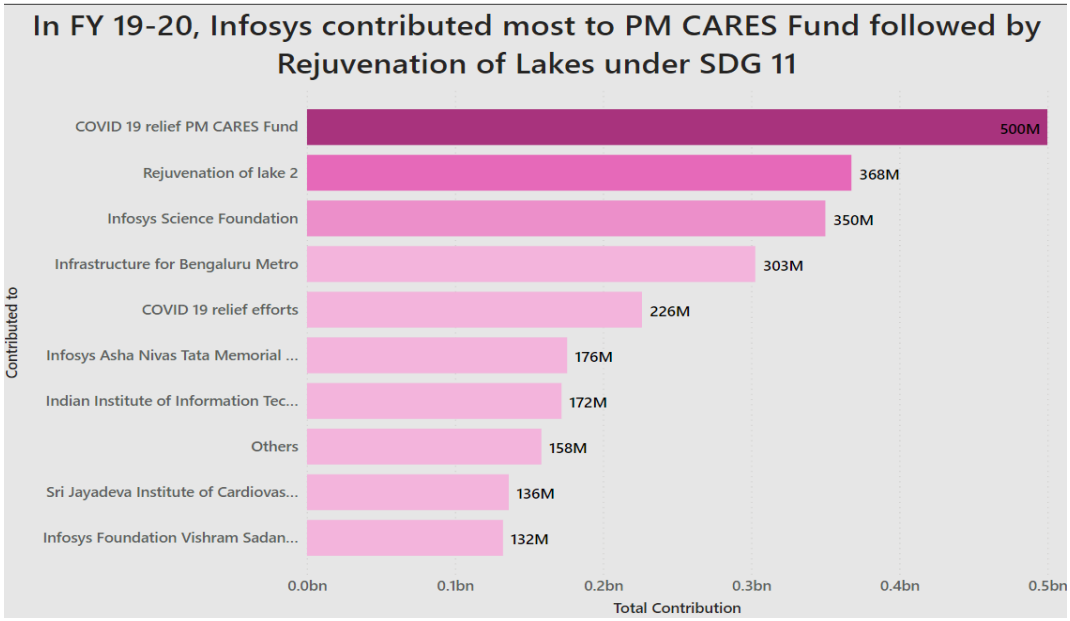
Figure 13 reveals an upward trend in the CSR contribution by Infosys in the last 5 FY.

Figure 14: Contribution made by Infosys to SDG



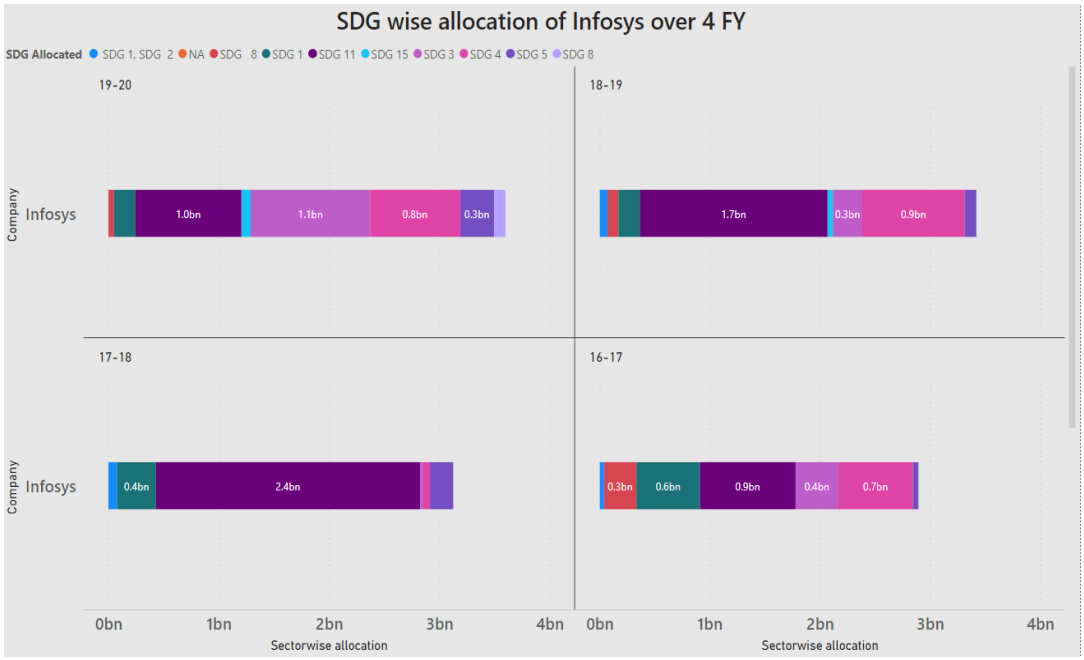
Infosys in FY 19-20 has mostly contributed towards SDG 3: health, which could have been towards COVID 19 contribution, followed by SDG 11 - Environmental sustainability, and Education - SDG 4 (figure 14).

Figure 15: Contribution made by Infosys across various activites



Infosys made a major contribution towards COVID 19 Relief PM CARES Foundation and towards environmental sustainability by contributing to lakes' rejuvenation. Besides, another focus area of Infosys has been towards Infosys Science foundation and infrastructure development of Bengaluru Metro (figure 15).

Figure 16: SDG wise allocation made by Infosys



Infosys has considerably focussed on environmental sustainability across financial years, followed by Education, however, Infosys has also been consistently contributing towards poverty eradication, SDG 1 (figure 16).

Figure 17: NTPC | Total Contribution in last 5 FY: 12.97bn

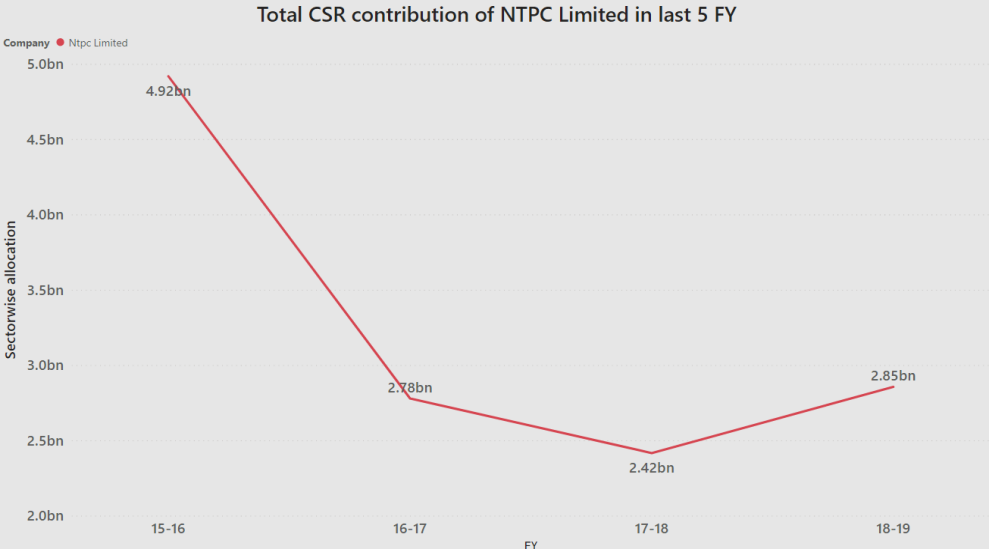
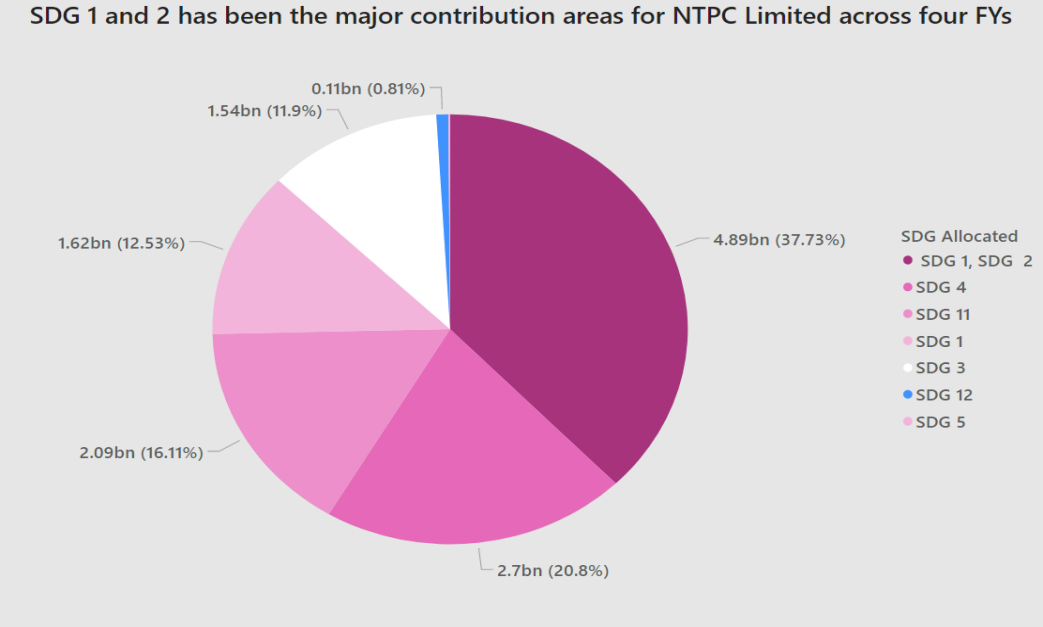


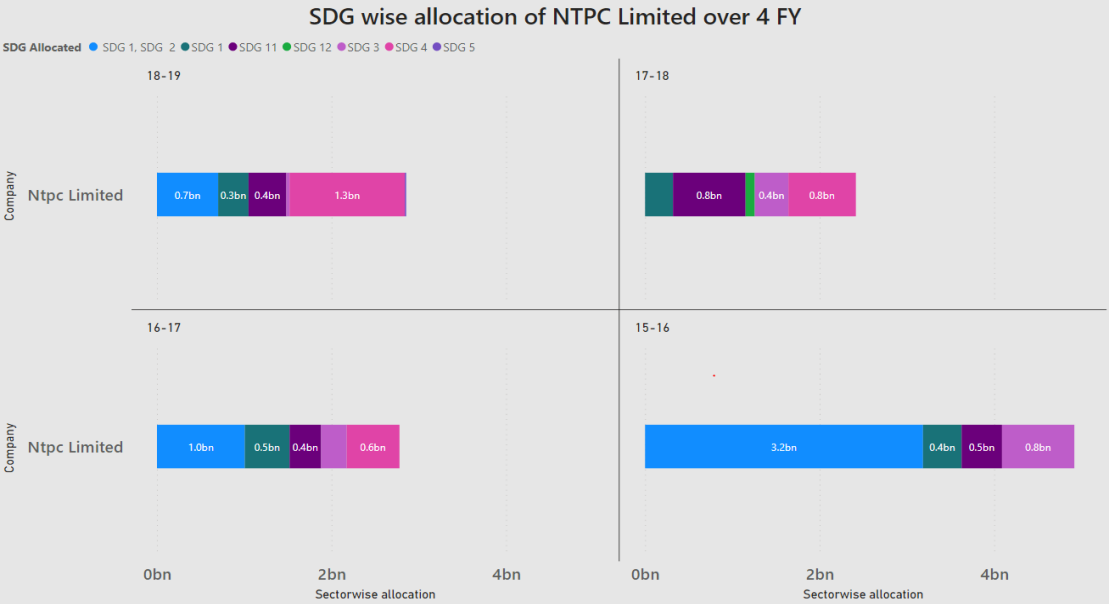
Figure 17 shows a decreasing trend in CSR Contribution, due to falling sales turnover of NTPC in the last 5 years. The heavy industry has not been particularly doing well in the past few years and COVID has further decelerated its growth. NTPC contributed heavily to CSR in FY 15-16, which is more than TCS and Infosys.

Figure 18: Contribution made by NTPC in SDGs



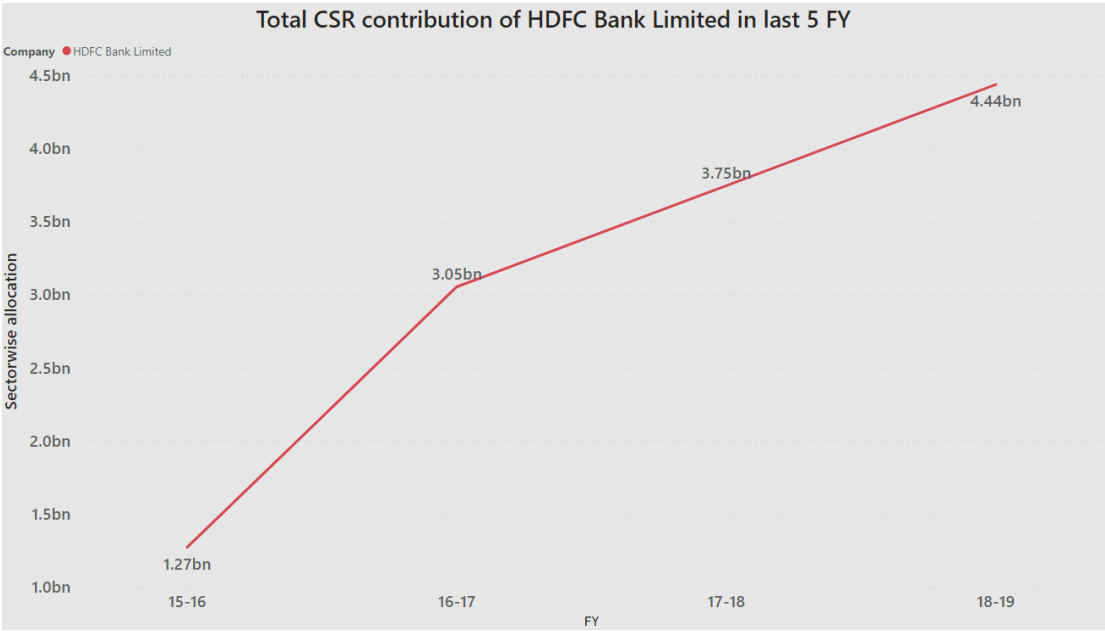
NTPC is a public sector company, so it is known that major focus of NTPC has been on SDG 1 and 2, followed by SDG 4. NTPC has also focussed on environmental sustainability under SDG 11(figure 18).

Figure 19: SDG wise allocation of NTPC



As mentioned earlier, the focus of NTPC has been on investing on SDG 1 and SDG 2 across FYs.,followed by SDG 3 and SDG 4, which is expected from a PSU.

Figure 20: HDFC Bank Limited | Total Contribution in last 5 FY: 12.51 bn



As seen from figure 20**,** NTPC's CSR Contribution is closely matched by HDFC Bank Limited with a total contribution of 12.51 billion; there has been a consistent increase in CSR Contribution by HDFC Bank limited over the years.

Figure 21: HDFC's contribution to SDGs

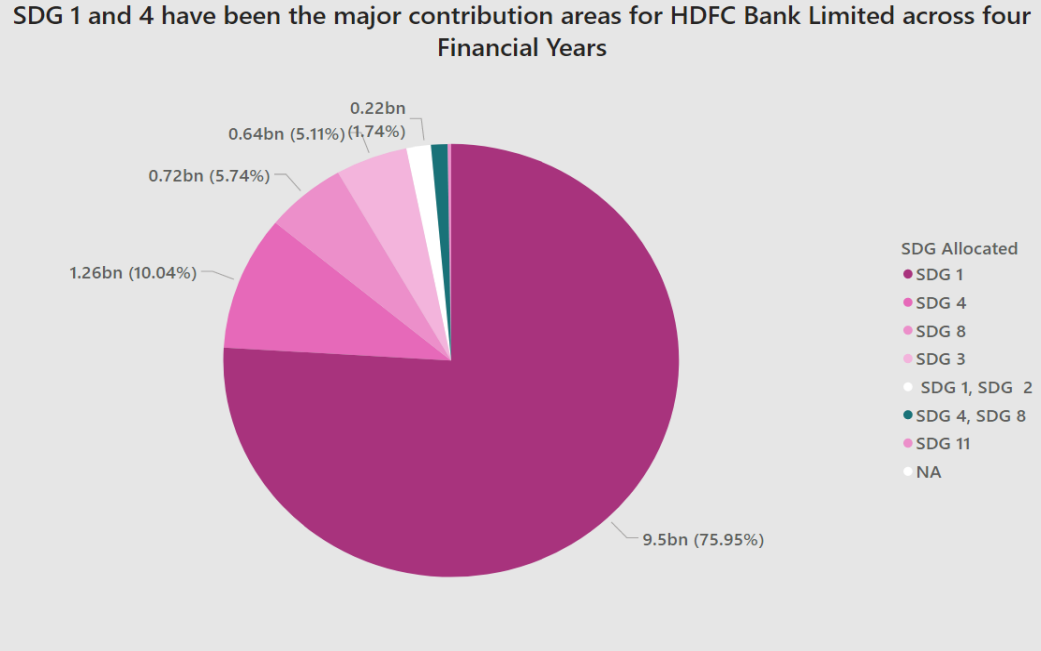
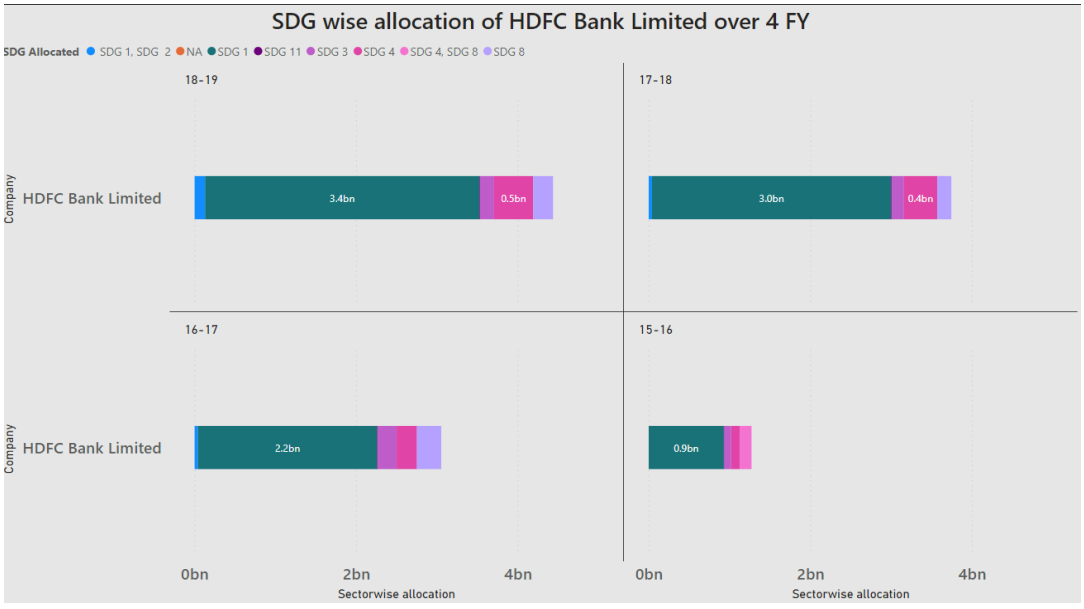


Figure 21 shows that 75% of HDFC's CSR contribution has been towards poverty eradication and reducing hunger, while the second area of focus has been Education for all.

Figure 22: SDG wise allocation



As per figure 22, HDFC Bank Limited has contributed the most towards SDG 1 andSDG 4; they have also contributed towards SDG 8 (Livelihood enhancement projects).

Section C: Sector wiseCSR spending

a. Banking Sector

Figure 23: Companies investing in CSR

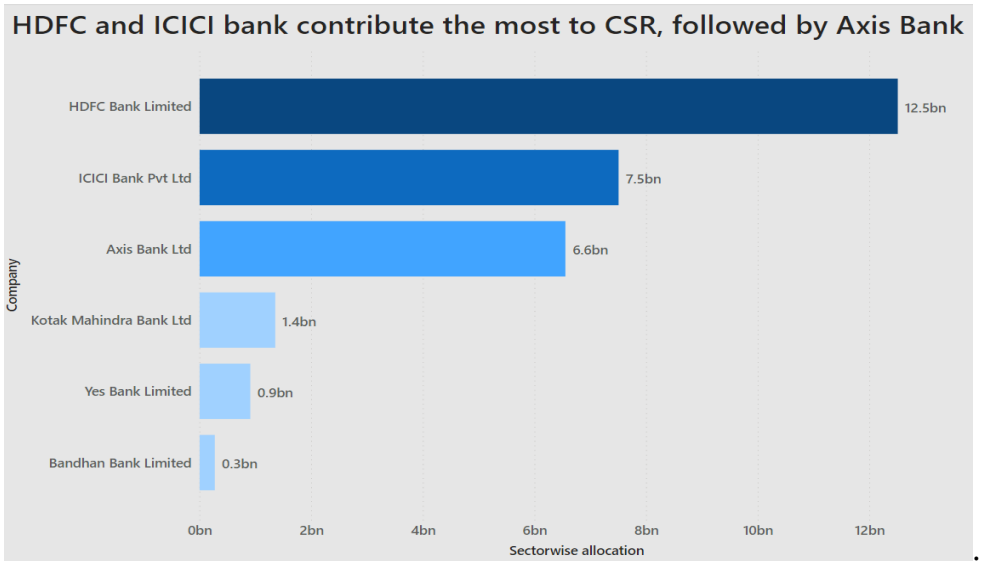
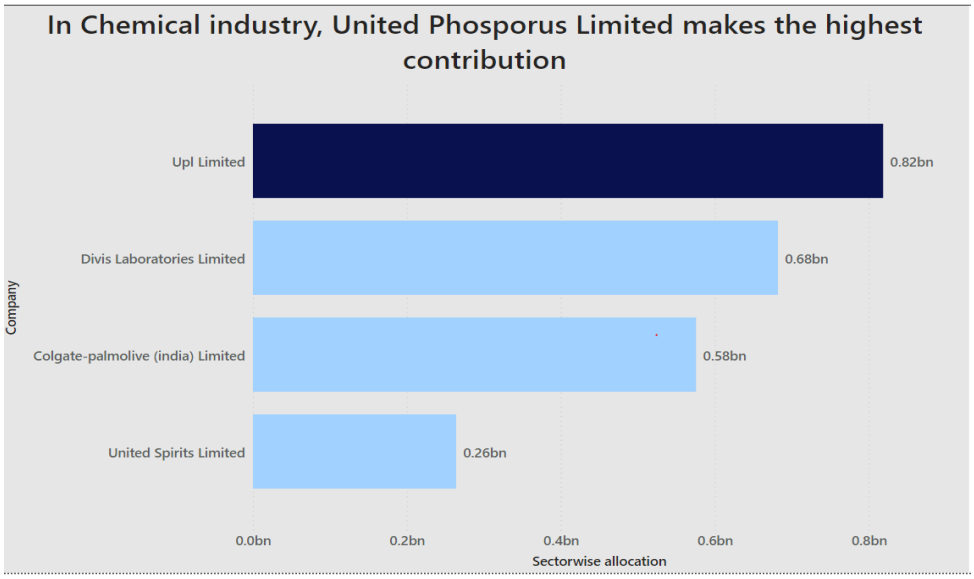


Figure 23 shows that from the banking sector HDFC and ICICI banks are the biggest spenders in CSR

b. Chemical industry

Figure 24: CSR spending in Chemicals Industry



It is interesting to note that the companies in the Chemical Industry are contributing far less than the companies in the banking sector; even though such companies are considered highly polluting . (figure 24)

c. Consumer Goods Industry

Figure 25: Consumer Goods

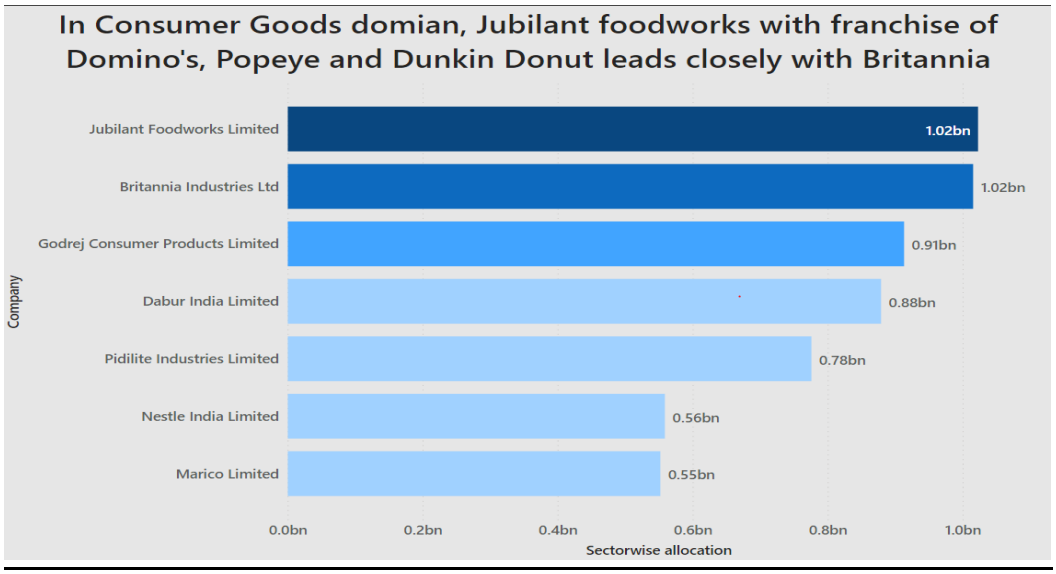
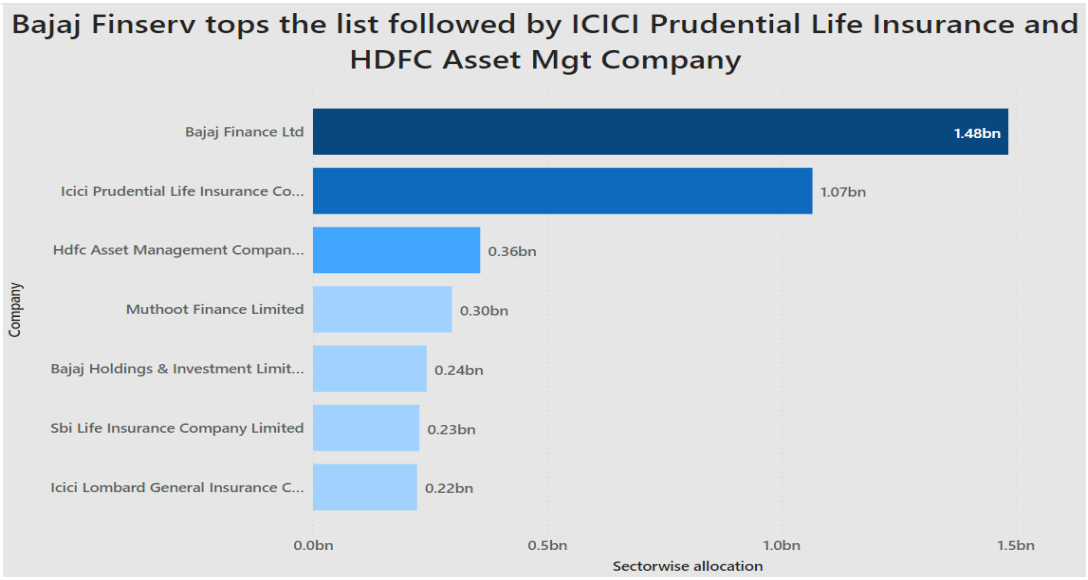


Figure 25 shows the highest contribution being made by Jubiliant Foods, followed by Britannia, Godrej Consumer Products Ltd., Dabur India Ltd. And Pidilite among the top 5 spenders.

d. Financial Institutions

Figure 26: CSR Spend by firms in Finance sector



In the Finance sector, as per figure 26, Bajaj Finance is leading, followed by ICICI Prudential, HDFC Asset Mgt., Muthoot Finance and Bajaj Holdings.

e. Automobile

Figure 27: CSR spend of Automobile companies

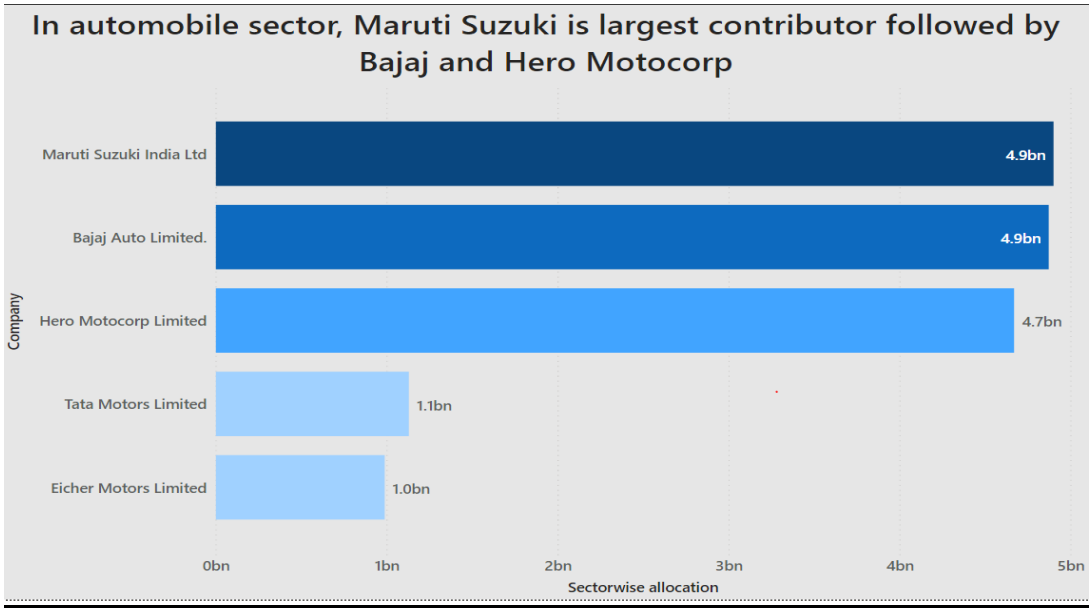
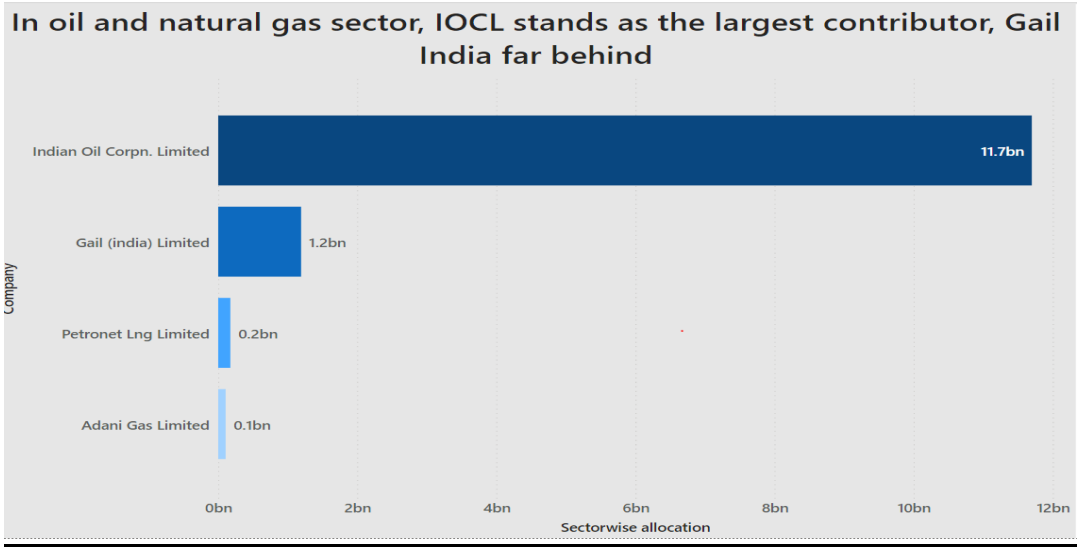


Figure 27 shows the spend of Automobile companies for CSR spending; Suzuki is leading the spend followed by Bajaj auto, Hero Motocorp and Tata Motors.

f. Oil and natural gas

Figure 28: CSR spend by the Oil and Natural Gas companies



Interestingly, in the oil and natural gas sector, IOC is ahead by leaps and bound as compared to other companies (figure 28).

g. **Figure 29: Pharmaceuticals**L

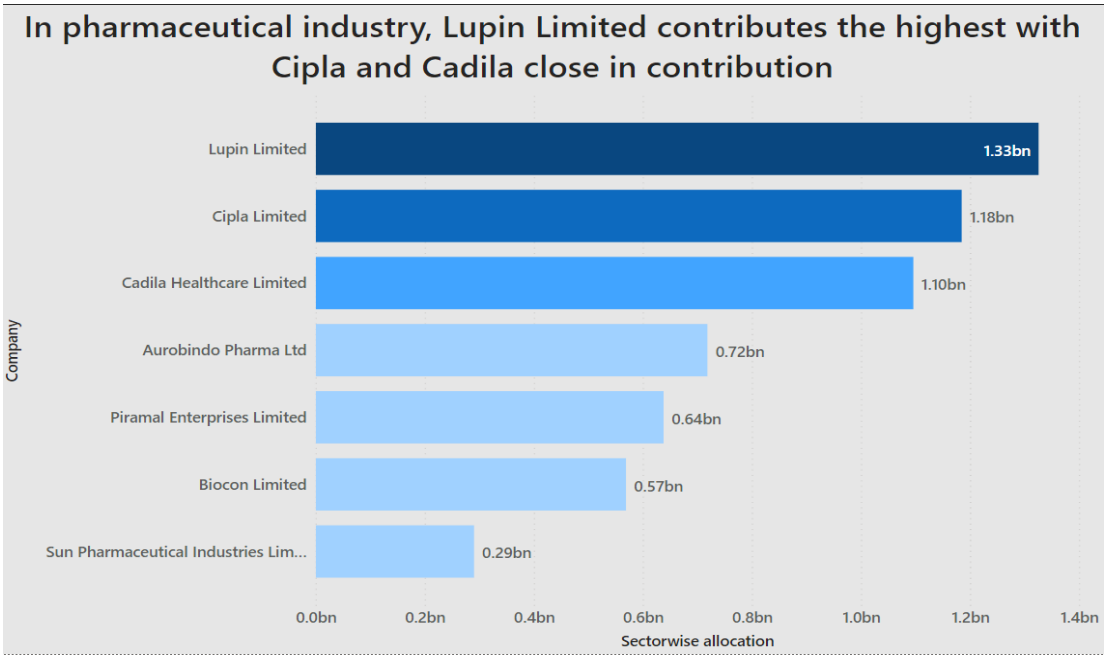


Figure 29 shows that Lupin has spent the highest amount on CSR over last five years, followed by Cipla, Cadilla and Aurobindo pharma. The top three companies have spent more than INR 1 billion each. Lupin Ltd has primarily invested in SDGs 1, 3, and 4. Cipla Ltd has invested in SDGs 1, 3, 4 and 11; whereas Cadilla has invested in SDG 3 follwed by SDG 4.

h. **Public Sector Undertakings**

Figure 30: CSR spend by PSUs

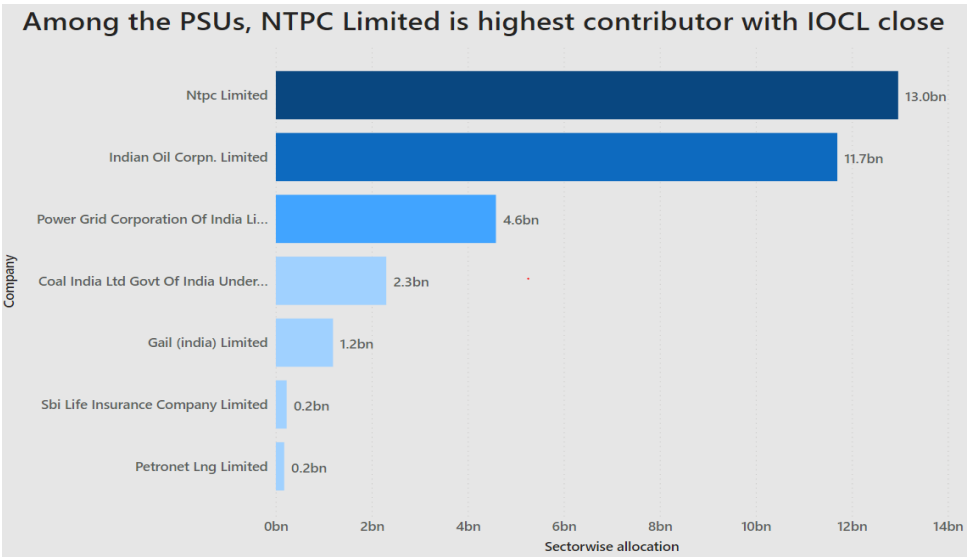
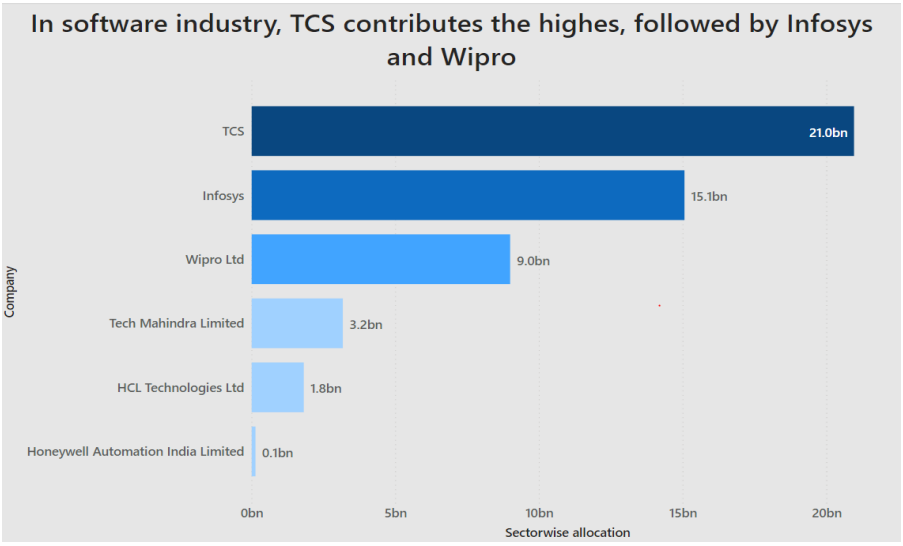


Figure 30 shows the CSR spending by the PSUs, NTPC leads the pack, followed by IOC, PGCL, Coal India Ltd, and GAIL.

i.Information Technology

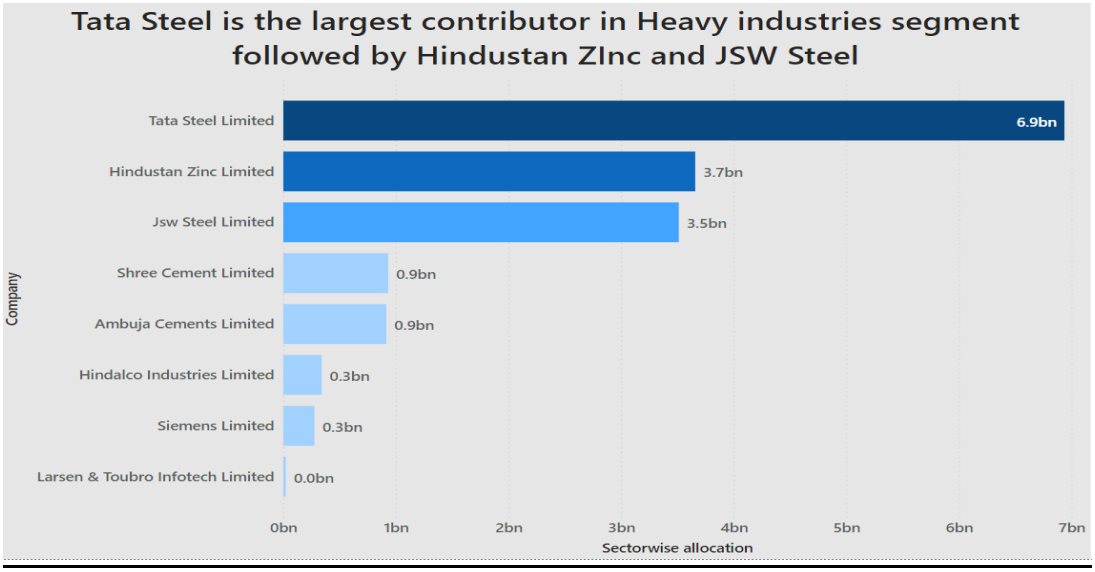
Figure 31: CSR spend by IT industries



As seen from figure 31, TCS is leading in CSR spending over the last 5 years; it has spent more than INR 21 billion, as compared to Infosys which has spent INR 15 billion followed by Wipro INR 9 billion. TCS has invested in SDGs 1, 2, 4, 5, 6, 11 and also in several government intiatives.

i. Heavy Industries

Figure 32: CSR spending in the heavy industries sector



As per figure 32, Tata Steel is leading the investment in CSR among the heavy industries, followed by Hindustan Zinc and JSW. Interestingly, Tata Steel is spending almost double of what Hindustan Zinc is spending.

5. Conclusions

It is interesting to note that Reliance is leading the CSR spending among the top 100 companies for the last 5 years. However, it has not been consistent with a particular SDG. Despite Education (SDG 4) being the last beneficiary of this investment, Reliance has been contributing majorly towards poverty reduction. Last year, the company contributed to Covid relief through PM CARES fund. Reliance has invested in the Education sector to donate to its institute – Jio Institute.

TCS, on the other hand, has contributed significantly to all kinds of projects. The Ethos and Values of the Tata Group have guided its respective companies to contribute to the socio-economic development of society. So rather than planning for which SDG they would be aligning their focus to, they believe in the overall upliftment of the society. Nonetheless, SDG 1, 2, and 4 also figure in their contributions.

The rest of the companies contribute to the goals mentioned above besides contributing to PM Cares fund of Pandemic relief.

Another interesting aspect to note is that none of the government-owned banks figure in the top 10 CSR spenders in the Banking sector. Moreover, these private banks are spending significantly across various SDGs. In fact, the firms from the Chemical industry are significantly short of such an investment. Is it because of the less revenues and profits or an under-investment? This needs to be examined. Consumer goods and Financial institutions are spending almost equally towards CSR projects whereas, Automobile and Oil and Natural Gas are spending a significant amount towards CSR activities. All other sectors such as – IT, Pharma and heavy industry are also spending a lot in CSR activities.

The study has projected broad trends about CSR spending towards SDG among companies and various sectors. It is evident that the footprint of Indian Corporates is quite significant in meeting Sustainable Development Goals. However, further research can be undertaken to understand the micro-trends.But CSR activities have proved that SDG can be achieved with more industries joining this with making iroads to other sectors not reached so far. There could be trade off between priorities and brand equity of Corporates.

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Posters

The 27th International Sustainable Development Research Society Conference
13–15 July 2021
Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis
Mid Sweden University
Virtual Conference, Sweden
Mittuniversitetet
MID SWEDEN UNIVERSITY

Name of researcher: Dr. P. K. Biswas and Dr. Shalini Rahul Tiwari
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Foot print of Indian Corporates in meeting Sustainable Development Goals:

The Challenges and Opportunities

IMPORTANCE OF STUDY

- Indian government has mandated investment in CSR by large companies to spend 2% of average profits in 2014.
- All Companies have not adhered to this regulation; 64% of companies spent less than mandated amount in 2015.
- In 2016, 74 companies did not spedn anything on CSR and 170 spent less than half.
- Increasingly, companies have mapped CSR contribution to SDG's.

METHOD

- Data on CSR spending of top 100 companies of BSE for last 5 years.
- Data analysed for -
  - sector wise CSR allocation of funds.
  - Main sectors to which the CSR contribution was made
  - SDGs which are advanced under these main sectors

FINDINGS

- Major contribution made in SDGs 4, 3, 1, and 11.
- Highest contribution in SDG 4, 3, 1, & 11 in 2018 – 19: INR 21 bn, 11 bn, 9 bn & 9 bn.
- Reliance Ind Ltd. – highest spender (38 bn), TCS (21 bn) and Infosys (15 bn).
- Top 10 companies contribute 58% of CSR contributions.
- 63% of contribution by RIL is towards SDG 1.
- TCS has contributed 44% to Central government funds and remaining to SDGs 1, 2 & 4.
- Among top 10, only two PSUs – NTPC and IOC appear.
- Banking sector leads in CSR investment – INR 30 bn, followed by Automobile sector – INR 18 bn, Oil & Natural Gas sector – INR 16 bn.
- Tata Steel leads in heavy industries sector with INR 6.9 bn; top 5 companies contribute – INR 15 bn.
- Contributions made by all Tata group companies will exceed that of RIL.

CONCLUSION

- Though RIL is leading, its spending is not consistent over the years.
- Though SDG 4 (Education) has been the largest beneficiary by RIL, but amount has been spent on establishing Jio Institute of Eminence.
- Tata group companies have spent across several SDGs consistently – as driven by the ethos and values of the group. The group believes in overall uplifment of the society.
- Private banks have invested far higher as compared to public sector banks.
- Chemical companies have invested significantly lower than the required amount.
- Almost all the companies had invested in PM Cares fund, last year, for fighting the pandemic Covid – 19.

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5. Production, Consumption and Innovation

5b. Design for sustainability

Abstracts

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URBAN CHALLENGES IN SCENARIOS LIKE COVID-19 PANDEMIC AS DRIVERS TO SERVICE DESIGN AND SOCIAL INNOVATION FOR RISK GROUPS

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Dr. Marli Teresinha Everling

Abstract

The 'Design for products and Services in Urban Context' discipline integrated in Univille (University of the region of joinville) Master's program in Design was scheduled to start on 17th march of 2020. Because of Covid-19 pandemic, the University, following municipal regulations, canceled every educational activity. During the following two weeks advances were made to afford the imposed reality that required social distancing and isolation. One huge step was the permission given by CAPES (Coordination for the Improvement of Higher Education Personnel) to offer online classes. So, two weeks later on March 31st, the classes started in a distanced approach using MS Teams platform. The schedule prescribed 13 meetings. At the beginning it wasn't clear how long the activities might be online, but it soon became obvious that the online mode would endure until the end.

Considering the connection of the subjects with urban context, every planned activity, suddenly, sounded obsolete. It stood out as a strong opportunity to discuss the cities in a pandemic scenario. So, the whole planning was reconfigured and the five first meetings were dedicated to concepts and theoretical discussions related to city, urbanism, sociology, social innovation and design based on: (i) Yuval Harari analysis about 'The World After Coronavirus'; (ii) New Capitalism documentary; (iii) chapters from books alike 'The image of City', 'The Death and Life of Great American Cities', 'Cities for

People', 'The Conscience of the Eye: The Design and Social Life of Cities' published respectively by Kevin Lynch (1960), Jane Jacobs (1961), Jan Gehl (2010) and Richard Sennett (2006), (iii) organizations and networks like World Design Organization, Council Design, and DESIS (Design for Social Innovation and Sustainability) Network because of their comprehension of design and approaches related to sustainability, communities and cities; (iv) Social Innovation based on authors like Murray et al. (2010), Brandsen et al. (2016), Mulgan et al (2007), Manzini (2008).

On the sixth meeting, a challenge named 'All2Gether' was proposed ; the team was invited to develop products and services that could minimize problems and sufferings of Covid-19 risk groups in the areas of health and wellbeing, logistics, behavior, mobility, citizen, housing and relationship. Double diamond was the methodological process used due to its fitability to challenges connected with Design, product service systems, urban context and problem solving centered on people. The team was composed of eight students and the activities (workshops) were mediated by professors Luiz Romão (skilled in Social Innovation) and Marli Everling (experienced in Participatory Design and urban context).

By focusing the challenge the team polished the problem as: development of products and services to reduce sufferings of Covid- 19 risk group.

During the process were used procedures like CSD Matrix (Certainties, Suppositions, and Doubts), asking the users, asking the experts, personas, scenarios, blueprints and service prototypes. The challenge resulted in a service driven to help elderly people in their daily life for the pandemic and post-pandemic scenarios. Besides, the experience helped to clarify how to work with participatory approaches using the double diamond in online learning classes.

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Visualizations of circular business models – a design perspective on concepts and visual presentations in the food industry

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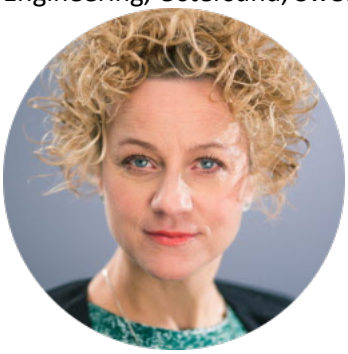
[1]Department of Design, Sundsvall, Sweden. [2]Department of Ecotechnology and Sustainable Building Engineering, Östersund, Sweden. [3]Chalmers Industriteknik, Göteborg, Sweden



Senior Lecturer Anna-Sara Fagerholm

Senior Lecturer Karina Göransson

Abstract

Design is discussed as a way of shaping the surrounding and as an expression of the culture to which it belongs (Skjerven and Reitan, 2018). By designing meaning is created (Ehn, Nilsson & Topgaard, 2014; Escobar, 2018). Recently, there has been wide interest in research focusing on design in a circular economy (Moreno, De los Rios, Charnley, 2016; Wastling, Charnley and Moreno, 2018). Studies on new business models pay attention to design strategies for a circular economy but does not provide guidance for designers developing new circular business models (Moreno, De los Rios, Rowe and Charnley, 2016). In addition, there is a huge gap between the concept of circular economy and its practical implementation in the industry (Bianchini, Rossi and Marco Pellegrini, 2019). Furthermore, there are few academic publications in the area of design specifically focusing on visualizations (Vande Moere and Purchase, 2011). Hence, additional studies focusing on the visual aspects of circular processes are needed.

Against this background, the purpose of this study is to examine visualizations of circular business models in the food industry. First, the concept of circular business models is discussed from a design

perspective. Second, this study summarizes how visual presentations of circular business models are visualized within the food industry.

The study begins with a literature review and is followed by a visual content analysis on how a selection of companies within the food industry visually present their circular business models. Results are presented on how the concept of circular business models is discussed from a design perspective. Also, this study summarize results on how visual presentations of circular business models are visualized within the food industry.

This study addresses the relation between the increasing role of the sustainability agenda in society and the visual presentation of circular business models by companies. With this study, we hope to provide a better understanding of the visual aspect of business models based on circular principles and from a design aspect, contribute to knowledge about visual presentations of sustainable processes in society. In a reality where the earth's resources are limited, a shift in production and consumption is required and knowledge of new circular business models are needed. This is in line with global goal number 12 – Responsible Consumption and Production – 12.2: by 2030, achieve the sustainable management and efficient use of natural resources, and 2.5: by 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

The world after the pandemic will not be what it was before the crisis and this enables a transition to a circular economy (Regeringskansliet, 2020). To succeed, sustainable business models are required (FAO, 2020). During 2020, domestic and global markets are facing challenges due to the restrictions on people’s movement that were imposed to contain its spread of of COVID-19 (FAO, 2020) and changes in access to groceries in stores (Wetter, Rosengren & Törn, 2020; Sim, Chua, Vieta & Fernandez, 2020).

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Resident perceptions of design for sustainability: insights from the European Union

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Abstract

Reducing associated socio-environmental impacts of a product during its lifecycle is a key question for product designers and policy-makers. Within the European Union, formal product-design and performance requirements are primarily governed through eco-design Directives, e.g. 2005/32/EC; 2009/125/EC and regulations 2019/2021. Whilst these practices have set minimum standards on design elements including energy and material efficiency, a broader design for sustainability perspective is lacking. Scholars working on eco-design and design for sustainability have predominantly focused on supporting or reviewing their adoption in existing companies. Or, examined industry perspectives towards formal legal requirements. Alternatively, this research aims to better understand European residents perspectives of design for sustainability requirements, and assess how closely these perspectives align with current policy requirements and views of consumer organisations within the European Union. This research adopts a mixed methodological approach, which includes stakeholder interviews with consumer organisations and a survey (n = 1600) of six European counties (Latvia, Sweden, Czechia, Poland, Italy, Spain, Germany and the Netherlands), concerning residents perspectives on product performance and design specifications, e.g. eco-design and design for sustainability. This research is in the data collections phases. Research is currently in-progress. This research connects to SGD 12 (responsible production and consumption), specifically targets 12.5 and 12.6. We envision the results providing clear policy implications on design for sustainability within the EU, based on their acceptance by residents.

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25.5.2020 Overshoot day

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Abstract

Portugal exhausted its natural capital in May 2020 and lived on credit until the end of that year (Earth Overshoot Day, 2020). At this rate, a planet is not enough to suppress production and supply needs. Portugal needs 2.5 planets (i*dem*, 2020). At this rate, we are questioning our future, because in this logic of unlimited growth the natural cycle of renewal is not being respected, causing in some situations; soil erosion, loss of biodiversity and water in the crops which at the end of the process will be part of food waste. In fact, according to IUCN between 2016 and 2019 endangered species in Portugal almost doubled having become the fourth country in Europe with more species at extinction risk (Mendonça, 2019) and in Portugal inadequate eating habits represent about 86% of the chronic illness burden in the health system (Nogueira, 2016, p.30), being the main cause of absenteeism and incapacity at work, with consequences for the competitiveness of the economy (Diário da República, 2017).

What if the collaboration of design in the process of developing a project for the agri-food sector helped to delay Overshoot Day, to adopt the principles of a circular economy and contribute to improve consumption patterns? Born out of the need to find or adapt solutions to problems day-to-day life, based on people's experience, how they use and enjoy products and services, design is a facilitator, which regardless of complexity and technology (Viladas, 2010, p.25) translates benefits into something that can be enjoyed by society.

Present in several stages of the value chain, through *product*, which is often the first contact that the consumer has with a company, the company's *communication* and the physical and digital *spaces* where its activities are developed, which includes the production, offices, points of sale, promotion actions, site and social networks, design can develop solutions that minimize the impact on the environment and simultaneously empower people on eating habits and environmental preservation, namely through shapes, materials, production processes, colors, legibility, concept and narratives that must value what is systemic, that is what it is done instead of what is sold, sometimes intuitively, by tradition or knowledge.

Starting from an idea or a design project you want to boost, we invite to a reflection on what you intend to achieve with a design collaboration, in a dynamic of cause and effect, which helps to identify, weaknesses and opportunities for the adoption of a circular design, in order to each stage of the process, the useful life of a raw material or product, successively reused with add value. This process begins by characterization of the design project and agri-food product, follow by objectives and targets that define, what you intended to achieve with the design project. After that come the Initiatives, a program of activities in line with the company's strategy, aiming to achieving what was previously defined.

The aim of this tool is to contribute to sensitize for the impact of design solutions and guide their collaboration to circular solutions.

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Design strategies in times of pandemic – a case study of how Covid-19 is visualized in the Nordic countries Sweden, Norway, Finland, Denmark and Island

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Senior Lecturer Anna- Sara Fagerholm

Abstract

In a pandemic, a large amount of information must reach people in an efficient, coordinated and credible way (Folkhälsomyndigheten, 2019a: 12). A lack of communication has been shown to exacerbate the crisis and reduce citizens' confidence in those in power (MSB, 2006). Here, design is important for how people perceive information as visual messages tend to have more impact than text (Jacobs, 2020; Otten, Cheng, & Drewnowski, 2015). Therefore, it could be beneficial to use visual elements in the design of complex information to ensure that messages reaches the target groups (King, 2016). Here, infographics can be a tool (Jacob, 2020; Weinschenk 2011). Visual elements in communication can also contribute to health-related topics being perceived as more interesting (King & Lazard, 2020).

To reduce the spread of Covid-19, people around the world are urged to follow the recommendations communicated by authorities in each country, (FHM, 2020). In this context, designed infographics can be used – in research these graphic design elements are described as visual representations of information, data, or knowledge (Ocampo, 2011), presenting complex stories or a large amount of data in a visual

and accessable way (Jacob, 2020; Damman, Vonk, van den Haak, van Hooijdonk and Timmermans, 2018; Weinschenk 2011).

Against this background, the purpose of this study is to examine how Covid-19 is visualized in information material from authorities* in the Nordic countries Sweden, Norway, Finland, Denmark and Island, and how design elements are expressed in the material.

Previous research has to a large extent been quantitative with surveys and opinion polls, but with the gradual increase in the role and visual expression of the media, qualitative studies are increasingly common (Vigsö, 2016: 74).

In this comparative case study, a visual content analysis is used, and results are presented on similarities and differences between how different northern countries visualize information material about covid19 and how design elements and infographics are used in the material aiming to build trust in times of risks and crises.

The background to research on crises is often about improving how society handles new crises (Vigsö, 2016: 73). In times of pandemics, there is always a high risk of misinformation being spread, which is a phenomenon that the World Health Organization (WHO) term
as infodemia (Institutet för språk och folkminnen, 2020). Visual strategies can be used to improve the quality of health communication during public health crises and reduce the unintended effects
of infodemic conditions (King, 2020). During public health crises such as the ongoing corona pandemic, there is a great need to improve and strengthen public communication to reduce the spread of infection (King, 2020). The overall ambition of this study is thus to build on knowledge of the role of design in societal crises. This van be linked to the UN's global target number 3 and the sub-goals 3.3 Fight infectious diseases and 3.D Improve early warning systems for global health risks.

* National authorities that has a national responsibility for public health issues and works to ensure that the population is protected against communicable diseases and other health threats.

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INTEGRATING FINANCIAL AND PHYSICAL SUPPLY CHAINS: HOW FINTECH CAN ENABLE A SUSTAINABLE BUSINESS PROCESS MANAGEMENT

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Abstract

The financial supply chain, running parallel to the flow of goods and services, is common to all economic supply networks, and its integration with the physical supply chain is a critical and ubiquitous. However, physical supply chain globalization is making sustainable business process management more and more difficult. Since the onset of COVID-19, demand shocks have troubled supply chains, highlighting their vulnerabilities, and raising concerns about resiliency. Much of the disruption to the supply chain appears to occur at the levels of production and distribution centers, but less at the transportation level. In this framework, blockchain technology - as a distributed digital ledger technology which ensures transparency, traceability, and security to the miners - may be crucial to easing some global supply chain management issues.

Community and consumer pressures to meet sustainability goals, but also to overcome some of the restrictions posed by the pandemic, prompt us to investigate how fintech can address and aid financial and physical supply chain integration in a sustainable management perspective. In fact, the study aims to critically examine the tools provided by fintech which could support the physical and financial supply chain integration, overcoming the abovementioned issues and, at the same time allowing for the achievement of the Sustainable Development Goal 9 (SDG), consisting of building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation.

The study is based on a theoretical approach and presents a general framework model supported by the most recent scientific literature in the industrial field.

The research findings show that fintech tools can support buyers and suppliers by contributing to coordination, collaboration, information sharing and information visibility, integrating the supply chain in a sustainable perspective.

The research is limited in that it is theoretical. Therefore, further research is required in order to quantify the impact of fintech interventions on physical and financial supply chain integration, but also the SDG achievements. However, it has some practical implications. The proposed framework model requires an understanding of the flow of physical and financial resources across supply networks and can help buyers and suppliers to develop a more holistic understanding of the supply chain, improving integration and optimizing working capital, overcoming inter-organizational, intra-organizational, technical, and external barriers, thereby achieving higher sustainable performance.

The study is original because presents an interdisciplinary model which uniquely recognizes the role of fintech in enabling buyers and suppliers to improve the integration of physical and financial supply chain, contemporarily ensuring the SDG 9.1 and 9.3 targets achievement and accelerating progress towards SDGs in times of crisis. Future research propositions and directions could provide insights into overcoming barriers and the adoption of blockchain technology for supply chain management.

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Territorial product-service systems for the circular society: a prescriptive design method

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Abstract

Product-service systems (PSS) are considered key elements of a transition to a circular economy (CE). In addition to environmental impacts and resource decoupling, circular PSS design needs to consider and support the wider transition to an equitable and just circular society. This paper adopts a territorial view as a lens for ensuring PSS contribution to the transition to circular societies. The concept of the territory in this study is not only an area delimited by an administrative authority. The notion of the territory here refers to an inhabited physical space that is economic, cultural, and political at the same time, it is a social construct. Since sustainability does not fall evenly across space, the meaning and potentialities of PSS are likely to vary between territories. Thus, considering the territorial dimension explores on a larger scale the potential of PSS to contribute to sustainable societies. At present, PSS design methods mention the importance of collaboration, mostly with the aim of reducing environmental impact and not creating a circular society. This paper aims to fill this gap, by proposing a prescriptive design method for the development of PSS concepts that evolve and are aligned to the local sustainability challenges and priorities of territories. An initial version of the method is developed through a literature review, of PSS design methods and tools adopting a systemic and territorial approach. The prescriptive framework comprises four main parts, understanding, envisioning, designing, and developing pathways. The first version of the method was tested by 56 MSc students during a two-month project. A second version of the method, which is presented in the paper, is currently under evaluation by companies and experts in the field to increase its validity and reliability. This research aims at aiding companies to align their sustainable and competitive strategies with local problems and to create stronger links with territorial actors focusing on the design and innovation processes within organizations.

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Cultural aspects in frugal design for the BoP – exploratory study of its application in a solar roof composed of artisan clay tiles

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Abstract

Since the concept of the Base of the Pyramid was introduced by Prahalad, numerous projects have been developed to serve this segment of the population. However, many of the design projects oriented to these contexts do not fulfill their purpose. This is mainly due to the lack of understanding of people's needs and the cultural and social differences that define the type of appropriate solutions for each BoP context. Recently, frugal innovation has emerged as a strategy to adequately address the challenges of designing and developing sustainable solutions for people living in contexts of poverty and marginalization. Regarding the enablers of this innovation approach, the literature highlights the dominant role played by the local ecosystem and culture. In this sense, there are factors specific to these contexts, which significantly determine the characteristics of the solutions. Among these factors, cultural aspects are considered key factors, since they can add additional value to the products, both for the economic growth of the communities, as well as for the promotion of the uniqueness of the local culture within a global market. In this sense, the transfer of cultural characteristics to solutions developed through a frugal design process becomes a relevant strategy, particularly when targeting marginalized communities.

Advances in frugal innovation research have identified a number of criteria and attributes that should be considered during the development of a solution. These attributes are generally focused on functionality, cost reduction and resource optimization. However, there are still few works that address frugal innovation with a perspective of integration of local cultural aspects. In this study, we explore the integration of cultural aspects in the development of a solar roof made of handmade clay tiles. This technological solution aims to address the lack of energy in rural BoP communities within the Mexican context. To develop the prototype, we used Pahl&Beitz's engineering design methodology as main framework and integrated the criteria of frugality identified in the literature.

Subsequently, we propose a series of metrics aimed at evaluating the cultural integration of the product developed within the local Mexican context. The metrics are based on Mexican research in the development of socially appropriate technologies whose key indicators are the jobs created and their characteristics. The results show that contextual aspects can be integrated into a standard design process and the frugality attributes are key elements to achieve the cultural acceptability of the technical solution developed. The case study also reveals that it is necessary to design the manufacturing process technology under the same criteria used for the technical solution. The harmony of the technical solution (solar roof) with the local architectural style in which it will be installed reduces the rejection of the product for aesthetic reasons. This generates a desire and acceptability on the part of the user to use this type of solutions. This study contributes to the literature on frugal innovation by integrating the cultural aspect based on a case study in the Latin American context.

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Developing sustainable products for the circular economy: the circular Sustainable Product Development (cSPD) process model

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Abstract

Over the last years, circular economy (CE) literature has made a significant progress on developing key concepts, identifying circular product typologies, outlining assessment methods, and exploring the synergies of circular product design with manufacturing practices such as digitalisation or environmental management. Nevertheless, less attention has been paid on describing changes in company processes necessary for the implementation of circular product development. For this reason, this research presents the circular Sustainable Product Development (cSPD) morphological box, aimed at providing implementation guidance to business and industry.

The cSPD is based on the analysis of 24 value-retention strategies implemented in manufacturing industries enabling circular products. The framework describes process reconfigurations in the Sustainable Product Development (SPD) process model to further integrate circularity considering process phases, design guidelines, criteria for evaluation, information management and new inter- and intra-organisational actors.

With this framework, we intend to identify the most defining parameters in the process model and assign them a discrete number of categorical values so that different combinations explain the generation of most prevalent circular product typologies in the manufacturing of durable goods. This framework is intended to be applied in industrial settings in the coming months in order to help product planners envision the organizational changes required to implement high value-retention CE practices.

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Post-anthropocentric Design Principles

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Abstract

This paper reports the preliminary results of an ongoing investigation into the theory and methods of post-anthropocentric Design. Conventional approaches see nature as a never ending reservoir of resources to fullfill human needs, regardless of the implications on the survival and welbeing of other species. Paradoxically, by disregarding the well being of other forms of lifes, the conditions for human

life on Earth is increasingly diminished. A pos-anthropocentric design considers that all forms of life have an equal right to live and are all interconnected and mutually dependent. The theme is investigated by the authors through a literature review and a field study carried out through an Action Design Research, focusing on developing a solution to protect a native stingless bee (Tetragosnisca angustula), widely present in the Brazilian urban environment. Besides of designers, the project involved a multidisciplinary team which included biologist, agriculture engineers, a zootechnicist, a chemical engineer.

The task consisted on developing a digitally manufactured beehive, using the products requisites gathered through a literature review, interview with experts and direct observation. The 3D printed stingless beehive was later implemented on a primary school where it was used to promote more empathy of pupils with stingless bees as well as a subject on disciplines such as mathematics, biology and geography.

After crossing the results with the existing theory, the following non-anthropocentric guidelines were confirmed on this study: a) adopt a bioinclusive Design process: actively including the non-human into the design process; b) adopt a open learning attitude: to actively observe and learn from the non-human, understanding its processes and transformations of the non-human, bringing such lessons to the design process; c) promote bio-synergies: actively seeking a synergetic rebalancing in the living system, creating conditions to mutually benefit tall forms of life involved; d) consider the priorities of all beings involved: actively consider the priority demands of the non-human, making an effort to identify potential rebound-effects and, also, the possibility of a hidden non-human in the design process.

This is perhaps the most counterintuitive approach since a human-centered Design is widely taught and understood as synonimous of good Design. Hence, applying these guidelines demands revision of our ethics as well as a new methods, aesthetic, onthology and epistemology in the Design field.

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Vernacular Design as a source of innovation to contribute for a distributed economy model

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Abstract

The distributed economy model, with small-scale value-adding units synergistically connected in a network and serving local needs near or at the point of use, offer a more promising scenario to achieve a more sustainable society.

Covid-19 pandemic has confirmed the higher level of resilience of those communities and organizations adopting the distributed economy concept. Yet, the limited access to products and services and the rise of teleworking had an impact on the generation of several improvised solutions to everyday problems.

This kind of manifestation, based on solving a problem adapting local resources and knowledge, will be considered as vernacular design in this paper. These vernacular solutions could be seen as a reservoir of innovative knowledge with great potential to benefit others with similar problems.

This research first analyzes the main characteristics of a sample of different solutions developed by average people in response to daily problems. Then explores its dissemination via open Design and digital manufacturing, two key strategies to achieve a more distributed economy.

It is achieved through a Design Science approach where a vernacular solution is converted into an improved digital product and then shared with other users via an open design platform and, finally, produced locally by another user by means of digital manufacturing.

The analysis has emphasized the economic dimension of sustainability, achieving as a target the SDG+ 8, 11 and 13, confirming the following implications of the distributed paradigm: a) better fulfilment of local needs, allowing on-demand production and reduction of marketing costs due to customer proximity; b) a higher level of customization and faster delivery of product/service changes; c) shorter, more flexible and smaller supply chains, with sharp reduction in logistics costs, lead-time, waste and capital investment; d) better monitoring of product performance, with higher local control over production; e) valorizes the local economy, integrating local competencies and infrastructure into the design process, increasing the bargaining power of local providers and encouraging open source innovation.

Finally, it is clear that the concepts and phenomena discussed in this article proved to be a different way to propose solutions in situations of crisis. This model emerged naturally through community action in response to the COVID-19 pandemic. But it also could be applied in other contexts. Relevant discussions on a global scale, such as climate change and more environmentally sustainable futures, can benefit from this model of proposing solutions based on distributed production and open design. Offering quicker responses adapted to the realities of each region and involving communities in the process.

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Using 2030 SDG meta-scenarios to foster a transition towards a green economy: a case study on a footwear company

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Abstract

In the search for a more sustainable society, there is an emerging demand for strategies that enable a transition of companies towards the Green Economy (GE), which has as its purpose the search for economic equity associated with environmental preservation and social cohesion (UNEP, 2019).

Regarding sustainability transitions, such a purpose can be reached by the systemic and societal approach (GEELS, 2010; LOORBACH, 2010; PESCH 2015). Design can contribute to such transition by articulating alternative visions of the future (CESCHIN, 2012; GAZIULUSOY & RYAN, 2017; COSTA 2019), triggering an organizational change and learning towards a GE. Nevertheless, the GE current studies focus on technological aspects and are often lead by big and multinational companies, most of them located in the global north (LOISEAU, E.; SAIKKU, L.; ANTIKAINEN, R. et al, 2016). In contrast, the present study intends to contribute to our understanding of the issue of GE societal transition by investigating the theme of a small company in Brazil, focusing on strategic business direction shift, changing organizational culture and developing competencies.

The goal is to propose a protocol as an artefact that trigger such a transition. The authors have explored the subject through an Action Design Research, developed in partnership with a footwear company. It involved the use of a reflective learning workshop using meta-scenarios guided by the SDGs related to GE: 01; 08; 09; 10; 11; and 12 as well as its 2030 targets. The process occurs along with three phases: (i) strategic diagnose: assessing the current strategic status of the organization regarding GE principles (DUARTE & SANTOS, 2019); (ii) co-creating meta-scenarios: a co-creation activity focused on sustainable product + service systems (S.PSS) concepts and; (iii) validating scenarios: selecting meta-scenarios by evaluating their feasibility, barriers and attractivity of each meta-scenarios and setting up goals and an action plan. A total of X meta-scenarios were developed, involving the use of systems maps, blueprints, illustrations, customer journeys and storyboards.

The observation has confirmed that meta-scenarios were effective in triggering a learning process towards a GE. Evidence of such learning included the adoption of new vocabulary associated with the GE as well as the set up of actions directed towards its principles. Hence, meta-scenarios did contribute to strengthening discursive and practical awareness (GIDDENS, 2002) regarding the economic dimension of sustainability. Since a transition towards a GE demands a long term perspective it must start at the strategic stages of the business process, including the fuzzy front end of the product development process. Meta-scenarios have enabled an effective understanding of the implications of GE to the organizational competencies, the changes required in the relationship with the supply chain, the need to revise key company values and new metrics to assess the organizational performance.

Full papers

The role of LCA in innovative product development

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Abstract

In our study, we present the importance of life cycle analysis (LCA) in the design process of products through the practical experience of the FIEK research program. It is accomplished through the development of innovative solutions for the construction product group, where the implementation of sustainability objectives was monitored by LCA in addition to technical parameters. The aim of the research project is to develop innovative products - in cooperation with universities and production companies - that not only bring innovations from a technical point of view but also are marketable and competitive from both an environmental and an economic point of view. Research tasks included:

- development of PUR-based insulation elements,
- development of lightweight concrete elements with innovative thermal insulation properties,
- development of sensors also used in building diagnostics and assisting comfort functions.

The methods used are diverse. The research was based on product development supported by LCA, life cycle costing (LCC), SLCA in addition to the conceptualization, eco-design and research methods applied in the field of materials science. The infrastructural background of the research was provided by the technical laboratory of the University of Miskolc (UM) and ÉMI Nonprofit Llc. (ÉMI), as well as the GaBi software support of the FIEK LCA Research Group to which research experience and expertise in LCA contributed.

The importance of the topic is given by the fact that the environmental development of three different product groups, from design to the end-of-life, contributes to improving the sustainable performance of the construction sector. Concerning the resource used, the products belonging to the first two groups represent circular solutions, according to which the recycled waste (reed, polypropylene, geopolymer, glass foam) in their composition reduces the resource demand. On the other hand, due to their

favourable thermal insulation and functional properties, by the installation of these products, the energy performance of buildings is improved (save heating energy) and reduce emissions.

The implementation of the research included the determination of the composition of the prototypes after the selection of the main components determining the functional properties and the potential fillers and additives, and the subsequent preparation of experimental samples. In parallel with this, environmental LCA were performed on all experimental samples and laboratory quality testing was executed according to the relevant standard measurement methods. After comparing and evaluating the results, selecting suitable samples for further development, and modifying the technology and the composition, new samples were chosen as well as analyses and quality controls were carried out, followed by more iteration and composition modification. The technical parameters and structural forms of the samples made by refining the compositions were optimized with the help of environmental performance evaluation and LCC analysis.

In our study, the focus is mainly on the production and the environmental properties of PUR-based insulation elements. The life cycle impact assessment (LCIA), the main technical parameters and the market positioning of the finished prototypes are presented in relation to the available products with similar function.

Keywords: innovation, LCA, LCC, Sustainable product, PUR product development

1. Introduction

According to the revised directive on the energy performance of buildings adopted in May 2010, from 2019 all new public buildings and from 2021 all new buildings must have "almost zero energy demand" (EU 2018/844). This requirement poses a serious challenge to designers, constructors and manufacturers of construction products alike. In order to meet the requirements of the Directive, materials with better thermal conductivity are also a priority for masonry and wall structures, and the focus has shifted even more towards thermal insulation materials, as all types of thermal insulation can play a role in improving the energy efficiency of buildings and reducing CO_2 emissions.

In the FIEK project coordinated by the University of Miskolc (UM), one of the research directions of the work led by the professional management of ÉMI Nonprofit Llc. (ÉMI) is the development of modern building elements that promote the realization of the above aims, and the products can also contribute to other sustainability goals (UN, 2015). During the research, three product groups came into focus:

- LCA-based development of environmentally friendly concrete components recycling of secondary raw materials and waste. modelling of structural elements and related manufacturing processes produced by recycling waste,

- development and modelling of innovative and environmentally friendly, plastic-based insulating materials, products and technologies,
- as well as development of state-of-the-art building diagnostic sensors.

Our study deals with the development process for PUR-based insulation elements and examines how these products fit into the three-pillar model of sustainability.

In Europe, approx. 40% of the total energy is used in buildings and 60% of this is used for heating and cooling buildings (UNEP, 2019). Much of this energy comes from burning fossil fuels, which results in significant CO_2 emissions. The simplest and most cost-effective way to make our new and existing buildings more energy efficient is to reduce energy demand and CO_2, which can be solved with properly selected construction products (masonry elements and insulation).

There are many types of insulation material today, but one of the best for thermal insulation that requires only minimal thickness in a building envelope to achieve maximum energy efficiency is polyurethane-based PUR or PIR insulation. Its advantage is that it can be used in all kinds of buildings and is just as easy to apply in existing buildings, as it is to install in new ones. The disadvantage is its bad fire resistance.

2. Methods

The research is based on environmentally conscious design, so the study briefly deals with the method of eco-design, which defines the framework of the research. Environmentally conscious product development has been aided by LCA, environmental LCA and life cycle costing (LCC). Obviously, the research included the modelling and manufacturing of experimental prototypes as well as the study of the functional and other physical properties of the products. LCA played an important role in this complex set of research methods, as using the results of LCA, based on multiple iterations, the final models and formulations were developed that resulted in products proposed for manufacture and industrial property application. Therefore, in the study, prototypes appear coded without composition names.

2.1. Eco-design as an environmental management tool

Eco-design concepts currently have a major impact on many aspects of design. Restraining global warming and the increase of CO_2 emissions will encourage companies to adopt a more environmentally conscious approach to their design ideas and processes. This means that in the design and construction of a building, the eco-design concept appears throughout the design process, from the choice of materials to the type of energy used and the disposal of waste. The essence of eco-design is that environmental impacts are considered throughout the life cycle of a product or service and, that efforts are made to reduce the impact on the environment from both input and output sides.

The following aspects come into view:

- the choice of material should not cause major landscape damage in the environment, be local, long-lasting, easily recyclable, should not contain toxic substances, should not result in waste
- for energy. energy efficiency aspects, energy savings, use of renewable energy sources, and
- water saving solutions, water recycling.

From the second half of the 1990s, environmentally conscious product development can help to improve the environmental performance of products in life cycle based testing. Ryn and Covan (1996) gave the definition as "a form of design that minimizes adverse effects on the environment by integrating it with processes in the environment." Eco-design has been extended to several disciplines and later the focus shifted to the details of eco-design practices, such as individual products, product systems or the industrial solutions. That is, they took into account aspects that can help reduce environmental impact (material, energy, water use, and waste generation) during product development and harmonize with environmental metabolism throughout the product's life cycle. By involving life cycle models through energy and material flow, ecological design is also well suited to the practical implementation of industrial ecology. Margolin (1998) considered eco-design to be important for achieving global sustainability. According to Orr (1994), the application of eco-design helps the world to create healthy, sustainable, resilient, just and prosperous communities. Today, eco-design is primarily concerned with the development of electrical and electronic products that help improve energy efficiency (EC, 20019). At the same time, the steps that lead to the development of environmentally friendly or less environmentally damaging products must be followed in all cases, as exemplified in the construction industry. Rossi et al (2016) studied the driving forces, tools, and methods that help eco-conscious design. Their study, based on an extensive literature review, found that the EU Circular Economy Action Plan (EC, 2015) represents a shift in corporate strategies and public policy towards the implementation of smart product design, product reuse and improvement, recycling, sustainable consumption, waste policy. Furthermore, the different levels of recycling, the intelligent use of raw materials, a stronger market for secondary raw materials and specific sectoral measures, i.e. the practical implementation of eco-design, may also expand within the circular economy. However, based on interviews with stakeholders, Lamé et al. (2017) found that the application of eco-design in construction was not yet appropriate. Eco-design tools seem to be lacking at an early stage of design, and it is at these stages that many criteria (economic, social and environmental) analysis and benchmarking tools are most needed to make eco-design more accepted.

Legislative expectations play a role in the implementation of eco-design aspects in the product development of our research, but more conscious producer consumption aspects have also emerged as motivations.

After all during our research, we aimed to develop PUR-based products that already have favourable building insulation properties, but these can be further improved by combining them with chemical technology or other materials so that (see figure 1):

- their physical and fire resistant properties are improved,
- the use of surface treatment materials shall improve the fire protection, building physical parameters and mechanical properties,
- in parallel with the improvement of fire resistance, the environmental impact and price of the life cycle should be reduced,
- by combining PUR/PIR materials with other materials, the building physical parameters should be improved,
- reduce environmental impact by combining with recycled materials,
- improve the building physical properties by modifying the structure of the PUR/PIR foams.

The study of patents for PUR/PIR products has helped to define research directions.

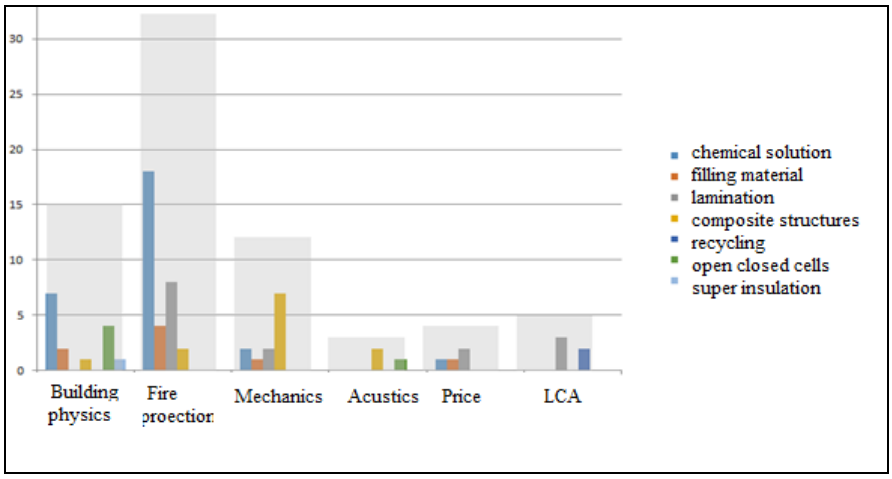


Figure 1. *Development distribution of relevant patents (Source. ÉMI, 2018.pp 13).*

In the patents examined, in addition to chemical repair, lamination and composite structural design played a more important role in improving the building physical, fire and mechanical properties, while LCA-based developments appeared in the case of lamination and superinsulation.

- A frequently used development method is lamination. In many cases, fire resistance and strength of the new structure developed were improved and a cheaper structure with a lower environmental impact was created by placing one-sided and two-sided armament. The chemical improvement of the PUR/PIR thermal insulation material was also aimed at improving the fire resistance and thermal insulating properties.
- It can be observed that at present researchers are only scattered about fillers, recycling, and superinsulation.

- The most common development goal is to increase fire resistance in the case of PUR/PIR patents. Less common goals are to reduce price and environmental impact, or use different natural materials.

It follows from the above that it is worth aiming at reducing environmental impacts and prices based on LCA in addition to the use of natural materials during the project.

Therefore, we followed the following steps in eco-design product development:

- mapping and analysis of all potential materials that improve the fire resistance and do not deteriorate the building physical properties by treating the surface of the PUR/PIR boards,
- determination of the environmental impact on the function unit based on the physical properties and LCA of these substances,
- modelling of prototypes, technological design, production of samples,
- LCA, comparison of prototypes taking into account environmental, economic and functional properties, then optimization,
- re-analysis of large-scale specimens of samples proposed for industrial production using technological data
- quality inspection of large-scale specimens according to the relevant standards,
- evaluative analysis considering technical, economic, and environmental aspects.

Totally 7 prototypes have been developed, of which 3 types are suitable for industrial property rights applications, therefore 4 prototypes containing filler and superinsulation are presented in this study.

2.2. Life Cycle Assessment (LCA)

The life cycle analysis or life cycle assessment (LCA) is one of the standardized methods to quantify environmental impacts during the cradle-to-grave, cradle-to-gate, or cradle-to-cradle life cycle. LCA method is usually applied to comparative analysis, when it is possible to choose among the products, processes, services, and systems having the same function, but each of them having significantly different environmental effects. Since the advent of the first LCA, the method has undergone continuous development according to Heijungs et al. (1992), Haes (1997, 1999), Guinée (2001a, b) and the methodology was refined until the publication of the ILCD Handbook (JRC-IES, 2010a, 2010b), later the JRC Reference Report (Wolf et al., 2012) and it is still evolving today (JRC, 2018). Nowadays, more than 18,000 scientific publications on LCA methodology are available in the science direct search engine, presenting more than 2,000 new scientific findings each year. LCA can be used to assess environmental impacts, to identify the “critical points” where the load is greatest, and to determine where and how to reduce direct or indirect impacts as much as possible. The applied methodology is consistent with the life cycle inventory (LCI) methodology described in the ISO 14040:2006 and ISO 14044:2006 standards. LCI methodology includes the following steps:

1. Definition of goal, scope, and other important basic parameters (goal and scope, function unit, data quality definition).

2. Inventory analysis, which means the quantification of all raw material consumption and pollutant emissions over the life cycle.

3. Impact assessment (LCIA) is an assessment of the environmental consequences of the consumption of raw materials and emissions.

4. Interpretation of results.

The system boundary covers the cradle-to-gate stage of the LCA methodology used in the project also complied with phases of A1-A3 based on the EN 15804:2012 standard (see figure 2). Auxiliary systems such as transporting materials, obtaining electric power from a Hungarian energy mix, using diesel oil for transport of the product are included in this research analysis.

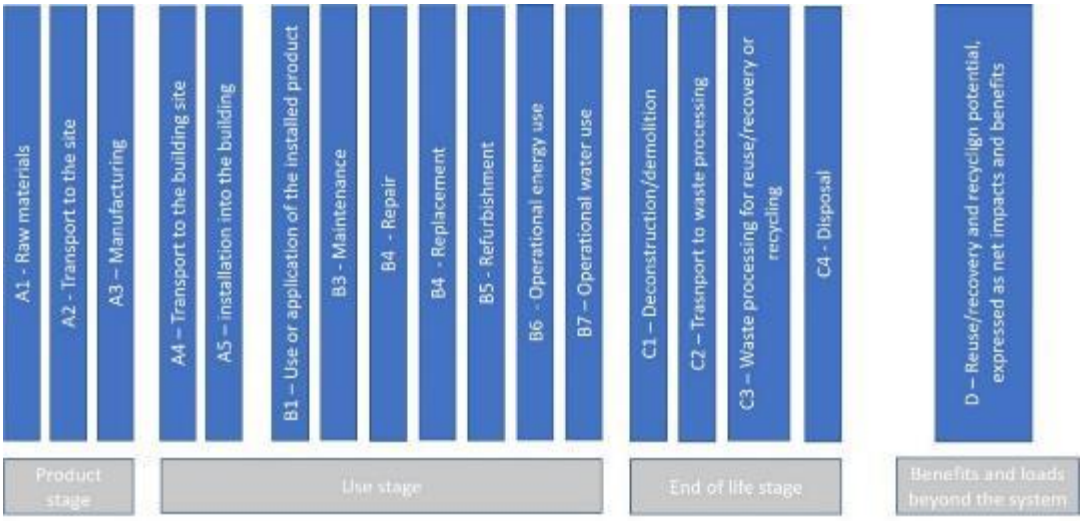


Figure 2. *The stages of the life cycle based on the EPD modules by EN 15804.*

Measured data were used for analysis. The missing data were exported from various databases (SimaPro, GaBi, Ecoinvent) and from literature sources and articles.

The LCA of the prototypes was developed from the raw material extraction to the production phase by GaBi 9.2 software. The analysis lasted from the cradle to the gate, using the analysis of the CML 2016 method. The aim of this research was to determine the energy and material resources, emissions, and environmental impacts of the developed prototypes and to compare them. Besides, we examined how to reduce the environmental impact, whether there is a possibility to make the product more sustainable concerning different life cycle stage.

A functional unit is a reference value that can be used to quantify the performance of product systems.

The allocation method is suggested by ISO 14044 standard. The production process was assigned as a function of the mass of the materials where the value projected on a surface of $1m^2$ was determined at

the specified structural thickness. For the transport of refinery products (diesel oil), the emission allocation was based on mass. The energy demand was assigned as a function of the energetic content. In the case of insulating elements as a function unit, the projected value of one square meter of the structural thickness required to achieve the U = 0.24 W/m^2K (2020 facade expected performance) heat transfer coefficient (calculated as an external wall, with Hungarian climatic conditions) was determined.

The system boundaries were developed from cradle-to-gate. The analysis begins with extraction of raw materials and these datasets are linked with production stage to create LCIs for the prototypes. The stages of the life cycle based on the environmental product declaration (EPD) technological modules, are as follows:

A1: extraction and processing of raw materials, extraction of secondary raw materials,

A2: delivery to the manufacturer,

A3: production of the product.

Measured data were used for analysis. The missing data were exported from various databases (SimaPro, GaBi, Ecoinvent) and from literature sources and articles.

Ten environmental impacts were used for the research analysis, are as follows:

- Abiotic Depletion (ADP elements), [kg Sb eq.]
- Abiotic Depletion (ADP fossil), [MJ]
- Acidification Potential (AP), [kg SO_2 eq.]
- Eutrophication Potential (EP), [kg PO_4 eq.]
- Freshwater Aquatic Ecotoxicity Pot. (FAETP inf.), [kg DCB eq.]
- Global Warming Potential (GWP 100 years), excl. biogenic carbon, [kg CO_2 eq.]
- Marine Aquatic Ecotoxicity Pot. (MAETP inf.), [kg DCB eq.]
- Ozone Layer Depletion Potential (ODP, steady state), [kg R11 eq.]
- Photochemical Ozone Creation Potential (POCP), [kg Ethene eq.]
- Terrestrial Ecotoxicity Potential (TETP inf.), [kg DCB eq.]

During the analysis, the reference system was the total inputs and outputs for the European Union. We used normalization and weighting for calculating the magnitude of the research results of impact category indicators. The applied normalization reference was environmental impacts for 28 EU countries. The weighting method was thinkstep LCIA Survey 2012 with CML 2016 (excl. biogenic carbon) in Europe. We also examined the relative contribution of each impact category to load after normalization and weighting. Normalized and weighted values of life cycle stages were determined by FIEK LCA Research Group of the UM.

3. Results and Discussion

3.1. Characteristics of PUR-based foam

Polyurethanes are versatile and excellent insulators, offering many solutions to the challenges of energy saving and eco-design. The polyurethane industry has always sought to reduce its impact on the environment and is currently working to increase the energy efficiency of its manufacturing processes and to create end products that can be used to save energy. Rigid polyurethane foam (PUR) is one of the most effective, high-performance insulation materials that allows very efficient energy savings with minimal use of space. Rigid PUR is widely used in construction, packaging and refrigeration, where its excellent long-term insulation properties and good dimensional stability have many advantages. Although low thermal conductivity is the most important quality of rigid PUR, other important properties include adhesion of adhesives and excellent mechanical strength with low density. Closed cell rigid foams are used for insulation in construction (Grőb, 2008).

PUR is produced by the reaction of isocyanate (MDI, TDI) and polyols. The two most used isocyanates are MDI (4,4'-dephenylmethane diisocyanate) and TDI (2,4'-toluylene diisocyanate). Polyols are low molar polyhydric alcohols containing 75% polyether and 25% polyester polyol. Foaming is done by adding formic- and acetic-acid, water or other foaming agent. Acid is used relatively infrequently, but physical foaming agents (pentanes, HFCs, HFOs) are very common, especially in rigid foams. Here, the aqueous reaction initiates heat generation that evaporates the foaming agent.

The foaming agent for flexible polyurethane foam is water and CO_2. For rigid PUR, pentane is used. Possible composition is 100-unit MDI; 53.5-unit polyol and 5.5-unit pentane. The density of the product is determined by the amount of foaming agent used, and the flexibility or stiffness is determined by the type of polyols and diisocyanates used.

In addition to the polyol and MDI used as the main components, polyurethanes also contain water, catalyst, foam stabilizer, oxidation stabilizer, bonding component and dye, all of which affect the life cycle environmental load, but the main components and the manufacturing process is responsible for more than 90% of the effects. Catalysts are used to increase the reaction rate between diisocyanates and polyols. The most used catalysts are metal salts or amine-based a wide range of catalysts.

3.2. Results of LCA of PUR-based foam samples

Density, structure, mechanical properties, and thermal conductivity of PUR foams are affected by the relative proportions of the main components and the chemical reaction that takes place between them. To produce the PUR-based insulation elements – having an improved fire resistance by the filler materials that are best suited to the technological goal, it was necessary to develop a reaction mixture that also ensured the mixing and pouring of the fillers. In addition to different ratios of MDI/TDI and polyol ratios, foaming agents were used in the experiments concerning life cycle testing. Multiple

analysis and iteration were also required to refine the composition. The proportion of the main components in the samples is given in the following table.

Table 1. *Composition of hard foams – ration of MDI/TDI and polyol.*

	P_MDI	P_TDI	P2_P	P2_AA	PUR	PUR
MDI - Polymer MDI (Ongronat 2100 v. 2300 v. 2500)	50		64	64	61.09	57.4
TDI		50				
Mixture of polyether polyols	50	50	32	32	31.13	39.8
Water content					1.17	
Pentane			4			2.79
Acetic acid				4		
Other phosphates (Tris (2-chloro-1-methylethyl) phosphate and Triethyl phosphate)					6.23	
Other N-containing substances (Bis (2-dimethylaminoethyl) - (methyl) amine, N, N, N'-dimethylaminopropyl-hexahydrotriazine)					0.38	

The environmental profile of MDI- and TDI-based PUR foams with the same polyol ratio reflects the difference in the environmental impact of MDI and TDI. The environmental impact of TDI-based foams is 20% higher, with the largest differences in the impact categories climate change, fossil resource, particulate matter and eutrophication.

Raw materials and the manufacturing process determine 90% of the environmental impacts, and also 90% of the impacts come from resource use, climate change, eutrophication, and particulate emissions in addition to toxicity. We also analysed the environmental load of PUR foam at different MDI, polyol and pentane ratios. The MDI ratio per 100 weight units of polyol varies between 120 and 180 (w/w%) and the pentane ratio between 5 and 20 (w/w%) in the tested formulations. In the composition of the foams, polyol, MDI, and foaming agent accounted for 95%, and the remaining 5% were other components influencing the chemical process and stability, the impact assessment of which was omitted. Comparative LCA for PUR syntheses were based on 1 kg PUR foam functional unit. From a technological point of view, a content of 144 parts by weight of MDI per 100 parts by weight of polyol and a content of 7 parts by weight of pentane with a density of 31 kg/m^3 proved to be ideal.

Table 2. *Values of impact category indicator in PUR base foam.*

	PUR 120.5	PUR 144.7
Impact categories	kg/unit	kg/unit
ADP elements [kg Sb eq.]	3.97E-06	4.17E-06

ADP fossil [MJ]	61.7	61.5
AP [kg SO_2 eq.]	0.00551	0.00544
EP [kg PO_4 eq.]	0.000945	0.000921
FAETP inf. [kg DCB eq.]	0.0151	0.014
GWP 100 years [kg CO_2 eq.]	2.4	2.42
GWP 100 years, excl biogenic carbon [kg CO_2 eq.]	2.45	2.46
HTP inf. [kg DCB eq.]	0.121	0.125
MAETP inf. [kg DCB eq.]	1.16E+02	114
ODP, steady state [kg R11 eq.]	4.33E-06	4.65E-06
POCP [kg Ethene eq.]	0.00165	0.00159
TETP inf. [kg DCB eq.]	0.00625	0.00589

These analytical data are very close to the values in the EPD given by PU Europe (density is also 31 kg/m^3) and GWP is 2.9 kg CO_2 eq/1 kg PUR.

Comparing the results of the analysis of the model set up for PUR synthesis, the values of the normalized weighted environmental impact category show that PUR 180.20 has the most favourable, while PUR 120.5 has the highest environmental load among the PUR-based foams, although the differences can only be measured in nanograms. In addition to seawater eutrophication (nearly 36% in all samples) and human toxicity (18%), depleted fossil resources (25%) followed by ozone depletion and global warming potential are the biggest impacts. Figure 3 shows all loads in addition to the impact categories. More than 90% of the environmental loads can be attributed to MDI and polyol. As the proportion of MDI increases, the contribution of the polyol to the environmental load decreases, with the effect of pentane is below 3% in all effect categories.

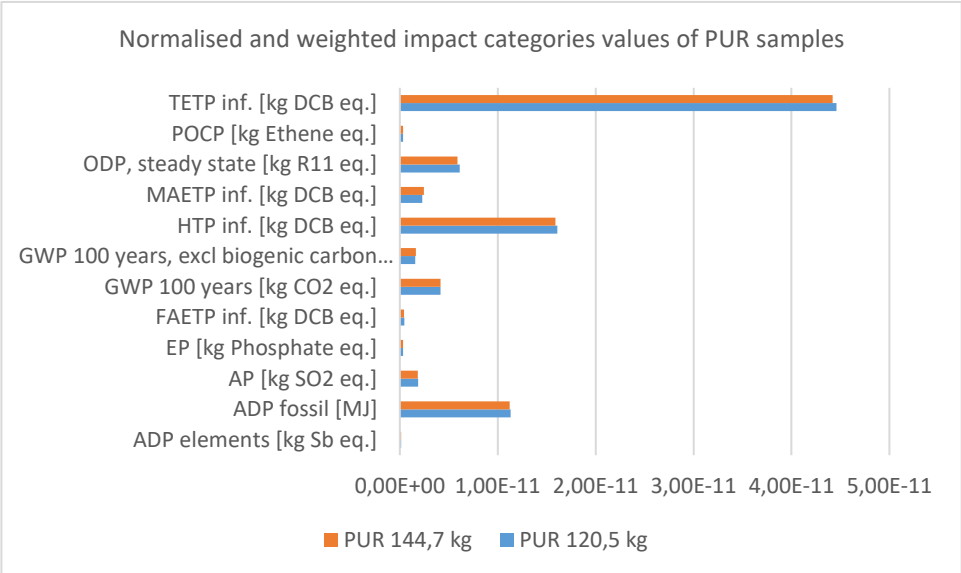


Figure 3. *Normalised and weighted impact category values of PUR samples.*

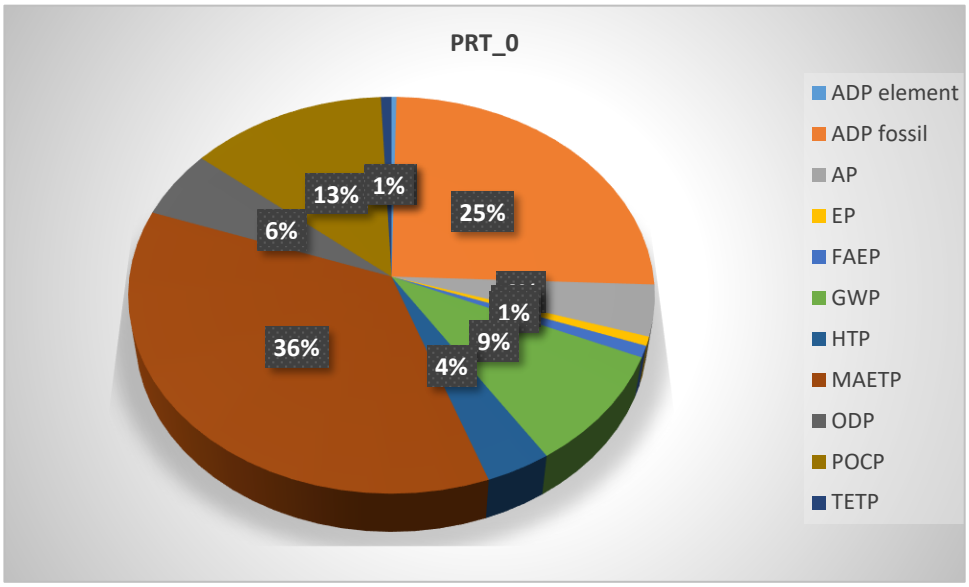


Figure 4. *Relative contribution of impact categories to the environmental impact (PUR 144.7).*

From a technological point of view, the most advantageous property was the polyol MDI 100. 144 parts by weight PUR produced with 7 parts by weight of pentane, so it became a reference hard foam for later analyses.

Table 3. *Some environmental impact category values of 1 m^2 PUR reference sample (Source. GaBi 9.2 analysis).*

Impact categories	unit	value/function unit
		(1 m^2 0,1 m thickness PUR)
Global Warming Potential (GWP 100 years)	kg CO_2-eq.	8.118
Acidification Potential (AP)	kg SO_2-eq.	0.0179
Eutrophication Potential (EP)	kg PO_4-eq.	0.00303
Ozone Layer Depletion Potential (ODP, steady state)	kg R11-eq.	$4.74 \cdot 10^{-6}$
Human Toxicity Potential (HTP inf.)	kg DCB-eq.	0.4125
Abiotic Depletion fossil (ADP fossil)	MJ	202.95

If the ratio of PUR in the insulation boards decreases, the ratio of environmental loads between impact categories changes depending on the environmental performance of the filler.

2.3. LCA of PUR based insulation elements

The research aimed to improve the properties of hard PUR foams while taking into account ecological aspects.

- improving the fire resistance of PUR insulation elements by reducing the ecological load by using different proportions of natural fillers
- development of a complex thermal insulation component with intensive thermal insulation capacity using superinsulation.

The main characteristics of the samples made with fillers are given in Table 4 below.

Table 4. *PUR based insulation prototypes.*

Prototype code	Short description, characteristics	Results of development to this time	Total thickness
PRT7_I	PUR-based thermal insulation rigid foam board with improved flammability properties treated with natural filler	rationalization of cost and environmental impact, reduction of ecological footprint	~100 mm
PRT7_II	PUR-based thermal insulation rigid foam board with improved flammability properties treated with natural filler	rationalization of cost and environmental impact, reduction of ecological footprint	~100 mm
PRT7_III	PUR-based thermal insulation rigid foam board with improved thermal insulation properties by superinsulation	integration of superinsulation	~30 mm
PRT7_IV	repairing grout with improved insulation by filler	rationalization of cost and environmental impact, reduction of ecological footprint	not relevant
PRT7_0	PUR-based foam board (PRef)	improving fire resistant and flammability properties	~100 mm

Table 5*. Values for the impact category indicator of fillers (kg/1 kg).*

	I	II	III	PUR
GWP (kg CO_2 eq)	39.6	161	3.50E+03	2.9
ODP (kg CFC11 eq)		2.60E-05	4.15E-04	4.90E-06
AP (kg SO_2 eq)	0.9	1.1	4.80E+01	0.0066
EP (kg PO_4 eq)	2.28E-02	0.3	5.17E-01	0.001
POCP (kg ethene eq)		3.60E-02		0.002
ADPE (MJ)		2210	5.40E+04	4.74E-06
ADPF (kg Sbeq)	0.3	4.60E-04		63.7

In the analysis of the prototypes, we took into account the transport distances, the energy and water needs of the technology and the material flows according to the formulations within the system boundary from the cradle to the gate. The analysis was performed with the GaBi 9 LCA software using the CML 2001 method, examining the effect categories given there.

***Table 6.** Environmental impacts.*

	PRT7_I	PRT7_II	PRT7_III	PRT7_IV	PRT_0
ADP	1.57E-05	6.86E-05	1.71E-05	1.57E-05	1.38E-05
ADP (fossil)	257	354	154	258	202.95
AP	0.0242	0.071	0.0214	0.0244	0.0179
EP	0.00419	0.0123	0.00322	0.00421	0.003
FAETP	0.0647	0.1	0.0417	0.067	0.0462
GWP	12	18.9	11	12.1	8.118
HTP	0.627	3.07	0.528	0.654	0.4125
MAETP	873	1.44E+03	1.34E+03	877	376.2
ODP	1.69E-05	9.02E-09	3.26E-06	1.70E-05	1.53E-05
POCP	0.00624	0.00749	0.00336	0.00627	0.005247
TETP	0.0268	0.0345	3.83E-02	0.0269	0.019437

The impact category values differ due to the different composition of the thermal insulation elements. The effect of the PRT7_II sample is larger in all categories than in the other samples, except for ODP, but in the case of EP, AP, ADP elements, HTP the difference is three to four times.

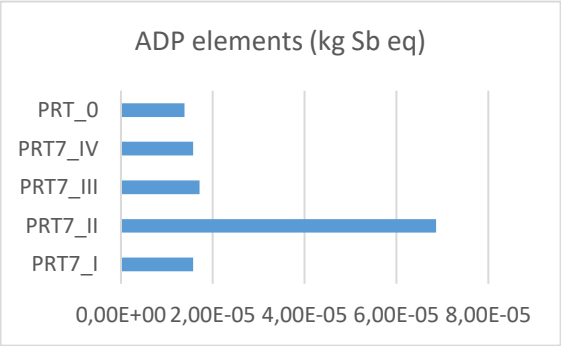


***Figure 5.** Abiotic Depletion Potential elements.*

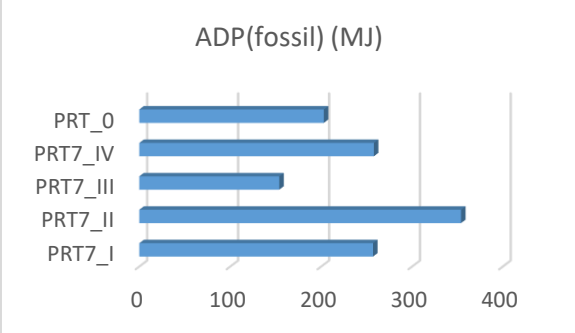
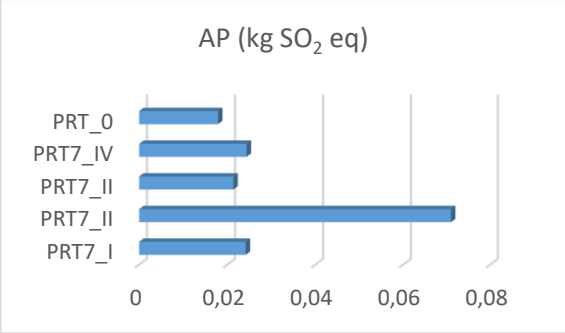


***Figure 6.** Abiotic Depletion Potential fossil.*



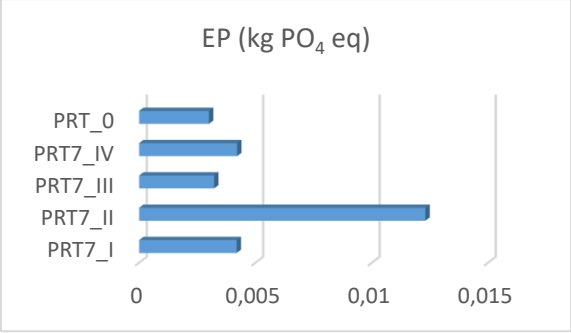
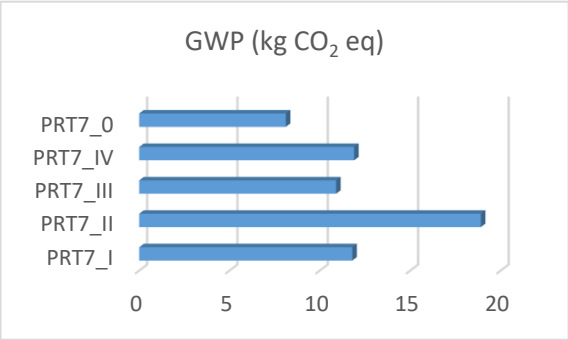


Figure 7. *Acidification Potential.*

Figure 8. *Eutrophication Potential.*



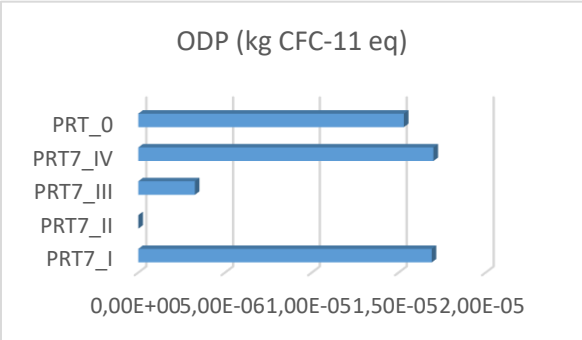
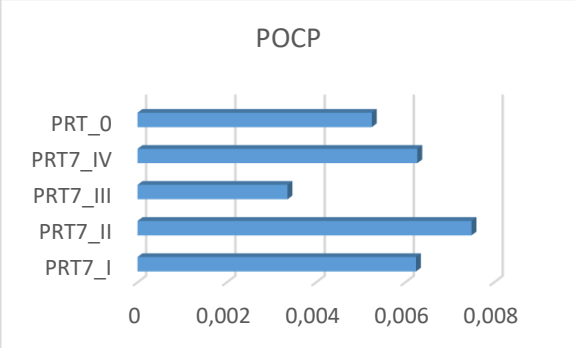


Figure 9. *Global Warming Potential.*

Figure 10. *Ozone Depletion Potential.*



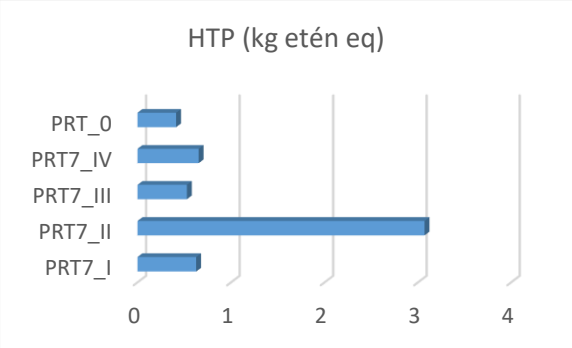


Figure 11. *Photochemical Oxidation Potential.*

Figure 12. *Human Toxicity Potential.*

Based on the Figures 5-12, it can also be seen that the environmental impact of the reference PUR sample (PRT_0) could not be reduced, but the fire resistance of the samples improved, and their thermal conductivity characteristics also met the expectations.

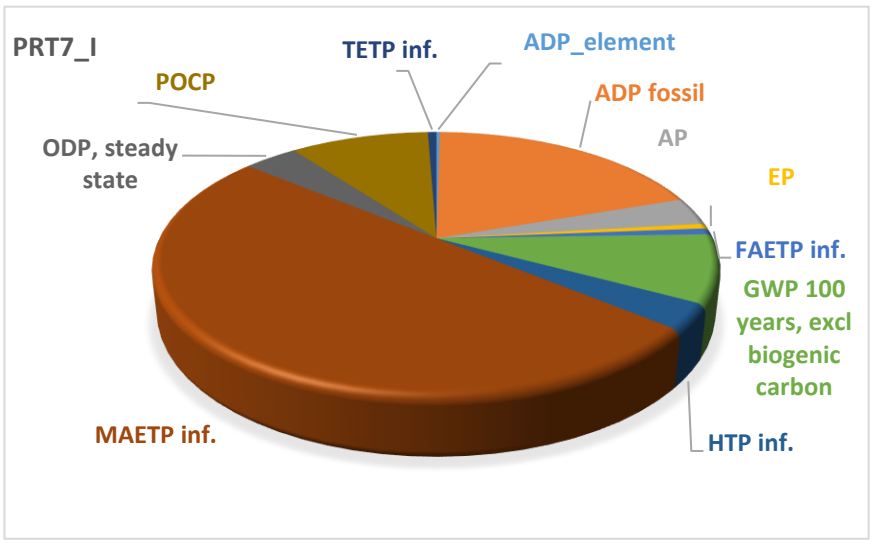


Figure 13. *Relative contribution to environmental load of PRT7_I prototype.*

The results after normalization and weighting show the relative contribution of each impact category to global problems. In all cases, the toxic effects appear with the greatest weight, like the PRT7_I sample (see figure 14).

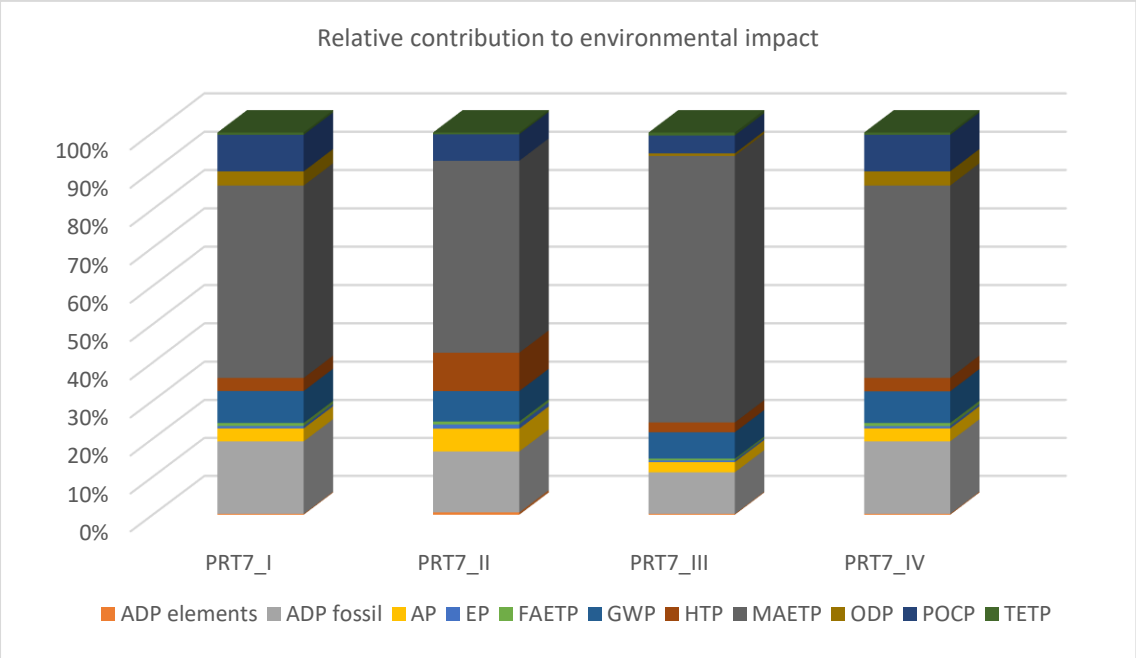


Figure 14. *Relative contribution to environmental impacts.*

The thermal conductivity and fire resistance of prototypes are important criteria for the effectiveness of development. Each of the above samples meets the desired thermal conductivity requirement.

Table 7. *Thermal conductivity and fire resistance tests.*

	PRT7_I	PRT7_II	PRT7_III	PRT7_IV	PUR
W/mK	0.0247	0.0255	0.0192	0.02612	0.02258
SBI test*	good	good	to be improved	to be improved	-

* SBI: Single Burning Item. In terms of fire protection 2 samples gave, while 2 did not give satisfactory results.

3.3. LCC calculation

Achieving cost reduction compared to products providing the same functional performance has been one of the development goals in addition to technical and environmental properties. In the cost calculation, considering cost factors arising during industrial production, cost was calculated by adding the amount of profit margin, margin and sales tax. Compared to the price of products with similar properties that perform the same function, the price level of three of the developed products is favourable. Due to its special functional properties, the price of thermal insulation containing superinsulation can also be considered a good price/value ratio.

Table 8. *Comparison of products and prototypes available on the market.*

Products/Prototypes	[W/mK]	Thickness [cm]	Price [Ft/m^2]
Bachl tecta-PUR 022 - laminated with aluminium foil	0.022	8	6 628
Bachl tecta-PUR HD - laminated with glass veil	0.028	10	11 950
Bachl tecta-PUR Polymer, laminated with aluminium foil+bitumen	0.024	10	11 972
Bachl PIR MV laminated with glass veil	0.026	12	16 797
PRT7_I	0.025	10	6727
PRT7_II	0.026	10	6643
PRT7_III	0.019	10	28119
PRT7_IV	0.026	10	7257

4. Conclusions

Research using environmentally conscious design supported by LCA, continuous consultation with developers, multiple feedbacks, and the performance of the products developed in this way proved the efficiency and effectiveness of the research method.

The prototypes presented in the study have favourable functional properties, half of them have improved fire resistance, their thermal insulation properties are perfect, their price level is lower compared to the products available on the market, and their price is adjusted to the higher functional properties due to their super insulation properties.

In terms of environmental performance, it was not possible to reduce the environmental impact compared to the rigid PUR insulation element considered as a reference. The environmental performance of the prototypes was worse in almost all effect categories, although the values of samples PRT7_I, PRT7_III, and PRT7_IV were nearly identical to those of sample PRT_0.

The environmental impact of the PRT7_II sample, especially in the HTP, ADPE, AP, EP impact categories, was several times higher than that of the other prototypes, due to the filler technology as it was made from waste by an extraction process and is a product of an especially circular technology. Thus, our hypothesis that environmental performance of insulation elements containing filler can be improved spectacularly, if the fire-retardant filler comes from a circular economy is not necessarily true.

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Abbreviations

AP	Acidification Potential
ADP elements, ADPE	Abiotic Depletion - elements
ADP fossil, ADPF	Abiotic Depletion - fossil fuels
EP	Eutrophication Potential
EPD	Environmental Product Declaration
FAETP inf.	Freshwater Aquatic Ecotoxicity Potential
FU	Functional unit
GWP 100 years	Global Warming Potential (for 100 years, excl. biogenic carbon)
HTP inf.	Human Toxicity Potential
ILCD	International Reference Life Cycle Data System
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
MAETP inf.	Marine Aquatic Ecotoxicity Potential
MDI	Methylene Diphenyl Diisocyanate
ODP steady state	Ozone Layer Depletion Potential
PUR	Polyurethane
POCP	Photochemical Ozone Creation Potential
SLCA	Social Life Cycle Assessment
TDI	Toluene Diisocyanate
TETP inf.	Terrestrial Ecotoxicity Potential

Sustainable design of a trigger sprayer suitable to e-commerce market

A case study of design for material reduction, disassembling and recycling

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Abstract

Worldwide consumption of plastics related to the production of household detergent containers was over 17 million tons in 2018, with an average annual growth over the last decade of 4.8%. Moreover, the pandemic will increase the demand for household detergents in 2020, 90% of which are packaged in plastic bottles. These are often associated with a liquid dispensing system called “trigger sprayers”. Due to its greater functional and formal complexity and due to the high number of heterogeneous materials used for the different components, the trigger sprayer often represents a critical issue in the disassembly and recycling phase of the bottle. The proposed paper aims to describe the research, development and prototyping process of trigger sprayer concepts, applicable to bottles of home care products sold through online purchasing channels, able to meet the requirements for the certification of "product suitable for e-commerce sale". The project, developed in collaboration with Aptar France, had as its further objective the optimization and enhancement of the environmental performance of the new product, through a life-cycle design approach and through the use of specific DfS strategies and tools. The new concepts developed are characterized by innovative technical-formal solutions able to increase the resilience of the product during transport, drastically reducing both the use of materials and the number of components, improving their performance. In the first phase of the project, a series of activities were launched aimed at identifying and analyzing the main environmental criticalities of traditional trigger sprayer models for domestic use. Through the photographic survey, the disassembly and weighing of the components and the identification of the materials used, it was possible to analyze the types consolidated on the market, the material and aesthetic-perceptive characteristics of the products, the ergonomic requirements and the technical and functional characteristics of the dispensing systems. At the end of the analysis phase, some new trigger sprayer concepts were generated, developed according to the DfS's design criteria and optimized to be used in bottles sold through e-commerce platforms. In the third and final phase the concepts have been prototyped to experimentally validate the strategies adopted and verify, with a special consumer test, the appreciation by the end user. The life-cycle design of the trigger sprayer with the adoption of design

strategies aimed at environmental sustainability have led to a substantial reduction of the plastic material use and to the optimization of the disposal and recycling phase. The results obtained from the project have contributed to increase the company know-how, in terms of DfS of the Aptar group, aiming to focus on the SDG 12 "Ensure sustainable production and consumption patterns" (12.2-12.5-12.6).

Keywords: trigger sprayer, sustainable design, design for e-commerce market, design for reduction, usability optimization

1. Introduction

Worldwide consumption of plastics related to the production of household detergent containers was over 17 million tons in 2018, with an average annual growth over the last decade of 4.8%[1]. This figure also takes into account the quantity of recycled plastic, which is used in the production of packaging that is destined for the detergent market. The increase in the use of plastics in the household cleaning sector is a direct consequence of the constant growth, worldwide, of the market for household cleaning products, and of the replacement of cardboard packaging, with some types of polymers. In industrialized countries with a mature market, and in particular in Europe[2] - despite the recession of recent years - the detergent industry has taken steps to face the slowdown in the market, focusing on product innovation, communication and consumer education to a correct use of detergents, simultaneously implementing promotional campaigns for cheap products, mainly marketed through e-commerce channels. In part, these strategies have also been implemented in "emerging economy" countries, for which the gap in the consumption levels of detergent products contained in plastic bottles is expected to recover. In summary, the estimates predict that the world consumption of plastics for the packaging of household cleaning products will increase in the coming years at an average rate of 4.7%, substantially in line with that recorded in the last decade, to reach 21.3 million tons in 2022. To further support the growth in the consumption of plastics for the household cleaning sector, there is a progressive trend towards replacing powder detergents - generally contained in cardboard containers - with liquid detergents, which for obvious reasons are distributed to the consumer in plastic bottles. In the US, these detergents already account for about 80% of total consumption and in Europe, as well as in almost all emerging countries, plastic liquid detergent containers are gradually eroding the share of cardboard containers.

In the Market Monitor carried out by Assocasa-Federchimica in collaboration with Nielsen, it emerges that the sale of home care products, during the pandemic emergency from Covid-19, in the reference

[1] Il mercato mondiale del packaging per detergenti, https://www.plastmagazine.it/mercato-mondiale-packaging-detergenti/ (accessed 14.05.2021).

[2] In Europa la prima richiesta di plastica, pari al 39,6%, è destinata alla produzione del Packaging. Source: PlasticsEurope Market Research Group (PEMRG) and Conversio Market & Strategy GmbH.

period 17 February - 17 May 2020, recorded an increase of 17.8% (Tarenzi, 2020). The rising figure must certainly be traced back to both the greater sensitivity and attention to the issue of personal and home hygiene and the change in habits induced by the particular period of the pandemic and to some purchasing dynamics, especially through e-commerce sales channels, which have consolidated and expanded. The numbers give a clear picture of what will plausibly be the growth trends of home care products in the coming years: the so-called "other products" related to home care, which in 2019 accounted for only 2.9%, grew by 59.8%. Leading the trend are mainly disinfectant products, with a 100% increase. Bleaches are the second fastest growing category, simultaneously in the lead, however, in the category of "washing additives", in the post-covid period, with an increase of 53.3%, equal to 18 million euros and about 60 % of the total.

In conclusion, the home care product market presents two significant trends, attributable to both new production-commercial models and to recent social changes and attention to hygiene. In particular, the first important data refers to the gradual replacement of traditional cardboard containers with polymer analogues. The second, on the other hand, refers to the growth of the detergency market as a response to the pandemic phenomenon caused by Covid-19, which has led to an exponential increase in the sales of sanitation and cleaning products, especially through e-commerce platforms. These two trends, therefore, translate into a significant increase in the demand for the production of polymers for the market of bottles, containers and trigger sprayers for home care. It is in fact evident that plastic is the most used material to produce both the bottles for the packaging of household detergents and the devices to allow their dispensing. The most used polymers are high density polyethylene (HDPE), low density polyethylene (LDPE) and polyethylene terephthalate (PET). The competing material is cardboard, but it is used almost exclusively for the packaging of powdered products and tablets, or to make secondary packaging intended for the transport of the bottles. In fact, the performance capabilities of these polymers in terms of durability, resistance, transformability, recyclability and containment of production costs, represent the main parameters of preference compared to other material solutions, and for many companies in the sector, it continues to be strategic to develop new plastic bottles.

At the same time, the recyclability and reduction of the consumption of plastic materials of the bottles is one of the themes of greatest interest for the development of new detergents with reduced environmental impact, especially for household care products (glass, floor and furniture cleaners, sanitary ware, deodorants, descalers, etc.) characterized by the presence of multi-material devices, both for dosing and for application on surfaces. In fact, these containers are often associated with a characteristic liquid dispensing system, called "trigger sprayer" which, due to its functional and formal complexity, and the high number of heterogeneous materials used for the different components, often represents a criticality in the recycling phase of the bottle, so much so as to require its separation and disposal in landfills. The development and production of these dispensing devices,

in recent years have evolved strongly, especially in response to the new B2B purchasing dynamics and the constant growth of the e-commerce phenomenon, particularly appreciated by companies in the home care sector, as a new sale channel. As highlighted by the consumption trends of plastic household cleaning products, many companies are investing resources and capital to optimize their products for sale on virtual commercial platforms, which require a subsequent phase of shipping the product to the final consumer. For this very reason, guidelines are being defined and standardized for the development of detergent products suitable for online sales (ISTA 6, 2016), whose final objective is to ensure the watertightness of the bottles and avoid the leak of liquids during the transport, maintaining the correct functionality of the spray dispensing system, even in case of particularly turbulent shipments. These guidelines, therefore, require a substantial formal and functional rethinking of the trigger sprayer, with a look at implementing a new set of design parameters, previously considered entirely secondary.

Therefore, the paper intends to describe the research, development and prototyping process, guided by the Life Cycle Design methodology, of a series of trigger sprayer applicable to bottles of home care products, conceived by the consulting company EcodesignLab Srl, spin-off of the University of Camerino, in collaboration with the company Aptar, studied to reduce the consumption of materials and the number of components able to meet the requirements for certification of "product suitable for e-commerce sales". The purposes of the paper are those of bringing out the contribution of design with respect to the objectives described in the design-brief, and describing the results achieved, through the adoption of specific eco-design strategies (Giudice et al., 2006), in terms of component optimization and reduction of polymeric materials for the production of a new trigger sprayer.

2. Methodology of applied research and preliminary analyzes

The development process started from a preliminary phase of framing the design-brief, developed by the company which included: the development of a trigger sprayer, more sustainable and with a simplified design and a reduced number of components compared to a traditional one; the inclusion of a new plastic motor, developed by the Aptar company for dispensing the liquid; the use of plastic materials with a reduced environmental impact and the implementation of design solutions to make the product suitable for e-commerce sales, allowing it to pass the tests required by the protocol.

Therefore, the methodology implemented (Thiebat, 2019) to achieve the objectives listed in the brief, was divided into four macro-phases:

- technical-functional analysis of the prototype and the plastic engine developed by the R&D of the Aptar company;

- research, benchmarking and technical-functional analysis of the main home care products and related trigger sprayers;

- design and development of new trigger sprayer concepts through specific eco-design strategies;

- prototyping and ergonomic verification of an innovative trigger sprayer model.

The first macro-phase focused on the study of the trigger sprayer prototype developed and patented by the company and, in particular, on the advantages generated by the implementation of an innovative motor for dosing the single-material liquid.

The developed prototype is schematically made up of seven components, as shown in Figure 1: a dispensing nozzle (b) which, as in many traditional models, with rotation in one direction dispenses the detergent and in the other, closes the trigger to avoid accidental dripping of the liquid; an actuator (a) that allows the passage of liquid from the engine to the nozzle, designed to also perform the function of the external body of the product; a bellows motor (c); a cover (d) that binds the motor and connects the actuator with the ring nut to the thread of the bottle; a trigger (s) for operating the engine bellows and supplying the set dosage; a dip tube for the liquid (g), connected to the motor by means of an adapter and a ring nut (f) which binds the trigger to the body of the motor and connects the entire trigger sprayer to the thread of the bottle.

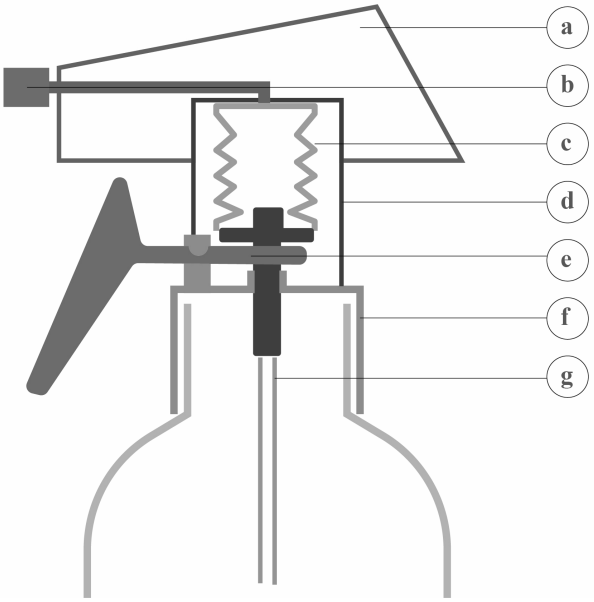

Figure 1. *Aptar prototype functional diagram*

The liquid is dispensed through the operation of a new type of motor, characterized by a bellows and an adapter connected to the dip tube, with a vertical layout: in the rest position, the two valves and the bottle vent are completely sealed; during the actuation and dispensing of the liquid, the trigger pushes the adapter, compacting the bellows membrane of the motor, and generating pressure inside of it. This pressure closes the internal valve, and opens the external one and, simultaneously, the vent of the

bottle opens, allowing the passage of the liquid inside the actuator and finally from the nozzle in the form of nebulized detergent.

One of the major innovations of this type of motor is that it is made entirely of plastic, without the use of traditional steel springs. In fact, the elasticity of the bellows system is exploited to generate, together with the trigger, both the pressure and the release of the adapter that closes and opens the vent of the bottle. In environmental terms, this single-material device becomes particularly advantageous for the disposal and the recycling phase of the entire bottle, allowing it to be disposed of in the appropriate bins for plastics, with the trigger sprayer still screwed to the bottle.

In fact, in most of the traditional models that still have the system with metal springs, the user should - for a proper disposal - separate the bottle from the trigger sprayer placing the former in the collection of plastic packaging while the latter in the unsorted collection.

After studying the technical and functional components of the new prototype in detail, an ergonomic analysis and usability analysis of the product was started, with the aim of identifying any critical issues and defining the outcoming improvement strategies. Through a photographic survey process, the anthropometric relationships and user experience in the detergent dispensing phase were documented, and the critical issues identified during the analysis were briefly described.

Once the study phase of the initial prototype was completed, we moved on to the second research activity, aimed at mapping and analyzing the main trigger sprayers on the shelf, in supermarkets and in stores that are specialized in household products. As it was done for the prototype study, an analysis sheet divided into five main sections was also developed:

- photographic survey of the product;

- main dimensions and overall weight;

- orientation of the engine layout (diagonal, horizontal or vertical);

- materials used for the main components;

- identification of project criticalities.

The benchmarking study, led to the development of 15 product sheets - some of which are shown by way of example (Figure 2) -, a summary sheet of the levels of usability noticed on the trigger sprayers (Figure 3) and two summary sheets with the design observations and the main critical issues relating above all to the experience of using the products (Figure 4).

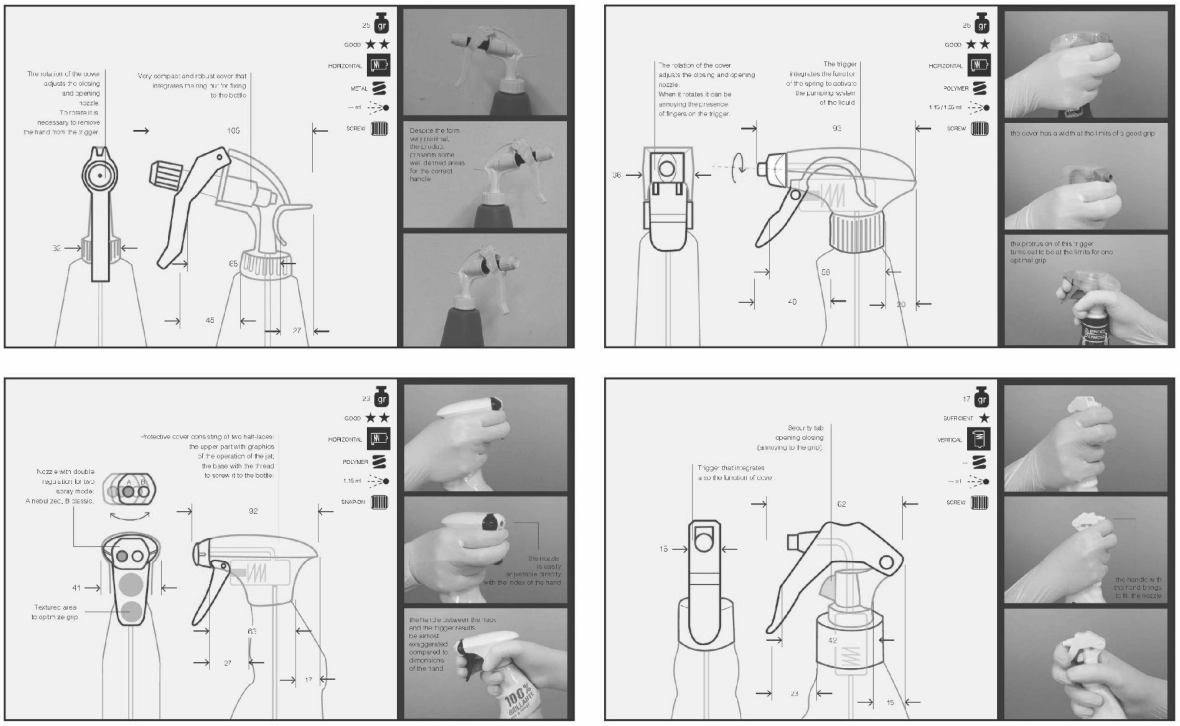

***Figure 2**. Examples of trigger sprayer filing, available on the shelf analyzed.*

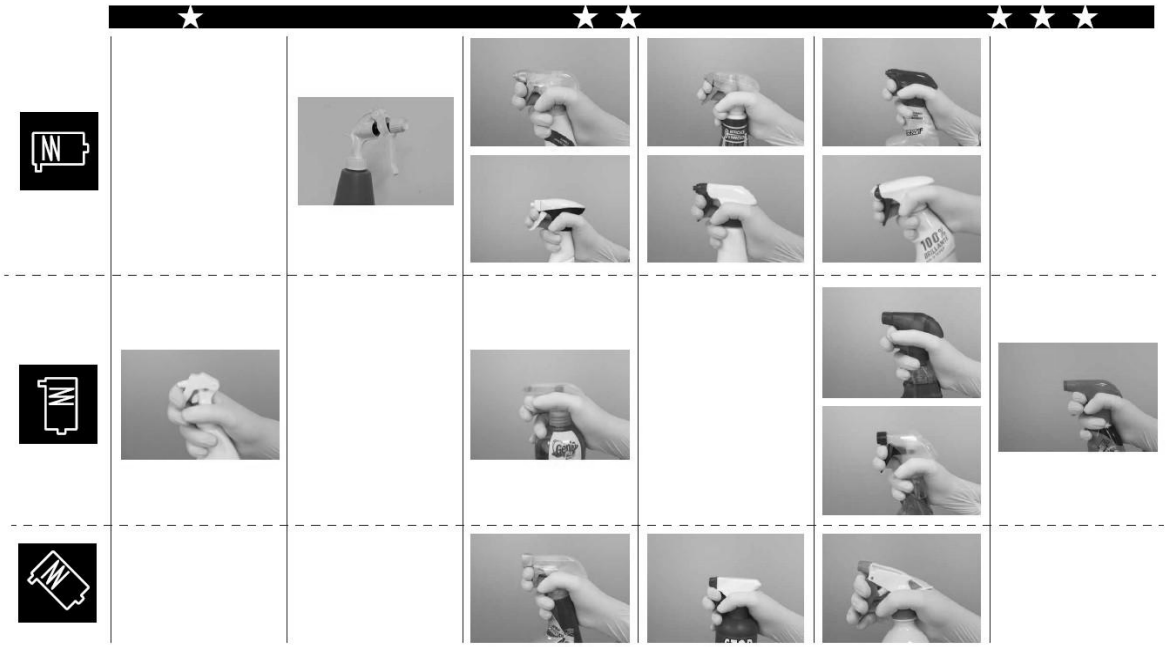

***Figure 3**. Summary sheet of usability level of the analyzed products.*

The analysis of the products on the shelf, from an aesthetic-communicative point of view, has made it possible to develop design considerations with respect to the methods of preparation and the distinctive elements of the product. First of all, two main categories can be distinguished: trigger sprayers for home care use and trigger sprayers for professional use. In the first case - relevant to the

project - the characterizing element is a standard uniform layout for all products, consisting of a cover and a trigger. Through a careful observation, it is evident that the aesthetically relevant elements for the type of product examined are, above all, the shape and graphics of the bottles, mainly due to their large usable surface; at the same time, however, it is noted that the trigger sprayer, while being able to contribute to the general communication of products, does not have any area dedicated to the application of information labels. Another important observation is that most trigger sprayers are not coordinated with the shape or general aesthetics (texture, graphics, etc.) of the bottles to which they are applied; in fact, there are only few examples of trigger sprayers with styles and shapes in line with the bottle. The range of chromatic finishes detected is limited to 6 recursive colors (orange, green, red, gray, white and transparent), generally used in two-color mode. After studying the aesthetic and communicative identity of the products on the shelf, we moved on to a detailed analysis of the functional performance and components of 15 different types of dispensers for house cleaning, marketed under as many different brands. From this activity, features emerged in terms of practicality and usability of the product, which improve the user experience and represent crucial characteristics for the generation of new concepts:

- an external cover that prevents access to the pumping system;
- a morphology of the grip point that highlights the practicality of use and increases the general ergonomics of the product, especially in terms of weight balance;
- texturing of the surfaces, to highlight the correct position of the hand and fingers and to increase the grip;
- the safety closure nozzle usually integrates a sort of retina for the nebulization mode;
- the trigger is generally shaped to be pressed with only two fingers and its length influences the pressure required to nebulize the liquid (in products for professional use the trigger is longer to give greater strength and stability);
- in trigger sprayers for professional use, the body performs as both the function of trigger and actuator;
- the optimal dimensions of the trigger sprayers detected are between 92-94 mm in length and 30-34 mm in width and a variable distance between 52 and 54mm between the trigger and the shell that is screwed to the ring nut.

In addition to identifying the main aesthetic and functional characteristics of the products analyzed, some critical issues concerning the design were highlighted, which emerged in particular following the dispensing systems tests. The above-mentioned tests involved several operators, and focused above all on the user experience, evaluating both the ergonomic performance - such as the comfort of the grip and the ease of activating the trigger - and the functional performance of the dispensing system, when it is directed downwards, horizontally and finally upwards. From the tests carried out, it emerged that:

- it is difficult to rotate the nozzle to close it or change the dispensing mode if the product is held at the same time, since the fingers, which wrap the trigger, can block its rotation;
- if the size of the nozzle is too short, it is easy for "dripping phenomena" to occur during use, since the fingers can clog the dispensing hole and cause an annoying dripping on the hand;
- some triggers, have sharp edges and corners, that cause discomfort when using the product;
- often the coupling lines of the covers, are protruding and sharp, affecting both the ergonomics and the feeling of general comfort of the gripping point;
- the correct placement of the two fingers on the trigger and the distance of the latter from the back of the cover are crucial to define a good affordance of the product.

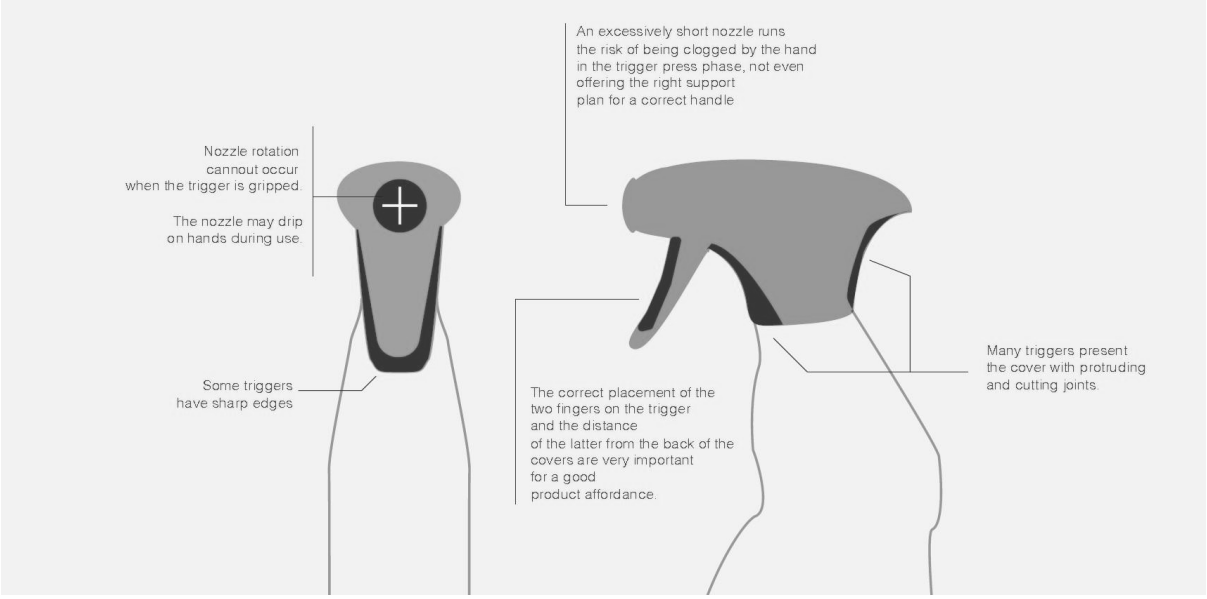

***Figure 4**. Summary sheet of the main criticalities and observations detected by the analyzes.*

Following these activities, a third phase of design research was launched, divided into two main activities: the definition of the design strategies for the optimization and reduction of materials and components (Vezzoli and Manzini, 2007); the development of new trigger sprayer concepts with reduced environmental impact and suitable for e-commerce sales.

3. Macro-strategies to increase the environmental performance of trigger sprayers, for the home care sector.

The main macro-strategies identified for product improvement and optimization, are focused on the layout of the engine and on the possibilities of lightening the bodies, to reduce the consumption of plastic material. With respect to the possible optimal arrangement of the engine, three layouts have been conceived: vertical, at 45 °, and horizontal, as shown in Figure 5.

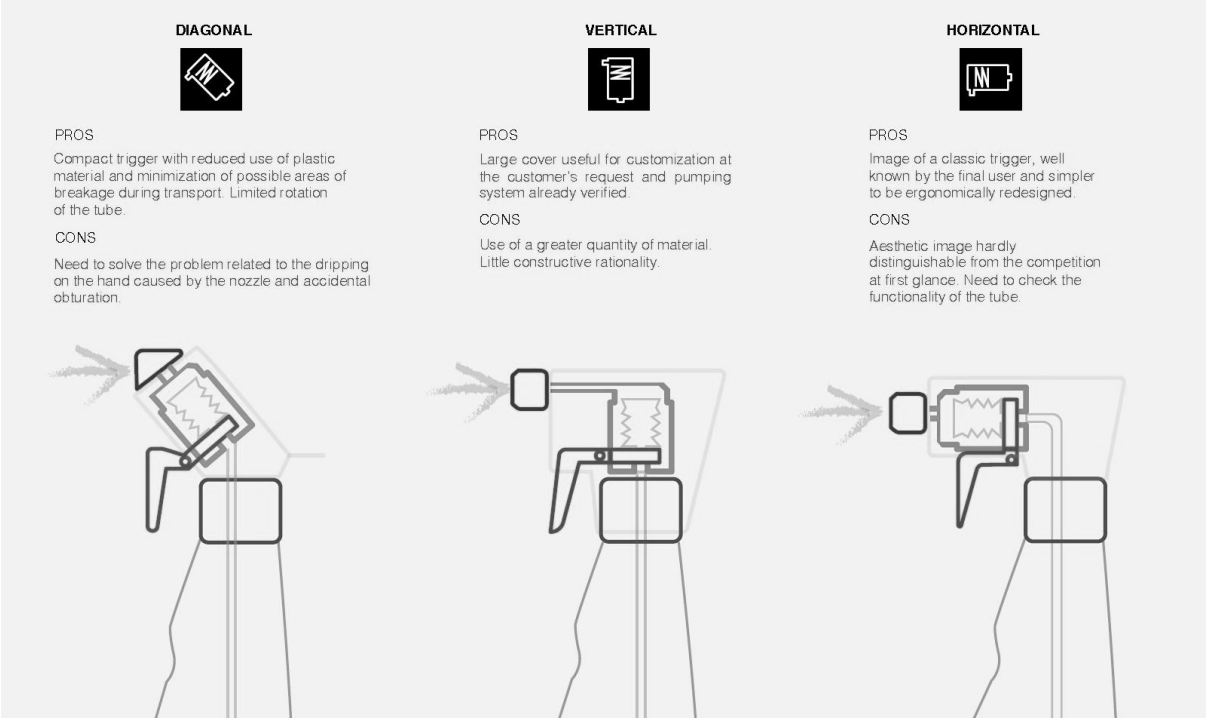

***Figure 5**. Summary sheet of the design benefits and criticalities in relation to the possible engine layouts.*

The hypothesis of a layout with a vertical motor, would have allowed the use of an already tested pumping system, together with the advantage of having a large cover, functional to personalize the product and to accommodate in an optimal way - in ergonomic terms - the user's hand. However, this solution demands a greater use of material, and a poor constructive rationality, having to transform the horizontal movement of the trigger of the thrust system of the bellows motor, into a vertical one.

In the case of a motor positioned at 45°, the trigger would be more compact with the double advantage of limiting the risk of breakage during transport and obtaining a drastic reduction in the plastic material during the production phase. In addition, the inclined position of the motor would also limit the twisting of the dip tube, during the release of the liquid, a drawback detected in the prototype analysis phase. This arrangement, however, risks generating the undesirable dripping-on-the-hand effect, due to a possible obstruction of the nozzle by the fingers, and the consequent and necessary oversizing of the object itself.

The third hypothesis, the one with a horizontal position of the engine, would have allowed a classic layout, well known by the end user, and easier to be ergonomically redesigned, based on the knowledge acquired during the analysis. This solution would have needed a particular connection though, between the motor and the dip tube, to be designed ad hoc.

With regard to the second macro-strategy, to reduce the quantity of plastic material, three different lightening solutions have been developed, each related to a specific arrangement of the engine: the

first, with the motor in a vertical position, described in the subsequent concept "A", involves the design of a series of holes and slots capable of reducing the plastic material and generating textured surfaces to favor the grip of the product during the use; the second with the engine in a diagonal position, proposed in the concept “B”, is characterized by both the reduction in volume and the compact design of the cover, responsible for the protection of the engine; the third solution, the most innovative with the motor in a horizontal position, assumes a grouping of numerous parts of the product and proposes a new mode of interaction that allows the general dimensions of the object to be reduced.

Therefore, the main results achieved - in terms of environmental sustainability and product usability - from the design development of the three new concepts of trigger sprayers suitable for sale through the e-commerce channel, will be discussed in the next paragraph.

4. Three concepts of trigger sprayers with reduced environmental impact and suitable for e-commerce sales for the Aptar company

The preliminary research phases and the aesthetic-functional analysis of the products were fundamental to frame the technical-production context and to set up strategies for the optimization and environmental improvement of the new design proposals. The main results, achieved by the methodological process and the adoption of the eco-design guidelines, are the development of three new concepts of trigger sprayers, summarily called: concept "A", concept "B" and concept "C".

The concept "A", features a vertical motor, as already foreseen in the initial prototype provided by the company, and is characterized by the development of a trigger which, in addition to fulfilling the function of cover, has a series of slots and holes, to reduce the use of plastic material and at the same time favor the grip in the main grip points of the product. The concept, shown in Figure 6, consists of four main components: a ring nut connecting the bottle, which integrates the large, visible hinge; a trigger locking device, which is activated by rotating it around the ring nut, and guarantees the watertight seal of the product, preventing the detergent from spilling out during the transport phase; a trigger that completes the visible hinge, and integrates the pressure piston of the engine bellows and the liquid outlet nozzle. The peculiarity of this model is certainly the shape of the trigger, which replaces the traditional plastic cover shells. Furthermore, compared to the models proposed on the market, which are very thin and not very functional, solutions have been studied to increase performance, in terms of ergonomics and usability. In fact, the surface of the trigger has been sized to accommodate the fingers of the hand in an optimal way, but without adding any plastic material. To further reduce the use of the material, the trigger has been lightened, thinking of two different excavation layouts: the first, which allows a reduction of the polymer used by about 12%, involves the creation of a series of micro-perforations in the designated areas in contact with the fingers, thus also obtaining a pleasant grip, to improve the use of the product with wet hands; the second is configured

in four large slots, three to highlight the areas where to insert the fingers on the trigger and one in the upper part near the hinge, to lighten the product overall. This second solution leads to an estimated polymer reduction of around 16%. In conclusion, Concept "A" is the result of a design process, which has adopted multiple ecodesign strategies: the first was to incorporate the function of the cover into the geometry of the trigger, so as to avoid the production of another component; the second was to provide micro-perforations or slots to reduce the material used, emptying the non-functional areas of the product and at the same time improving the user experience and comfort, through the generation of a surface with greater grip.

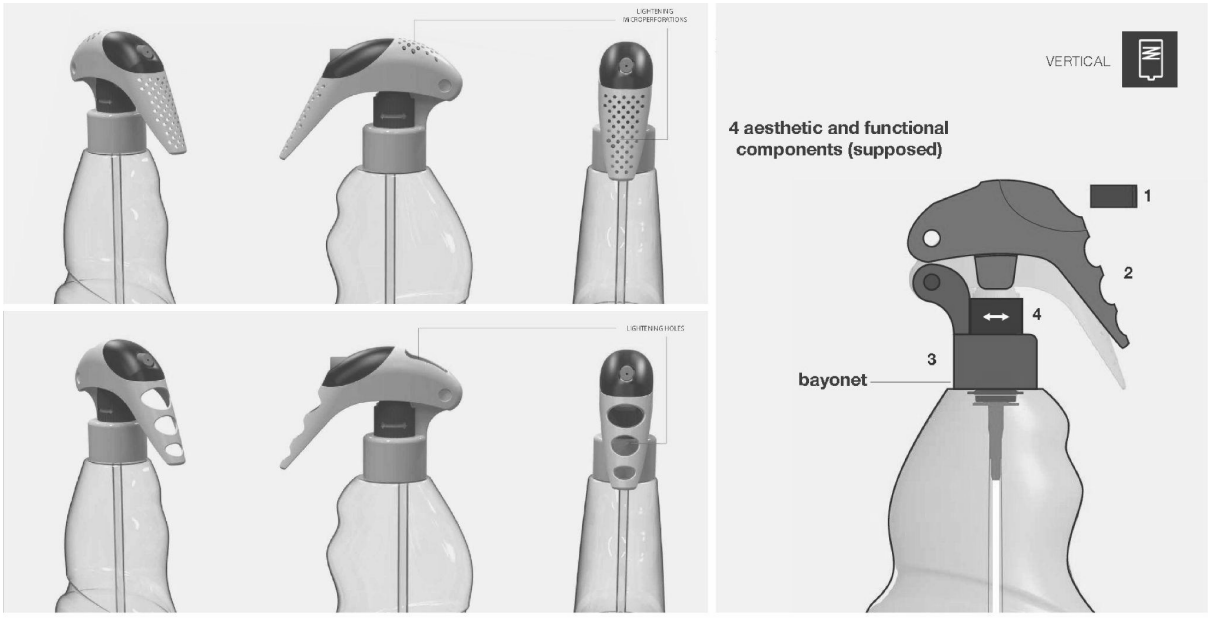

***Figure 6**. Concept "A".*

The concept "B", shown in Figure 7, unlike the prototype analyzed in the preliminary research, has a diagonal motor orientation with a 45 ° inclination. This model is characterized by its compact design and a directional nozzle, for a more effective dispensing of detergent, even in the most critical areas of the house (corners and high surfaces). The architecture is mainly made up of five parts: a half-cover designed to protect the engine and characterized by a special fin designed to balance part of the weight of the product on the back of the hand; a second half-cover that closes the shape of the cover and integrates the thread to screw the trigger sprayer to the bottle; a trigger for dispensing; a safety pin, to guarantee the sealing of the detergent during the transport phase and a directional nozzle through its rotation.

The peculiarity of this concept is certainly the development of a compact cover, with greatly reduced volumes and high storage density. In fact, with respect to the architecture of the initial prototype, an attempt was made to rationalize both the number of components - reducing them to four - and the distribution of the material to produce the bodies. This process of optimization and rationalization of volumes has led to a reduction in plastic material, estimated to be at around 18%. Furthermore, a new

dispensing method has been hypothesized to direct and optimize the jet, even in the most critical points, since from the preliminary analyzes it was observed that to spray the detergent on surfaces placed in angles or at a certain height, it is necessary to rotate or overturn the bottle. This dynamic results in poor dispensing efficiency, because the dip tube is unable to pull out the needed quantity of detergent from the bottle. Therefore, a solution that provides for the rotation of the nozzle has been conceived, in order to direct the jet towards the critical points and, at the same time, keep the bottle vertically, to facilitate the flow of the detergent into the dip tube. In conclusion, the concept "B", is the result of a design process that adopts the strategy of rationalizing functional parts and optimizing volumes, in order to reduce the largest possible amount of plastic material for their industrial production.

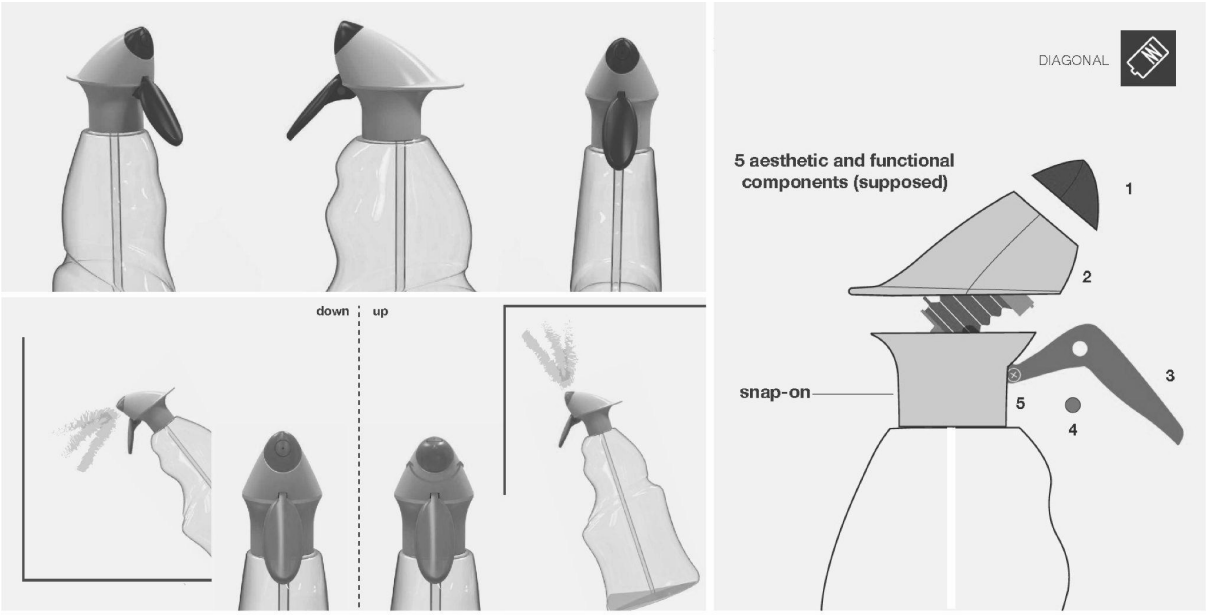

***Figure** 7. Concept "B".*

The concept "C", shown in Figure 8, unlike the two previous design solutions, presents a horizontal engine layout, and differs from traditional delivery methods, taking inspiration from nasal nebulization systems. The solution proposes a typological innovation, having - although atypical compared to other consolidated types on the market - the great advantage of optimizing the efficiency of the engine and ensuring the safety of the product during transport. The architecture of this model is mainly made up of 3 components: two half-shells, one of which has the ring nut for fixing to the bottle, suitably assembled to protect the motor and designed to facilitate the grip of the product through soft shape and textured areas, and a new component that integrates trigger and nozzle. The operating principle is very similar to that of the established nasal spray dispensers: gripping the product with the trigger/nozzle inserted between the index and middle fingers of the hand, it is possible to press and compress the bellows motor, which generates the jet and the nebulization of the detergent. Compared to both traditional models and the two previous concepts, this solution has no

center of rotation of the trigger, as it axially pushes the bellows of the motor, increasing the general efficiency of the liquid dispensing and eliminating one of the major problems of the product during transport, that of the breaking of the trigger at its weakest point: the hinge. For the design of the handle and the development of a shape capable of guaranteeing the ergonomic performance required by the customer, various hypotheses of geometries were made, and prototyping activities started, supported by preliminary tests and focus groups, aimed at optimizing and refining the three models developed.

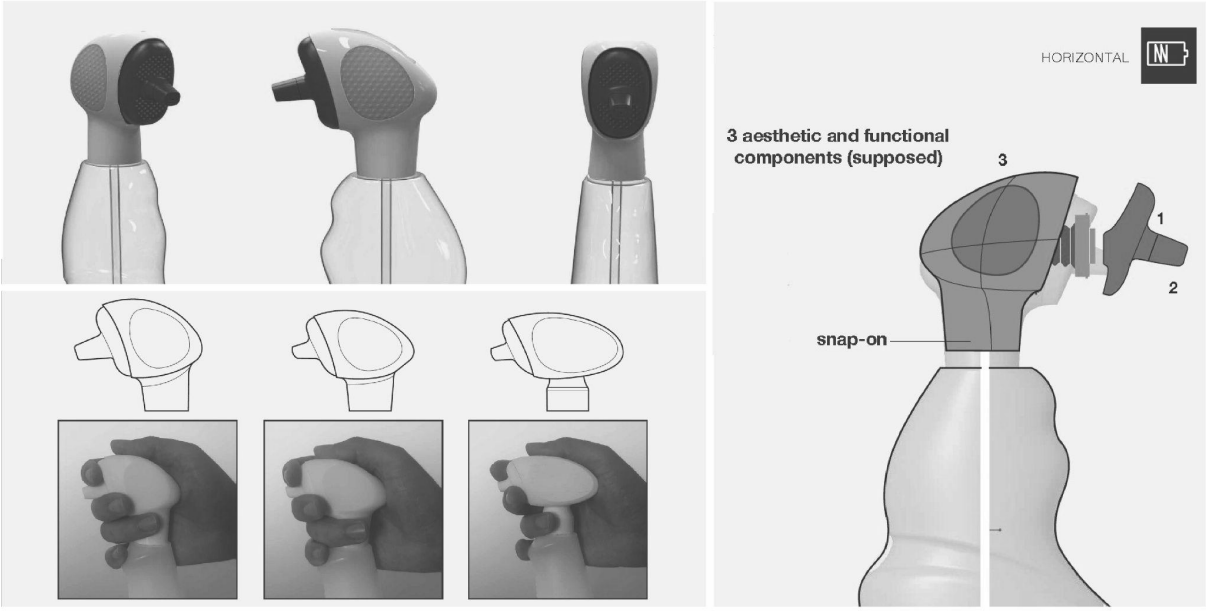

***Figure 8**. Concept "C".*

The conception of this delivery system designed around the horizontal arrangement of the engine has made it possible to generate an unprecedented concept of trigger sprayer, compact and rationalized in the components, capable of optimizing its industrial production process. Adopting a strategy of integration of functions, through the development of the cover with the integrated ring nut and the innovative trigger, which incorporates the geometry of the nozzle and makes it compact and safe for the transport phase without the use of special safety rings, it is possible to hypothesize a fair reduction of the plastic material, estimated at around 7%.

In the next page, Table 1 shows the main estimated results achieved by the development and design process of the new trigger sprayer concepts.

Table 1. *Summary of the main results achieved through eco-design strategies.*

concept trigger sprayer developed	**n°** COMPONENTS (supposed)	**%** MATERIAL REDUCTION (supposed)
A	4	12-16
B	5	18
C	3	7

5. Conclusions

As discussed in the paper and briefly shown by the numerical values in the previous table, adopting the methodology set out in the preliminary research and analysis phases and applying the DfS criteria to the development of a new trigger sprayer "suitable for e-commerce sales", it was possible to obtain significant benefits, compared to the main commercial types analyzed and to the initial prototype by the Aptar company, in terms of:

- rationalization of the basic components of the product;

- optimization of the technical-production aspects of the individual components;

- design of new formal and functional strategies to make the trigger sprayer product more compact and resilient to the transport phase;

- proposing new dynamics of user-product interaction, centered on both the efficiency and effectiveness of the expected action and the result obtained;

- creation of a new type of trigger sprayer, in reference to the concept “C”, unpublished for the reference commercial segment.

The strategies of the DfS transversal to all the concepts developed - aimed primarily at rationalizing both the material used and the number of product components - have shown that it is also possible to reduce the number of steel molds and the material used for their production. Furthermore, the elimination of the traditional metal spring - made possible by the great technical innovation of the plastic bellows motor developed by the Aptar company - has allowed the product to be reconfigured, in the key of an extreme integration of the components, consistent with the new expected "end-of-life" of the trigger sprayer, which can be completely disposed of in the plastic recycling bin.

In conclusion, the tools and methodologies adopted, typical of a design process guided by Design and the adoption of eco-design strategies and guidelines, have allowed the development of three highly eco-efficient trigger sprayer concepts, capable of responding in an innovative way, to the emerging e-commerce market. In addition, they have proved to be a strategic and supportive lever for the R&D group of the Aptar company, towards an environmental, functional and aesthetic innovation of this specific type of product. The further advancement of this design experience has led the company to develop a new mono-material product, both in the internal functional components and in the external aesthetics, completely recyclable at the end of its life, which will be marketed by the main international markets in the coming months.

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Responsible Design is the Apex Design Mode to create our sustainable future

This process benefits all the Sustainable Development Goals (SDGs)

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Abstract

Most design modalities strive to embrace sustainability, yet none are broad or agile enough to evolve to new problems that are appearing faster. This led us to intentionally capitalise on the current strengths of leading design modalities and combine them with the best elements of future focused trends into a more cohesive framework. One that develops long-term sustainability as soon as possible. A fusion of Circular Design plus Regenerative Design and Transition Design comes fairly close yet each alone falls short in several critical areas. There is no longer the luxury to 'get things more wrong'. Required is a design modality that fuses together every component that benefits all natural life. We go beyond reviewing major design trends by defining what is lacking and show how best this may be addressed and rebalanced. For decades, practitioners and Society for Responsible Design curators have proposed beneficial new ideas to design thinking practice. Initial research and feedback on design directions has been very positive and we share our findings for wider review and consideration. This includes that evaluation of ideas from multiple perspectives is required and they increase in value when reviewed through a 'Responsible lens'. The continuously developing area of Responsible Design is a methodology that invites everyone to add to these strengths. Integrating all these design components results in an approach that makes it worthy of claiming the newly nominated term 'Apex Design Mode' as appropriate. This forms the collective of processes holding the greatest opportunity to address all the SDGs and more. It is well supported by the capacity to achieve significantly better long-term results in many fields. This complete approach also includes the more robust techniques of collating, assessing, developing and implementing best global greener practice, across all fields. Then we shall achieve much better results in the fastest manner possible. When sustainability is fused with responsibility we can show, 'Responsible Design = Good for everything'.

Keywords: Responsible Design, Apex Design Mode, Ecological Best Practice, Responsible Thinking, Sustainability

Figure 1. *(Oral presentation Slide 1) Responsible Design...*

1. Introduction

The idea of Responsible Design has been around for well over 30 years and referenced in design processes through those years in many ways. In recent times however, this potentially quite significant ingredient of all good design has been sidelined and it is now time to reassess its value. Our need now for a more effective set of design guidelines, to develop real sustainability solutions to the many existing global problems is urgent.

You would think that multiple global crises demand the most expedient responses to them all. The Nobel Prize Summit (2021) relates very well, on just what and where the many issues are that need to be addressed. Just citing Climate Change and Species Extinction while massive, in reality are still only parts of the combined dilemmas that are often referred to as wicked problems (Rittel and Webber 1973; de Almeida Kumlien and Coughlan 2018). The ideas presented while great still left some gaps in their methods of application.

The core concepts of sustainability are well known as are the many related global issues being addressed by the United Nations (UN) Sustainable Development Goals (SDGs) and every form of development. Quite simply, if we all continue to destroy the natural world which supports us at multiple levels, we shall certainly suffer the same fate. Working more closely with nature was confirmed in the globally televised Leaders Climate Summit on Earth Day this year. From the US to China, it was stated in several ways but using a similar message. US President Joe Biden (2021) explaining, “it's also about providing a better future for all of us” and later by China’s President Xi Jinping (2021), “to improve the environment is to boost productivity”. These ideas may be relatively simple statements, yet they need to be well resolved as to HOW globally we may best achieve them in the shortest possible timeframe.

These global issues have definitively not happened just this century, nor has defining responses and appropriate solutions. We have been working within design spheres for several decades and have developed numerous simple processes of adding responsible actions that can easily be combined to suit individual situations to benefit all the SDGs and the related and overarching issues as well.

The amalgamation of lived, observed and working experiences with the realities of sustainability, particularly living eco-systems and wildlife conservation, underpin the thinking and methodology for this paper. Early work with scientific researchers identified massive losses in significant geographical range reductions and related loss of animal numbers that were already occurring. Further indications for many species following these trends were in high likelihood of becoming endangered or facing extinction. Such understandings and later work (Seidensticker 1991; Newton 1990; Brown and Morgan 1989) confirmed the recognition that many changes in systems, processes and behaviour were required to support rather than detract from nature and humanity. This highlighted the need for more rigorous sustainability assessments and that there are many levels of sustainability. Being nearly sustainable is just not enough, whatever is created in large numbers or requiring large quantities of natural resources must be shown to be sustainable in the long term. Anything less is just not responsible. The number of crises today result from not practicing sustainable actions over time.

***Figure 2**. (Oral presentation Slide 2) all SDGs benefit from Responsible Design.*

Many years assessing and curating the Graduate Sustainable Design Exhibitions (20 in all), where exhibitors were chosen as best in discipline for their designs across Australia, confirmed that sustainability needed to be coupled with responsibility. This was the key complement of the equation. When designs were reviewed to meet responsible directions, it reconfirmed the need for a more comprehensive approach to product, process or design assessments, for them to become truly beneficial and ecologically sound on a larger scale. Responsible Design criteria evolved over time, honed and

broadened with sustainable briefs, on-going consultation and collaboration with lecturers, designers and design disciplines. The development of Responsible Design was a dynamic thing and continues to remain dynamic.

If we collectively want to solve multiple global crises, perhaps the bar with the SDGs and pandemic is set too low? Will our current trajectory reverse the climate disruptions and biodiversity loss as well, or is this too much to hope for? We can certainly all aim for this with the intent that we will succeed. Problem solving is a capacity that great design uses in abundance. Can reviewing the many design methodologies give insights to get us all in front of the curve? Acknowledging that all ideas and modes should be treated with respect and collaboration is the only answer. Revisiting Papanek's *Design for the Real World* (1972), we also invite the reinstatement of 'responsible' as the key method or factor to get us there. Using Responsible Design allows us to replace unsustainable assets with responsibly designed and co-create 'new business as usual'.

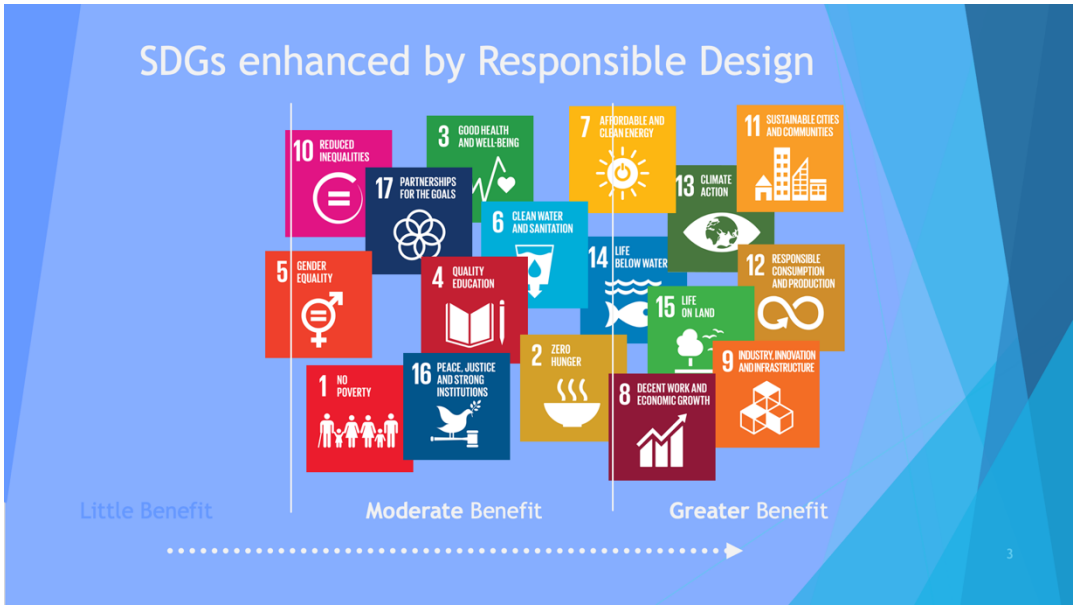

***Figure 3**. (Oral presentation Slide 3) SDGs enhanced by Responsible Design.*

Usage of 'Responsible' to describe new industry sub-sectors markedly increased in recent decades e.g., Responsible Investing, Responsible Travel, Responsible Business. Google searches in May 2021 returned over one billion results on each. One of these, Responsible Industry (2014) confirmed products and services need to measure up to how Environmental, Social and Ethical Responsibility criteria increase value, reputation and avoid risks while improving benefits for all. The related health & ageing category also included privacy, safety, gender equality, ethics, treatment of employees, CO2 footprint and data handling, confirming the breadth of issues to cover. It is interesting to note that 'Responsible Design' was a forerunner in the late 80s with associations forming globally, including the Society for Responsible Design (SRD) in 1989. (SRD weblink 2021).

As an ever-evolving process, Responsible Design acknowledges great successes and failings of human activity, especially those challenges threatening our long-term survival. It thrives on concerted efforts by a range of stakeholders collaborating to solve a problem or devise the design of things from individual items to whole communities. It recognises no one industry or sector has achieved sustainability alone and not moving from 'business as usual' equates to disaster. The global imperative calls for a substantive rethink to better directed management of innovation. Redesigning everything with responsible thinking at its core may be the best way to achieve real progress in sustainability across all the SDGs. Applying Responsible Design to the SDGs suggests this is achievable after including the top elements of all design modes to strengthen this position.

Responsible Design method is many things but quite simply all about applying the definitions and practice of 'responsible' to all we create. Our experience, studies and research over decades shows this is insufficiently used. These are the terms to employ; stewardship, caring, meeting obligations, being accountable, answerable, trustworthy, rational, setting benchmarks and appropriate standards to create things that are beneficial to the natural world for the longer term.

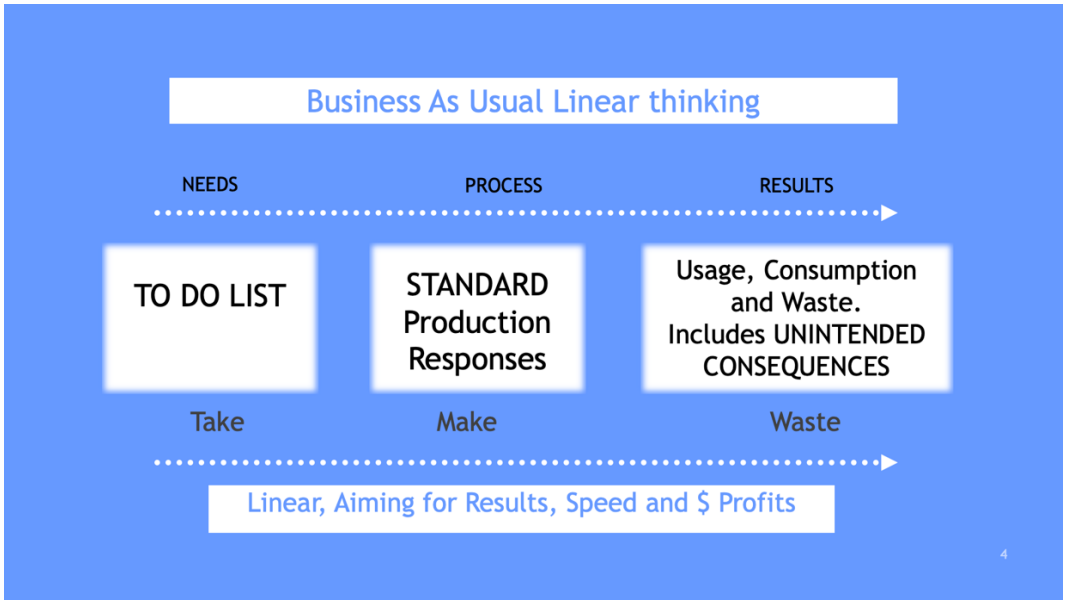

***Figure 4**. (Oral presentation Slide 4) Business as usual linear practice.*

It represents a broad set of methods and steps to guide design across all disciplines, industries and production processes to help streamline and follow proven ecologically effective steps to achieve the best results possible. Its other main point of difference is by promoting the use of ethically based solutions at the core of all design processes. In simple theory, to stop plastic pollution, you could just stop making plastics. This may be impossible in the short term so using Responsible Design encourages you to take all steps possible to counter this. There are multiple methods to restrict plastic production to the minimum while looking for alternative or better performing materials and also encouraging higher rates of plastics recovery plus designing more appropriate usage that doesn't get discarded.

Essentially using every workaround and new methods possible to reduce the negative plastic impacts, then remove it where and however possible (Ellen MacArthur 2021a; Yes! Magazine 2021).

Linear production models are still widespread, though business and public pressure are starting to encourage moving away from this toxically wasteful practice.

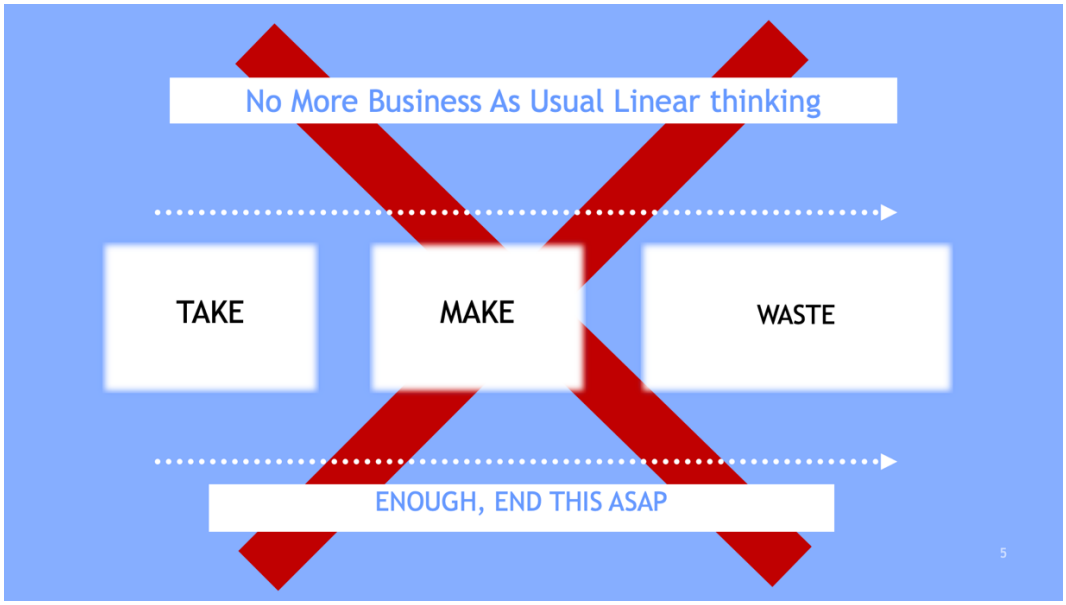

***Figure 5**. (Oral presentation Slide 5) No More Business As Usual Linear thinking.*

2. Methods

Using a narrative analysis format with a goal to identify the best framework to address global crises, this paper will review the top design modes, acknowledge their strengths and review their shortcomings. We then show means to use Responsible Design thinking to assist making each of them stronger, more resilient and successful. Additionally, by exploring the many definitions of 'responsible', we confirm it embodies numerous valuable dimensions worthy of greater attention. We describe several examples of products and services that illustrate these ideas to spur further cooperative sharing and development. For background, we relate the processes adopted over 30 years in the Society for Responsible Design that has led to the Responsible Design model and show the results of an ongoing SRD survey with responses from a broad audience to confirm the direction of designing our future. The paper completes with calls for action and collaboration in a variety of ways to ensure growing knowledge and community that we may all enjoy. Recent studies have identified the value and relevance for many of these strategies with the objectives of socially inclusive and environmental sustainability (Monson 2021).

3. Results and Discussion

During the last Century we have seen wicked problems significantly increase. There are even several descriptions of them, due to their fluid and interconnected nature, they inhabit variable dimensions.

From scope to scale they are unique, avoid defined boundaries, may appear and disappear and one can be a symptom of another.

To help devise better modes to address these, timeline references and discussion of many methods as design directions are reviewed in (Friant 2021; Friant et al. 2020; Ceschin and Gaziulusoy 2016). They mostly revolve around more widely applicable design approaches such as the Circular Design concept which requires that all possible must be contained within a closed perpetual loop. Nature and Regenerative Design neatly fit into these cycles as well. Our intent is to show how these design modes, explaining methods and procedures, may all be used to their best capacity. By combining their strengths and adding to their evolution, we can arrive at a stronger result that can be more widely used for maximum ecological results. Transition Design is also added to the group of design modalities that show inherent benefits (and some limitations) to deal with our current challenges. The application of a much broader results-oriented design methodology fused with our collective best practice learnings should be able to address current problems within shorter timeframes. Following are the main features of the top design modes.

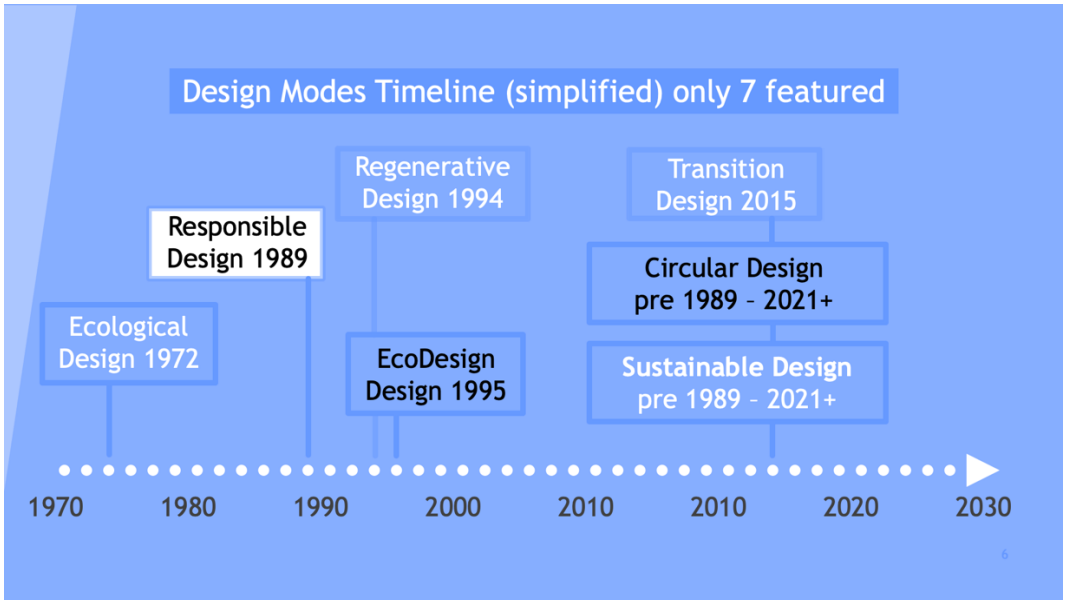

***Figure 6**. (Oral presentation Slide 6) Design Modes Timeline (simplified) only 7 featured.*

Circular Design has many parts, origins and relatives. It seems like even lay people have a basic understanding of it. Possibly the most historically similar applications of it were during the Great Depression. So many were doing all they needed, improvising with whatever they could, to sustain their families. Quite a few parallels to recent years in some respects. Global crises demand appropriate and varied responses with so many lives profoundly affected. The modern incarnations of Circular Design or Circular Economy or Circular Thinking has many obvious benefits by redesigning systems to keep everything possible in a perpetually productive loop. If we all were practicing it, there would be far less to resolve. The process still has some fairly large flaws that need addressing. Most man-made systems

are not readily circular. It is most likely that some may not be possible to be made circular. This would suggest capping or reducing their negative components asap. This is underway in several industries from chemicals to fossil fuels. We can all certainly relate to the medical usage and wastage of single use plastics and related over the current pandemic that are not easily made circular or readily resolved. We are suggesting that adding the 'Responsible' component to all points possible or appropriate may be the best course of improved action. There are still many strengths to the Circular process not least of which is its marketability as it makes for quite recognisable graphics and the uptake by many through the great work of the Ellen MacArthur Foundation (2021b). They have adopted the Circular Economy as one of their major sources of processes and solutions with many businesses and countries participating.

Table 1. *(Oral presentation Slide 7) Responsible Design benefits over Circular Design Table.*

Regenerative Design has its origins in Permaculture featuring self-reliant living, organic gardening within a local agricultural environment theme. Developed further by Professor John T. Lyle to include all systems in consumption and production. This led to the *Cradle to Cradle* book (McDonough and Braungart 2002) and process. Using a whole systems approach, Regenerative design replaces any linear sequences or production systems with those that are completely cyclical, natural and self-renewing in every manner possible. Innovation and thoughtful use of companion partnerships closely match natural systems at every opportunity. In practice, it aims to mirror nature in creating its own cycles of renewal for all the energy and materials it uses, allowing its parts to revitalise through their operation with minimal external maintenance. Solar radiation is the main energy source teamed with other renewables and passive energy conservation techniques. Reusing all components is maximised plus full recycling and composting systems for end wastes focusing on organic and natural substances. All toxic substances are avoided as is the minimal use of fossil fuels and related products.

This mode works to match and assist nature's amazing capacities and the sustainable practices to live well within them. Most sustainable practices seek to maintain systems without degrading them, whereas regenerative practices go beyond by applying management techniques to restore systems and even improve them and their productivity. This mode can have some great results though it can be a bit limited in scaling to industrial proportions. It is more often suited to agricultural and food production as it can be somewhat challenged with more difficult technically based industries, synthetics and complex practices. This mode can still be significantly strengthened by applying a Responsible lens to ensure global responses are adequate for dealing with the severity of issues at hand.

Some processes straddle several modes with relative ease. A dynamic model in responsible design Construction and Architecture is found in the International Living Future Institute (2021) Living Building Challenge (LBC). Advancing a "sea change in building, infrastructure and community design", LBC is an intended catalyst for our reconnection to the natural world. Doing so collectively, we can all address climate change and more. This holistic approach expects the integration of the natural and built environments, adopting building project guidelines around everything from independent energy generation, water capture and waste process directions. They also go well beyond mere 'box ticking' exercises. Their Red List identifies the "worst in class" materials, chemicals, and elements known to pose serious problems and not for human usage. This is a serious guide to incentivise all governments, professionals, building contractors and humanity at large to re-establish our relationship with the living environment. Two worthy examples of the many Full Living Certified buildings include: the Bullitt Centre, Seattle, Washington with a claim to be the greenest commercial building in the world and the Sustainable Buildings Research Centre University of Wollongong that won a significant capital works construction grant from the Australian Government. While these buildings and principles are breathtaking, they don't address the much greater bulk of existing buildings in the substantive way that is needed. Retrofitting these for lower energy may encourage more responsible progress. Worth noting, in the 90s, NSW Chapter of the Australian Institute of Architects confirmed in effect that "you can't design a sustainable building by itself, you need to develop a sustainable society to inhabit the building to make sustainability truly work".

Transition design (TD) is a practice of designing and planning that looks at the longer term and implements staged strategic linked steps to reach there. Their focus is on sustainability via urban design and advocating design-led societal transition toward more sustainable futures. It works to simplify some scenarios by not trying to perfectly solve an exact local problem but the overall problems of the area so it can avoid getting lost in minute details by giving an overviewed result. It favours prioritising designs, modular construction and using well-educated stages to reach the optimal ecological result with better long term outcomes more effectively and sometimes faster than other means. This design mode has developed fairly recently and enjoys several origins. One of the foundational lecturers and 'voices' for Transition Design was himself also an early SRD/EDF convenor/director. It is good to see the

immediate past Convenor of the Society for Responsible Design having such success with another eco design modality that holds truly great promise. We also note the words of TD founder, Terry Irwin (2018, 2012) explaining in a TEDx Talk her epiphany that she became convinced, "…I had to learn to design in a more appropriate or responsible way". We agree that TD has some exceptionally well developed concepts based on earlier foundations that are well worth sharing. We would share in return that 'Responsible actions' may really strengthen this valuable work and gain greater traction and benefits across society.

Apex Design Mode (ADM) is the title we apply to Responsible Design for its capacity to stitch together all the salient design modes into a cohesive form of addressing wicked problems. When Responsible is secured at the Apex of our thinking, the results are far more likely to flow into more plausible longer-term solutions across the board. Our experience suggests that dynamic inclusion of new ideas found to enhance this process is the best way forward and suggest wider adoption and usage of Responsible action and the term Apex Design Mode.

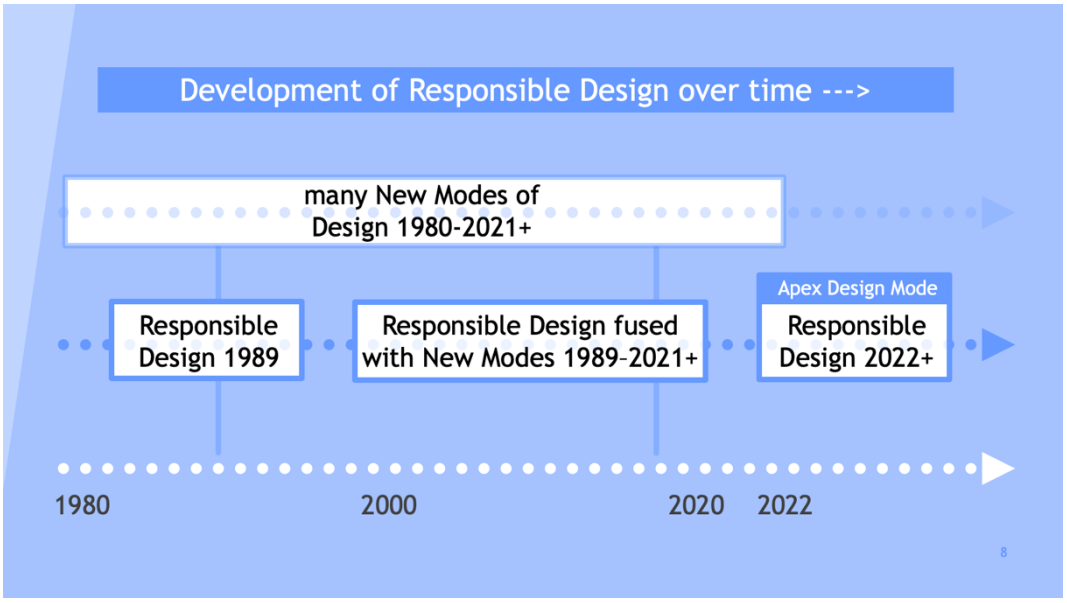

Figure 7. *(Oral presentation Slide 8) Responsible Design evolves into the 'Apex Design Mode'.*

This simple ecological test may be utilised to see when any activity needs adjustment. If the total of any business or activity including emissions, materials, supply chain and by-products or disposal is ultimately assisting in the loss or decline in the number of species, you get a fail. However, if your business or activity is assisting in the increased number of species, you clearly get a win. A midpoint is also a loss as it likely ties in with those who on balance are causing a loss of species, that you are not improving. We have to be singly and collectively creating conditions that encourage multiple species to thrive just as nature has done, largely unaided, for millennia. Additionally, any offsets made should be clearly shown to be advancing the increase of the number of species.

Design Thinking has been deservedly enjoying a significant growth phase in the 21st Century. It consistently creates value in multiple forms and avenues, making significant advances. Most would assume that this can only be a good thing. There is however the negative aspect that design can be used to create things that are the cause of results significantly worse than previously considered, especially when you take into account a range of criteria, unintended consequences for a start. (Shedroff 2019; Papanek 1972).

Ecological Best practice is an all embracive description of how we may collate and follow the most efficient means to achieve global improvement. It is a method of thinking, assessing, developing and then implementing best global greener practices. It involves every sphere of activity by humans and their interaction with nature from economic to social and environmental aspects, ensuring the responsible approach is included with every element. What is best for all species and our planet? A collection of directions and methods to tackle the world's problems aided by collective governance.

Many countries and groups in recent years have declared a Climate Emergency and an Ecological Crisis (Comms Declare 2021; Citizens Declare 2020). These declarations have seen increased interest by scientists, engineers, designers, academics, councils, governments and civil society to devise potential solutions to the many challenges. We suggest utilisation of the Apex Design Mode processes which offer responsible adaptability and flexibility to meet changing factors, conditions and environments would generate the change scenarios required faster. This should assist in achieving Net Zero Emissions by 2050 with 50% CO2 emissions reduction by 2030.

All the design modes would be strengthened by requiring higher standards in many key areas. A dynamic fusion of the best design modes is what Responsible Design has strived to achieve since inception. Following is a summary of the salient points of Responsible Design and discussion of how it has and continues to evolve.

Responsible Design method is many things but quite simply all about applying the definitions and practice of 'responsible' to all we create. Our experience, studies and research over decades shows this is insufficiently used. These are the terms to employ, stewardship, caring, meeting obligations, being accountable, answerable, trustworthy, rational, setting benchmarks and appropriate standards to create things that are beneficial to the natural world for the longer term.

Just 10 Responsible Design defining components include: *Recognises the world we create has to be designed better *design decisions create the future *this is an ever-evolving process *considers all relevant issues before designing *researches the range of good and bad practices *works to understand the many perspectives of the project *is inclusive in its outlook and process *recognises the responsibility of designing. The larger the project, the greater this is *uses best practice to create then reviews and shares this information *Collaboration increases the benefits all round.

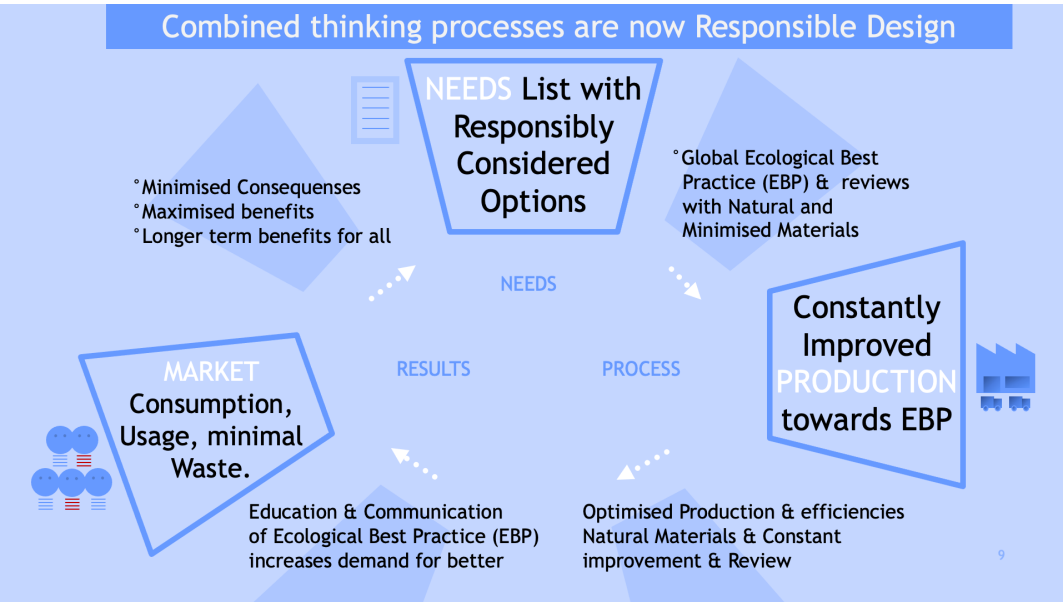

***Figure 8**. (Oral presentation Slide 9) Combined thinking processes are now Responsible Design.*

It should be noted, it was never the designers role to fix the world by themselves. If we have deadlines to fix things and scientists say we have only 10 years, we all should be working in the same directions. The whole population needs to be involved in creating solutions that have the best chance of making the difference. All interconnected as they should be. All design modes are good, in fact they are each brilliant in their own ways. What's not being well discussed is how we can make them all work best together. We suggest the added link / lens of Responsible Design. Using this Apex Design Mode has the best chance of resulting in the whole being sustainable. It is incumbent on us that we all work together. Because only through working collaboratively and responsibly with the design methods we currently have can we develop them to create workable solutions urgently.

Top features of Responsible Design: *complements all design modes by making them more ethically based and ecologically balanced *Insists appropriate consideration for positive impacts to benefit all natural life now and well into the future *creating Sustainable Value that considers human and global consequences of actions *encourages understanding the implications of design, in materials, production, consumption, final product or service *encourages a cleaner, healthier, safer and more sustainable world with concepts and directions *reduces global environmental impacts and enhances social benefits through all design disciplines, services, well-being and beyond.

Design may significantly contribute or detract from desirable outcomes unless properly studied and due consideration is applied including the latest in considered design thinking and innovation. Design or innovation devoid of responsible design too easily results in superficial change with limited benefits and potentially catastrophic long term consequences as we are beginning to discover now. Globally these are massive challenges that we all may contribute to in many ways. Responsible Design

encourages the positive and discourages the negative, wherever possible rethinking and redesigning all we create.

Table 2. *(Oral presentation Slide 10) Ten more Responsible Design components include:*

To demonstrate these directions, for 8 consecutive years 2004 – 2011, innovative leading edge designs were showcased in the SRD Change Graduate Sustainable Design exhibition series. It grew from a good student initiative to become a fully self-funded National event with significant cash and software prizes. Designs for each exhibition were selected from a wide selection of design disciplines. Many benefits resulted for exhibitors from their cross-disciplinary consultation and collaboration, as they worked together to design, stage, market, present and promote the concept of sustainable responsible design thinking to peers, lecturers and general public. Participants also found new understandings in sustainable approaches from their experience that dispelled any 'silo thinking'. All of which finally lead to a greater appreciation of design thinking and application from their newly acquired broader responsible lens. Much of their work (SRD Change National 2011) and two papers are still available online (Ramirez et al 2011, 2010). Sponsors included international creative corporation Adobe and Australian sustainability leaders Investa. Promotion included presenting a catalogue of these good ideas to Richard Branson in 2011 at Sydney's 'Carbon War Room' conference.

Two Industrial design projects from the SRD Change National graduates exhibition are also worthy of special mention for their responsible conceptual thinking and development. Balin Lee's project 'Kopper', a palm-sized soap replacement device, offers to provide a superior level of hygiene particularly in the third world. Many preventable diseases can be controlled through basic hand washing practices, unfortunately many don't have access to clean water or soap. 'Kopper' increases hygiene as it uses existing water supplies (regardless of contamination). It's electrolysis and filtration systems eliminate 99.99% of all parasites, viruses and bacteria, whilst producing clean water as it's only by-

product of use. 'Kopper' provides chemical free hand cleaning, designed to be over 94 % recyclable and made almost entirely from recycled materials. These projects tackle problem solving at multiple levels with innovation and Ecological Best Practice at their core. Other modes don't actively encourage seeking such combinations and wider reference needs to be included. Phillip Brien's Nitrogen Seed Preservation System aims to assist developing agricultural communities around the world. They are often situated in areas prone to weather extremes, geological disasters and civil unrest, that can all lead to the destruction of the seed stock these economies rely on. This system can assist to preserve seed stock for extended periods of time by making a suitable 'atmosphere' in storage. Separating Nitrogen gas from the air using membrane separation technologies and all in a portable backpack solar powered unit. The Nitrogen generated is pumped into a sealable container to purge out all Oxygen. A moisture absorbing pack is added to the seed and the container sealed and stored in a stable, low temperature location until required. It allows much longer term storage of seed stock, uses existing technologies and is portable, solar powered, quick and easy to set up and use. Both these projects illustrate means to assist several SDGs, people in need and increase food security and health for many. Ideas like these need more exposure, collaboration and development (Lee and Brien 2011). Perhaps a new **SRD Change Global** version can be organised online for all to see. This may include 'wild ideas' from any field. Please forward any suitable projects or means of assistance.

***Figure 9**. (Slide 11) SRD Change National Exhibitors, Venues & Youth SDGs conference series.*

Fashion, one of the most polluting industries in the world, is struggling to make substantive change. Responsible Design solutions highlighted from curating eight years of exhibitions shows there are many more ethical design considerations, that can be applied within the industry. Twelve positive directions working with more responsible sustainable practices are being prepared for a workshop by SRD. These include ideas from an International Mittelmoda emerging talent award winner featuring deconstruction

and up-cycling. Plus, a versatile collection of other directions including layering, knits/crochet, natural materials, low/zero waste, reversible & invertible, pattern maximising, clever cutting, indigenous and natural dyeing. All just a guide of what's possible and with never ending combinations. This can even be teamed with certified ethical and responsible accessories to complete the concept turning fashion back towards a natural balance, leaving synthetic micro-fibres 'to the dust' (Fashion and Textile Design 2021). This helps to illustrate that 'every string in your bow' needs to be used i.e., explore all possible appropriate strategies, adapting and changing the focus as required to find the optimal solution(s). One group developing this mode well is Zero Waste Design Online (2020).

Focusing on the UN SDGs, an education program began in 2016 to equip youth with solution-oriented planning skills to address the many issues confronting their regional areas. Students quickly grasped the implications of their task and applied their new skills to dynamic plans to address targets within the goals. The combined students' plans from around Australia were presented to government in 2017. The program expanded internationally, firstly to Mauritius giving both Australian and Mauritian students the opportunity to collectively workshop their SDG plans. These cross-cultural student collaborations led to much greater understanding and awareness which empowered students to approach their future with more certainty. SRD collaborated and assisted with the program and its growth, now followed by students in both hemisphere's. (Young Persons' Plan For the Planet 2017). Promotion included showing and then forwarding the first of these student plan reports to Christiana Figueres, Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC) 2010-2016, in September 2017 and a copy was hand delivered by an Australian delegate to the UN High-level Political Forum on Sustainable Development and the SDGs in New York 2018.

Examples of Responsible Design solutions. SolarCentury (UK) led by Jeremy Leggett, who also addressed the opening of the youth program mentioned earlier, started a solar revolution for the people of the East Africas, whose days were cut short living without electricity. A solar light that could be recharged by sunlight, which could be as small as the palm of your hand, converts sunlight into electricity and in turn charges small batteries used to power efficient LED lights. This design solution has led to enhanced family and community interactions after dark, improved security for villages with the lights reaching the most vulnerable and has given young African women, with limited access to education, the ability to study at home at night. Since 2006 Africans working for UK Charity SolarAid's (2006) retail brand SunnyMoney have sold more than 2 million solar lights, operating among the poorest of the poor in East Africa, measurably improving the lives of more the 10 million people.

Delving a little further into batteries is an article showing the broad value and advantages of Responsible thinking in practice: Principles for Responsible Battery Management (Keoleian 2021). In keeping with this approach, it is worth noting that this thinking goes far beyond industrial design and into every other form of human endeavour. To name just a few: Environmental Law; Agriculture and Soil carbon

building; Environmental, Social and Governance; Responsible Innovation (Pavie and Carthy 2015) and there are many more.

Society for Responsible Design ongoing research. Interesting data directions are trending from an ongoing online SRD Survey with 45 responses so far from 7 countries (Australia, UK, Canada, Indonesia, USA, Italy and Switzerland). The survey called for responses in 10 key areas of direction for the SRD. Participants were asked for written answers plus rating their position to the statements from 1 to 12. SRD should Promote and demonstrate Responsible Design as the Apex Design Mode to create our sustainable future. **84% agreement**; SRD must focus on methods to accelerate the greener circular economy, grow regenerative design and investing in clean and green super. **81% agreement**; SRD should focus on looking for & developing solutions to the world's big issues. **81% agreement** Select quotes "Climate change, UN SDGs, but start circular design/economy now to get on the road to the solutions."; SRD can just continue to develop as it has for 31 years. **94% agreement**; Without prompting Climate Change was the top reported issue. IPCC (2021). The SRD Survey (2021) continues.

It is encouraging that many sectors from government, corporate (new C02 removal prize, Elon Musk, 2021), education and beyond have all been growing an incredibly valuable discussion on sustainability.

At the Nobel Prize Summit, Dr Jane Lubchenco (2021) spoke about the oceans of the world. She related how massive they are as are their challenges, too big to ignore and not too big to fix. She inspired with multiple ways to address the challenges and confirmed the need for these to be met by us all. In addressing the major global issues, she quoted the words of John W. Gardner, "We are all faced with a series of great opportunities - brilliantly disguised as insoluble problems. This is our challenge to reveal the disguise and embrace the opportunities that we can create."

Table 3. *(Oral presentation Slide 12) Responsible Design lens considerations to create sustainable futures.*

Responsible Design 'lens' considerations to create sustainable futures

Responsible advances	Aspects not covered by most design processes	Really key for developing method & difference	HOW TO
Holistic support	Equally supports all pillars of Society, Economy & Biosphere	Better addresses long-term strategies supporting all nature, economy & society	Rebalancing current priorities
Failure removal steps	Includes all known consequences & works to address them all	Looking for past negative issues & devising strategies to deal with them	Fault finder reviews
Learn, grow & share	Encourages continuous improvement & EBP knowledge sharing	Experiments include new methods by collating & adding shared data	Inclusive growth mantra
Nature stewardship	Regenerative focus to increase number of species & habitat	Aware of natures role in design to increase biodiversity	Create opportunities for life
Reverse engineer climate	Emissions reduction & indigenous knowledge is built into all thinking	Combines global efforts to decarbonise fuels, materials & production processes	Send carbon back to geology
Backcasting issues process	Addresses & Resolves many future problems & current SDGs	Briefs are SDG aware plus long-term sensitive design	Green governance thinking
Kaleidoscopic vision	Considers multiple perspectives to resolve multiple issues	Greater reviews of Macro to Micro reveal new ideas	Pause, rest to reassess
Forward looking	Combines all for clarity of significance & purpose of actions	Designing and curating for our sustainable future today	Leadership & role sharing

12

the more that are included, the closer to creating sustainable futures

As identified, the Responsible Design method incorporates all available input to create the most appropriate and dynamic results. Continuous updates and innovation of ideas, processes and principles are expected for framing comprehensive solutions. Practicing this over-arching mode also requires examination of the points of bias adopted by everyone in approaching design solutions and all they encompass.

To counter challenging world issues, attention to the full purpose of Responsible Design by everyone is now needed. While we have shown the Responsible Design method, it is acknowledged more capable teams are also needed to be assembled to assess, review and maximise these efforts to achieve this goal. Application of essential criteria for Responsible outcomes as listed in Table 3 can make significant inroads to achieving this to the scale required. The more that are included, the closer the results will be to creating more sustainable solutions. Your positive action and feedback is welcomed via the emails at the start of the paper, we seek the global collective to inspire.

4. Conclusions

Our analysis shows employing the Apex Design Mode using a Responsible lens will achieve greater progress to address all wicked problems. You don't need to be a designer to participate in this process. Indeed, the greater selection of people that participate the broader, more robust and useful the result. Many of these ideas, concepts and practices may not even be found in some examples of the traditional design disciplines. They need to be.

Responsible Thinking is universally beneficial, and the Design component is simply a more creative version of it. When we share these concepts, we can build a much greater resource than by ourselves. And by ensuring that the world also shares the information, ideas and innovations it is demonstrably going to benefit the people and species of the world. Further ensuring this process transforms to the point that we are practicing all we need, to make circular economies a reality full of regenerative practices that work to repair our world.

Wider inclusion of Responsible Design will result in greater progress to sustainability in the real world with greater benefit to all the SDGs and their targets from moderate to significant levels. By providing more focus on the directions to get everyone there faster and with longer lasting resulting benefits, responsible design thinking combined with developing Ecological Best Practice will significantly accelerate progress towards resolving the crises we face. This is particularly so for SDG+Target #11.3 and even more for SDG+Target #12.8 where responsible action can further positive results.

Wake from our pre-crisis dreams, RESPECT past wisdom, embrace the CRISES of today and Responsibly Design our sustainable future, Together.

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NB. Higher resolution graphics are available if requested.

Environmental design of outdoor sensors

Foundation of intelligent building management and settlement management systems and services

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Abstract

Nowadays, it is becoming increasingly important to measure environmental impacts in terms of energy efficiency and quality of life as well. We have developed an outdoor, low-cost environmental sensor that measures airborne dust concentrate and other air parameters. Our goal is to perform high-resolution measurements based on hundreds of metering devices to achieve full urban coverage. Using the data measured and collected by the sensors, our second goal is to establish the intelligent building management and settlement management systems and services. As the planned system will consist of hundreds of nodes, its environmental impact and durability cannot be neglected either. Therefore, environmental planning is of paramount importance to us during development. When developing sensors, it is advisable to focus on the most important factors in ecological design. During the life cycle analysis, the combined environmental impact of the nodes and the network itself must be examined.

Keywords: sensor network, green computing, air quality, LCA, eco design

1. Introduction

As part of a joint project between ÉMI Non-profit Llc. and the University of Miskolc, we created a low-cost sensor prototype that is suitable for measuring many air quality parameters and other parameters (VOC - Volatile Organic Compound, temperature, humidity, carbon dioxide, oxygen, brightness, air pressure). The created prototype is under constant development and testing.

Our ultimate goal is to develop and establish a model that can lead to implement a hardware/software system that consists of up to hundreds of sensors for the control, data collection, processing, monitoring, and settlement system integration of technologies pre-embedded in sensor-integrated finished components. The procedure and the system model to be created, can offer more efficient, sustainable operation; they can even make decisions and interventions.

One of the key tasks of the project is to perform high-resolution measurements based on hundreds of self-designed air quality measuring devices to achieve full urban coverage and full coverage within public buildings.

Using the data measured and collected by the sensors, with different interpolation methods an anomaly map will be created (see Fig. 1), that represents the current measured values and will be freely available to everyone. The measured data helps the Sustainable Development Goals *SDG11 - sustainable cities and communities* and *SDG3 - good health and well-being* goals.

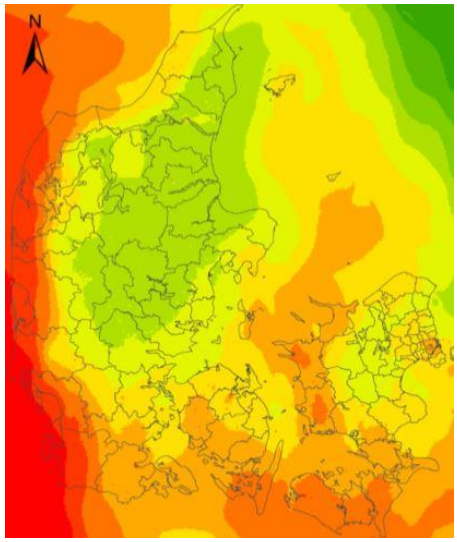

***Figure 1**. Modelling the distribution of atmospheric pollutants*

Environmentally friendly design and implementation are of paramount importance in the design of measuring instruments and the development of the entire connected network. We have kept this approach in mind not only in terms of hardware, but also in software development, network design and deployment. We have focused on the most important factors in ecological design. However, the environmental assessment of ICT (Information and Communication Technology) infrastructures still face methodological shortcomings. Bonvoisin et al. (2012) aim to identify current uncertainties in environmental assessment and suggest solutions to overcome them in the case of WSN (Wireless sensor network). To this end, in the first part of their study, they review the existing literature on environmental assessment of ICT infrastructures and the related methodological problems and solutions.

Interesting studies can be read on the primary environmental impacts of each ICT infrastructure and service, using methods such as embodied energy and life cycle impact assessment (LCA). All of these studies analysed environmental impacts in detail, which helped identify “hot spots” and provided useful information for eco-design. However, as Andrae and Andersen (2010) also observed, there is a problem with the distribution and unavailability of existing in-depth environmental data for environmental studies. The ICT sector does not have the necessary transparency. Therefore, inconsistencies cannot be easily understood and cannot lead to a better scientific understanding of the environmental impacts of

ICT. Reimann observed that the larger the perimeter of the system under study in LCA, the weaker its definition (Reimann et al., 2010). Some have tried to expand the range of methods available to allow environmental impact assessments for large systems such as ICT infrastructures. One such method is hybrid LCA, which successfully eliminates large data gaps and abstraction (Loerincik, 2006), but does not in itself contribute more to transparency. As the environmental assessment of ICT infrastructures has already shown interesting results, further research is needed on the system-wide description of infrastructures. The analyses still need to be improved in terms of clarity and transparency, and models are needed to improve formalization. This, in turn, would allow the results of environmental assessment to be used more effectively in planning. When calculating the environmental impact of a network, the life cycle of all components and synergistic effects must also be taken into account. During the life cycle analysis, the combined environmental impact of the nodes and the network itself must be examined. Preprocessing sensor data is also a crucial step as part of data preparation for further processing. The procedure helps to get clearer data with less noise, it is nevertheless important to consider embeddability of such devices so that production costs could be reduced (Bouzid et al, 2020).

2. Methods

An important question in a research and development project is how can we balance environmentally friendly solutions between cost-effectiveness and longevity? Even in everyday life, we often find that environmentally friendly solutions are often more costly and can be used for a shorter lifetime, but there are also cases where cost-effective solutions are combined with very short lifespan and poor materials, making it difficult to find a balance between these three factors. The outdoor sensor prototype shown in Fig. 2 has been operating in Miskolc-Martinkertváros (Hungary) for more than 1 year. During the design and development, we paid special attention to certain aspects of the implementation, such as software development, network design, raw material use, maintenance, fault detection, etc.

Figure 2*. Outdoor sensor prototype at Miskolc-Martinkertváros*

2.1 Software and network design

During the prototype development, the software implementation was not only examined in terms of stable robust operation, but also the effect of the devices on energy consumption was taken into account. In a previous article, Márton L. Kiss (2018) described the differences in energy consumption generated during the development by different software implementations of the metering system, so we tried to apply software solutions that provide low energy consumption, keeping in mind the green computing guidelines. Of course, real-time data must be provided, as this is one of the basic conditions for integration into facility management systems.

Because green computing is the environmentally responsible and eco-friendly use of computers and their resources also main goal, therefore, we sought a solution where the sensors could connect to an existing built-in wireless network. Our choice fell on the LoRaWAN protocol specification based on LoRa technology developed by the LoRa Alliance. It uses non-licensed radio spectrum in the industrial, scientific and medical (ISM) bands to allow low-power, wide-ranging communication between endpoints and gateways connected to the network (Basford et al. 2020). This standards-based approach to building LPWAN (Low-Power Wide Area Network) allows for the immediate setup of public or private IoT (Internet of Things) networks anywhere with hardware and software with bidirectional secure mobile devices. One of the most important features of LoRaWAN networks is that it uses an unlicensed frequency (ISM), where two frequencies can be chosen, which are 868 MHz and 433 MHz in euros. The European Union approved LoRaWAN power is 25mW and the bandwidth is 125 kHz or 250 kHz may such a network is capable of data transmission from a distance of 10-15 km. Depending on the terrain and obstacles, the transmission rate varies between 292 and 10,937 bits/s as a function of distance. It uses asymmetric traffic and 128-bit AES encryption. It is not necessary to use a two-way connection and is resistant to interference. Devices do not need to be synchronized to the network and their signal is received by multiple base stations, thus operating in robust operation. The LoRa Alliance has developed the LoRaWAN protocol specification this is a nonprofit alliance with open members. Industry leaders have launched it with the goal of standardizing low-power area-based networks (LPWANs) worldwide. This enables the development of IoT systems and devices and machine-to-machine (M2M) communication. Starting smart cities and industrial applications for development. Alliance members are working together to create the global success of the LoRa Protocol (LoRaWAN), sharing knowledge and experience to ensure interoperability between operators in an open global standard. The standard is independent of the manufacturer, widely accepted and has a large number of supporters. Many people manufacture LoRaWAN equipment all over the world. Currently, the two basic specifications are LoRaWAN 1.0 and 1.1. The 1.0 specification can break down a network into a network server (NS-Network Server), be able to connect to a server (JS-Join Server) and an application server (AS-Application Server).

These solutions not only promote low power consumption, but also efficient maintenance by minimizing on-site service, because during the development, based on our experience, we solved the detection of possible system faults and restarted the system remotely and also provided remote access. As the entire system will include not only outdoor but also indoor sensors and each sensor may have different constructions, a common universal database structure has been developed and the display will be implemented on the Node-Red platform. Node-RED provides a browser-based flow editor that makes it easy to wire together flows using the wide range of nodes. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click. The advantage of the development environment is that it is modular, flexible and does not require more hardware resources (Lu et al. 2020).

The block diagram of the sensor network on Fig. 3 illustrates the structure of the system. The sensors communicate with the LoRa Gateway via LoRa, which communicates via Ethernet with the LoRaWAN Network Server, which communicates with our proprietary University Application Server, and where the data is saved and displayed.

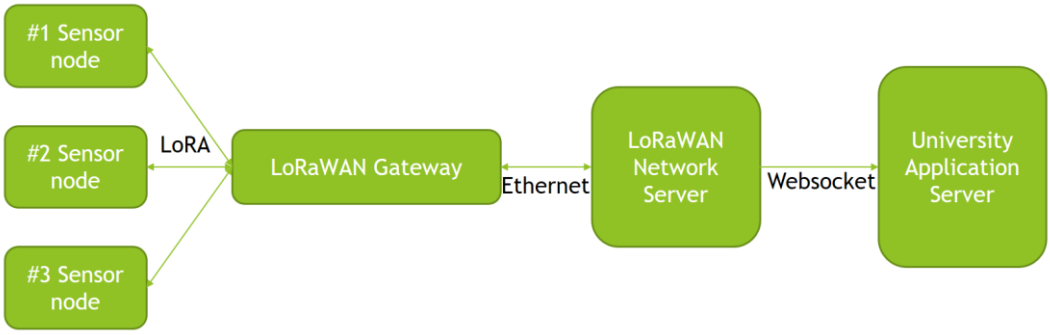

Figure 3. Block diagram of the sensor network

2.2 Hardware design

The developed sensor package consists of 3 main hardware units. 4 pieces of this device were installed in Miskolc – Martinkertváros. In terms of building the entire system, there is a Module 4, the data processing and display server itself.

- Sensor module: this unit includes sensors for measuring various parameters, surrounded by an ABS-based housing made with self-designed 3D printed technology. When designing the cover, we had to take into account the weather conditions and ensure the permeability of the air inside the cover, otherwise false data would have been recorded. There are also two sensors in the house, a temperature and humidity meter and a sensor for measuring PM10 particulate matter. The box was manufactured locally on our own 3D printer, and the material was also obtained from a filament manufacturer in Miskolc. The sensor module is connected to the data processing and communication unit via a 7-wire cable, on which the supply voltage required for the sensors and the sensor interface cables run.

- Data acquisition and transmission module: The task of the data processing and communication module is for the sensors placed in the sensor module to read their data via the appropriate interface and to transmit it to the network server on the LoRaWAN network. The custom-designed PCB was in an IP67-protected mounting box placed with antenna to provide wireless communication. It was important to design our own PCB because it allowed us to integrate many functions into one, for which separate modules would have to be purchased from European distributors. In this way, we were able to manufacture the printed circuit board with a manufacturer operating within 100 km and we also bought its components from Hungarian suppliers. This unit is responsible for collecting and transmitting the data measured by the sensors and, in the event of an error, sending the corresponding error message.

- Power supply: The power supply is a 230V AC / 12V DC adapter that supplies power to the device. The power supply is needed to ensure continuous operation of the device. The use of the solar cell has also occurred, but the electrical power of the built-in sensors is too high to ensure continuous operation without installing a larger amount of batteries.

3. Sensor life cycle analysis

During the development, a sensor life cycle analysis (LCA) was performed. The analysis was performed according to ISO 14040, from assembly to end of life and it was performed manually, based on the characteristic factors of the components according to the CML 2001, focusing mainly on the greenhouse effect, but other important impact categories (ADP, AP, EP, HTTP) was also examined.

Using the databases of GaBi and SimaPro software, the following impact categories can be examined to assess the environmental impact of the sensor using the CML 2001 and ReCiPe methods and the PEF/EF method adopted by the European Union in 2018. The characteristic factors are used from the database, which can be aggregated by correcting with the normalization and weighting factors according to the PEF/PE methodology and obtaining the results in environmental load points.

According to the ISO 14040 and ISO 14044[1] standards an LCA shall include the following phases:

- **goal and scope definition**,
- **inventory analysis**, when resources consumptions and emissions of the life cycle are quantified,
- **impact assessment**, when potential environmental impacts due to resource consumptions and emissions are assessed,
- **interpretation** of results.

The connection of these phases can be seen in the following figure of the ISO 14040 standard.

[1] ISO 14040/14044 (2006): Environmental management — Life cycle assessment — Principles and framework / Requirements and guidelines

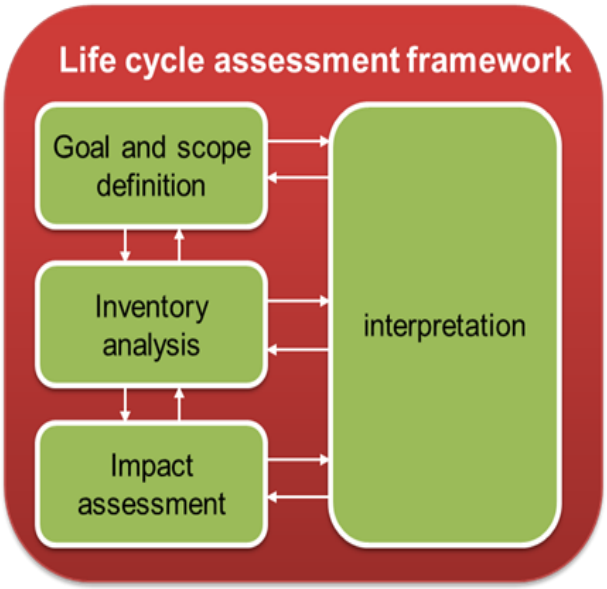

***Figure 4**. Methodological steps according to ISO 14040*

The goal of the assessment is to determine the environmental load of one sensor, during a year. The *Function unit*: Environmental impact of 1 sensor under 1 year.

The system boundary covers the production, consumption and end-of-life phases, but the production phase includes the procurement related to the procurement and the previous environmental impact of the parts to be installed. The life of the sensor was determined at the following points, which form the backbone of the studies.

The next step was the inventory preparation, data collection and the inventory analysis. Measured data was used, allocation was not applied.

***Table 1.** Sensor components*

Sensor components	Mass (gramme)
Sn	7,8
Other metal	15
Epoxi	14,5
Cooper	187,9
Steel	296
Fermit	12
ABS	219,8
kaucsuk	2
microchip	4,6
PLA	180
PVC	447
Hot-melt	80
Rubber	50
Total	**1516,6**

Acquisition distance: 6831 km; 231 g, Control distance: 10 km in 12 cases. Waste treatment: incineration, 881 g but 187.9 g Cooper recycled, and 447 g PVC reused in two times,

- Characteristic factors used to assessments
- Defining midpoint indicators:
    - for sensor components,
    - for the sensor life cycle,
    - for alternative scenarios:
        - for different sensor boxes,
        - different mode of transport,
        - renewable energy.
- Investigation of the possibility of carbon neutralization by afforestation.

Table 2. *Characteristic factors (CML 2001)*

	GWP	ADP	AP	EP	HTTP
Sn	20,6	0,315	0,542	0,170647	HTTP
Other metal	3,18	0,0177	0,0199	0,002371	36,31747
Epoxy	8,05	0,0681	0,0214	0,003429	4,099038
Cooper	0,787	0,00488	0,00352	0,000359	0,456291
Steel	1,63	0,0113	0,00833	0,00156	0,033034
Fermit	3,41	0,0477	0,00832	0,000743	0,033034
ABS	3,74	0,0451	0,0124	0,001579	1,393727
kaucsuk	3,11	0,05	0,0471	0,001203	0,104363
micrchip	0,269	0,00186	0,00196	2,494595	0,216929
PLA	3,11	0,0221	0,0116	0,011381	6,23E-06
PVC	2,83	0,0348	0,0198	0,001447	0,78657
Hot-melt	1,31	0,0372	0,037	0,000501	0,583863
Rubber	2,64	0,0383	0,0108	0,003664	0,456291
aircraft	0,062	0,000403	0,000257	0,000791	0,940736
control	0,182	0,00124	0,000555	0,00014	0,066384
use kg/hour	5,20E-06	3,72E-07	3,44E-08	3,71E-08	6,23E-06

The manufacturing phase of the sensor, which involved the assembly of the components of each sensor module. The following were examined:

- the environmental impact of components performing the same function,
- the impact of procurement distances,
- the impact of procurement-related modes of transport,
- service life of parts,
- safety, service life and environmental impact of the sensor box material.

Usage section covered the following:

- energy consumption (if possible renewable energy, use of solar panels),
- maintenance,
- control (logistics planning, choice of means of transport),
- data processing.

The environmental impact of the end of life is affected by what happens to each component. After disassembly selection according to

- can be reused in its material,
- suitable for energy purposes,
- can be disposed of by incineration,
- will be deposited.

We examined that

- how the environmental impact per component develops,
- how the environmental load of each life stage changes, which phase represents the greatest load,
- how to reduce the environmental impact was examined.

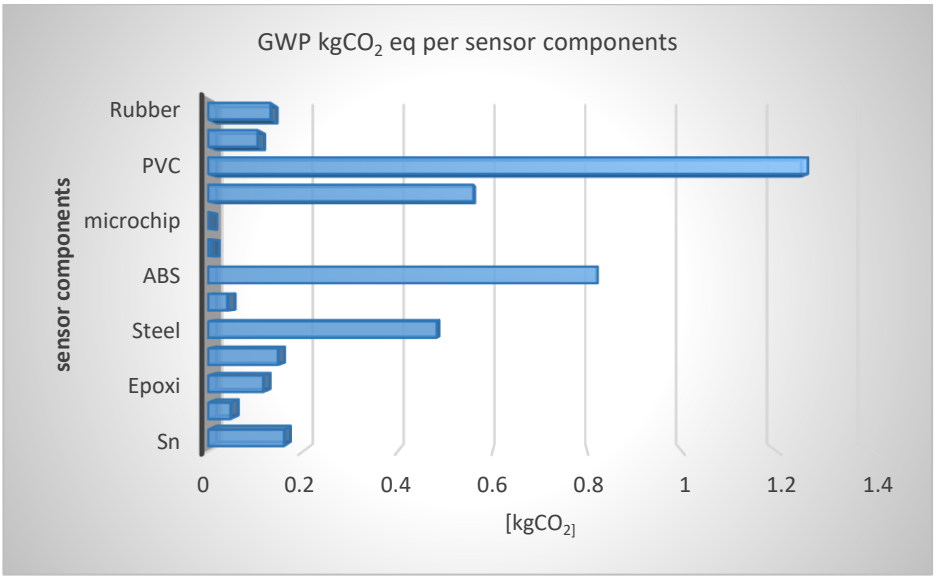

Figure 5*. GWP per sensor component*

Fig. 5. shows the GWP - Global warming potential values according to the material level composition of 1 sensor unit. The biggest greenhouse effects were PVC and ABS, followed by PLA and steel. These materials occur primarily in enclosures and protective insulation.

The situation is similar also in the other categories, the PVC and PLA have the biggest effect on the environment.

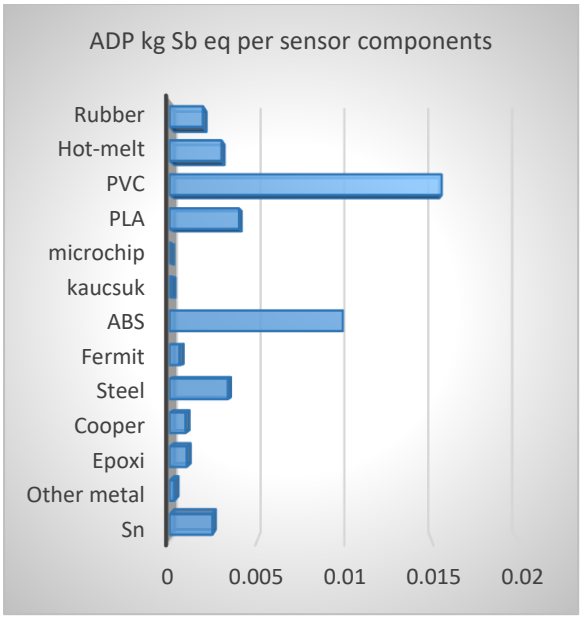

Figure 6. *ADP kg Sb eq per sensor components*

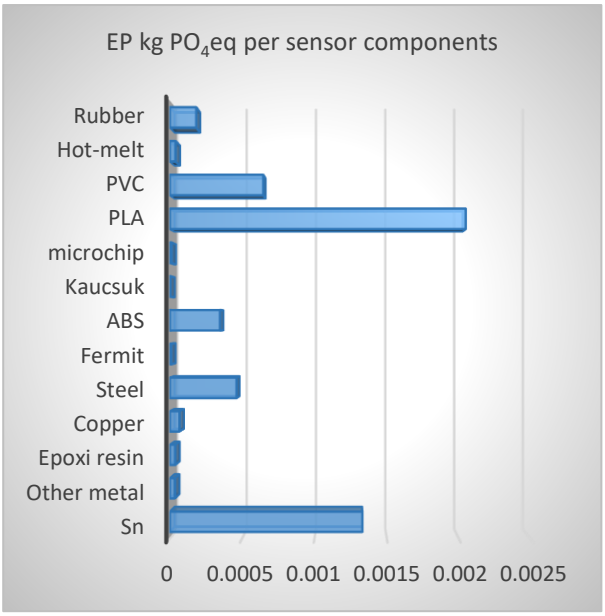

Figure 7. *EP kg PO₄eq per sensor components*

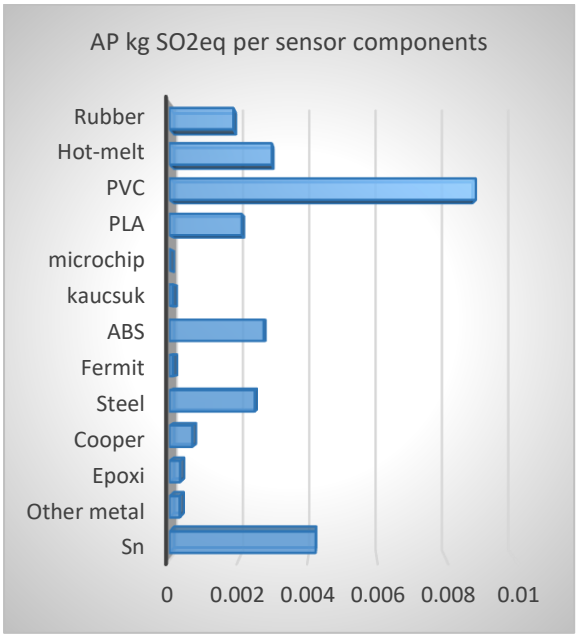

Figure 8. *AP kg SO2eq per sensor components*

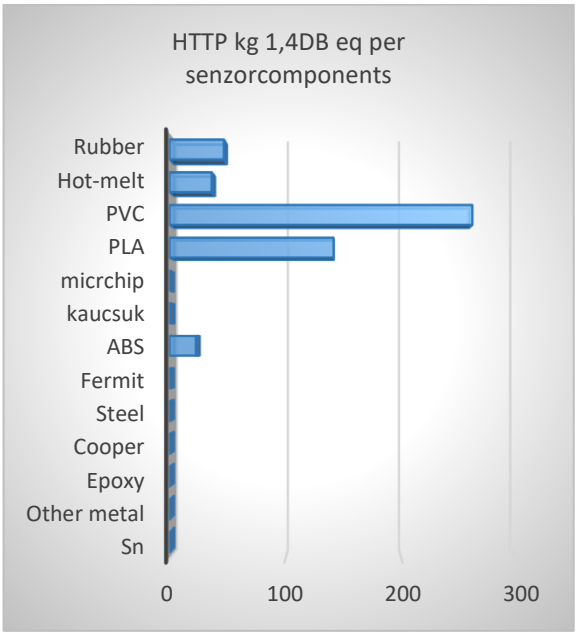

Figure 9. *HTTP kg 1,4DB eq per sensor components*

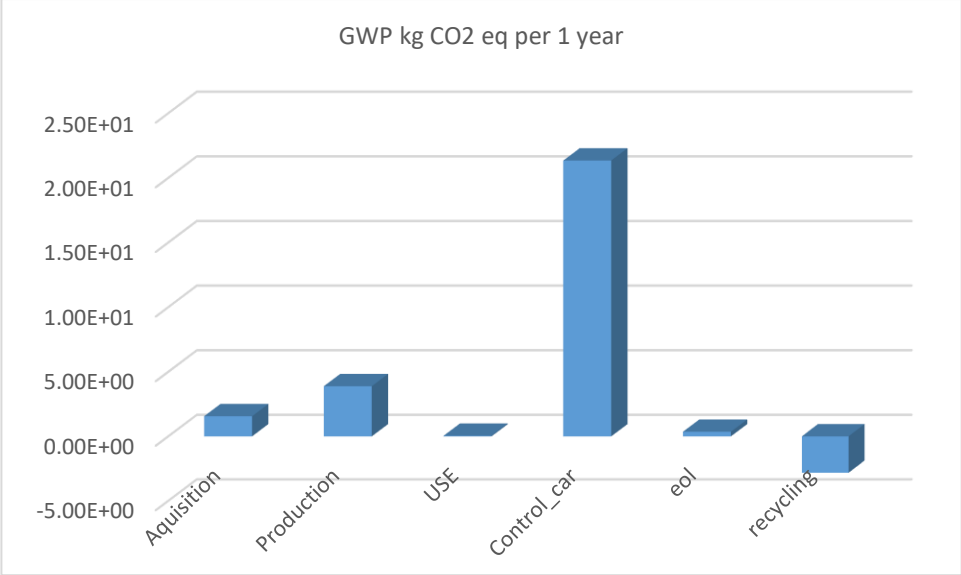

***Figure 10**. GWP value of the sensor 1-year life cycle (kg CO2e)*

The picture is the same in case of the other categories.

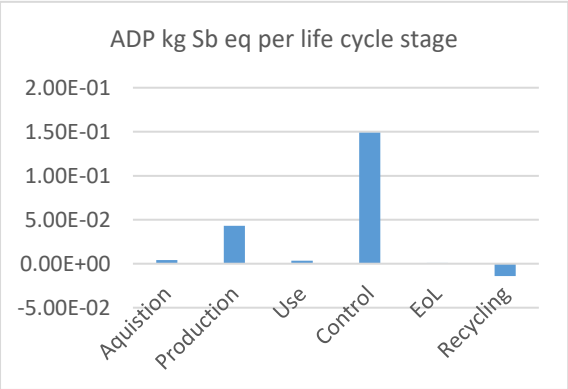

***Figure 11.** ADP kg Sb eq per life cycle stage*

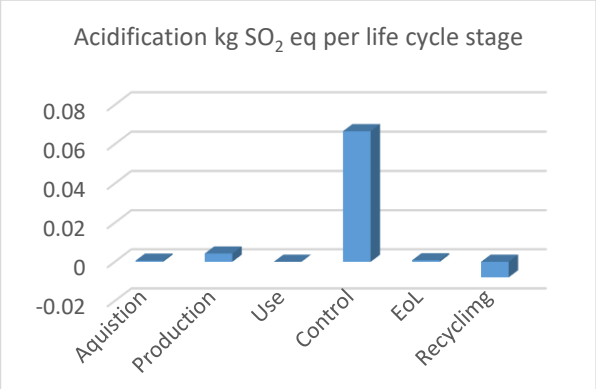

***Figure 12.** AP kg SO_2 eq per life cycle stage*

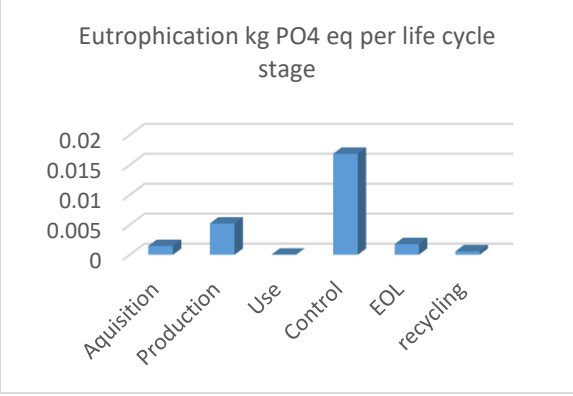

***Figure 13**. EP kg PO4 eq per life cycle stage*

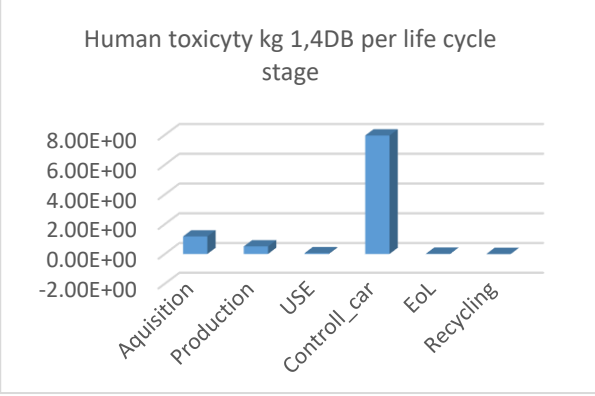

***Figure 14.** HT kg 1,4DB per life cycle stage*

By connecting several sensors (20) to the system, the environmental impact of this control is reduced as shown in Fig. 15. Depending on the level of use of the planned system (building or town level), it can have up to a 100 node.

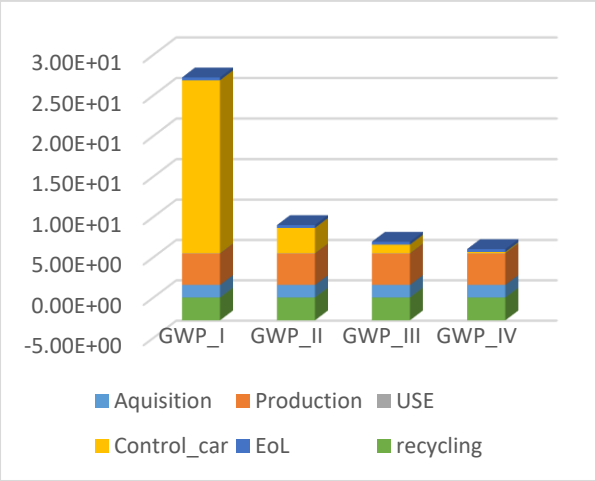

Figure 15. *GWP kg CO2 of different scenarios*

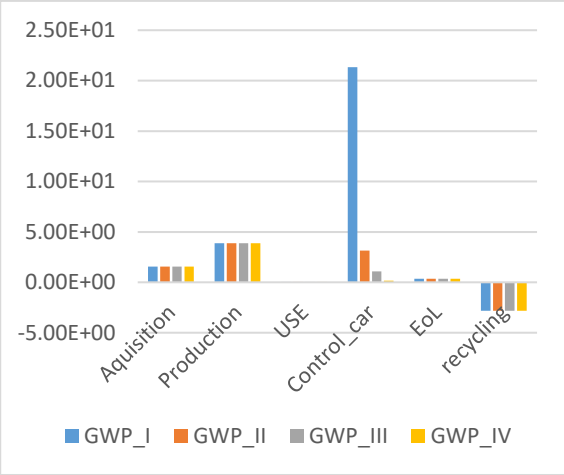

Figure 16. *GWP in life cycle stage of scenarios*

I: control by car, II: control by bicycle; III:20 item, control by car; IV: 20 item control by bicycle

The weighted category values (it based on the EU environmental footprint factors[2]) show the relative contribution to the environmental loads.

It can be seen that 96% of the environmental load comes from greenhouse gases, and this is caused by inspections and repairs that occur in the use phase within the life cycle. So rightly, the question arises as to how to reduce it.

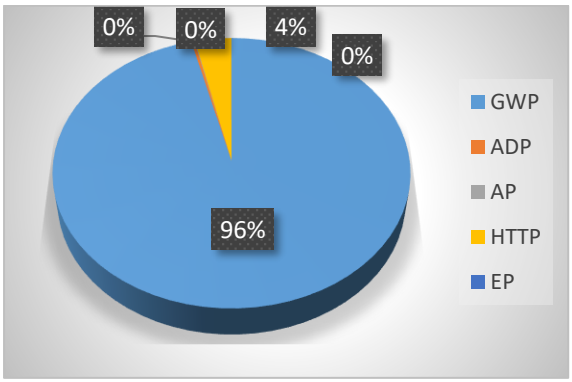

Figure 17. *Relative contribution by car*

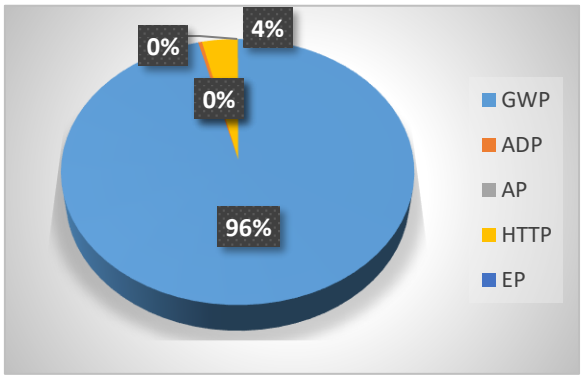

Figure 18. *Relative contribution by bicycle*

[2] JRC (2018): Development of a weighting approach for the Environmental Footprint, Technical Report https://ec.europa.eu/environment/eussd/smgp/documents/2018_JRC_Weighting_EF.pdf

4. Results and Discussion

Based on the results of the life cycle analysis, there are three key points of the system to be built:

- maintenance/depreciation,

- the choice of cover and protective insulation material, which make up the bulk of the device, as it has to withstand a large temperature range on an annual basis due to climatic characteristics and ensure that the sensors can measure real value,

- recycling of components.

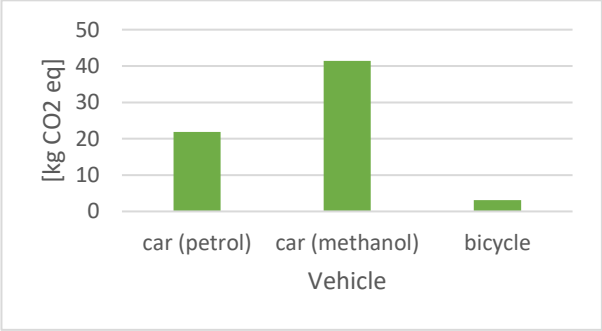

Figure 19. *Control greenhouse effect*

Regarding the issue of installation and maintenance tasks the choice of vehicle used for the inspection also has an impact on the environmental impact. Fig. 19 shows that in the case of bicycles, the environmental load was taken into account in pizza equivalent (the environmental impact of 12 cycling inspections is equal to 12 pizzas).

Due to the cladding and insulation, we examined several raw material alternatives, the comparison of which is shown in Fig. 20.

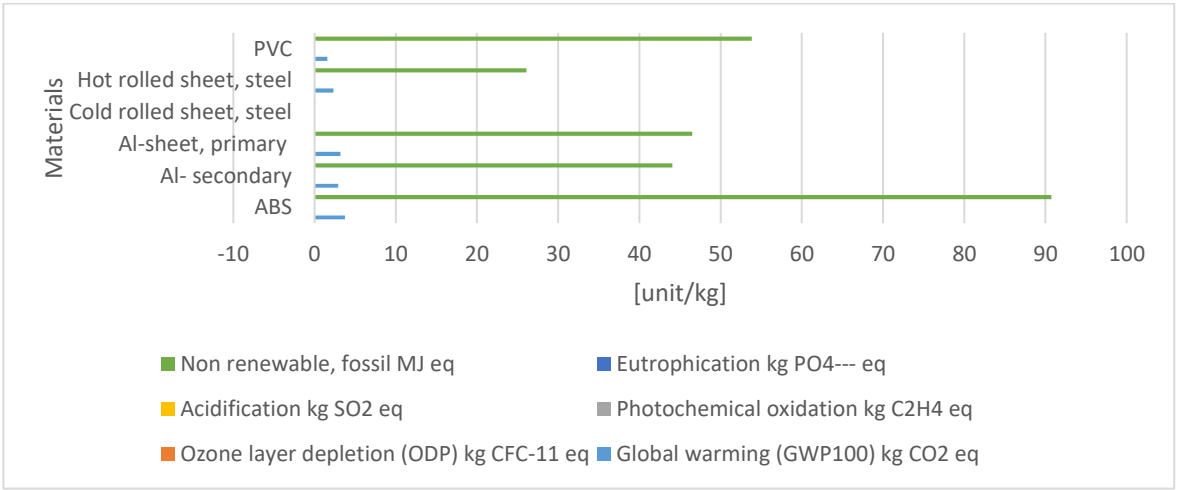

Figure 20. *Potential box constituents environmental impact*

Based on the value of possible materials per unit mass, the load of ABS and PVC is outstandingly high. However, considering the quantities of actual material used for the box, the environmental impact of PVC is the lowest. Fig.21 shows the GWP value of a box made of a given material.

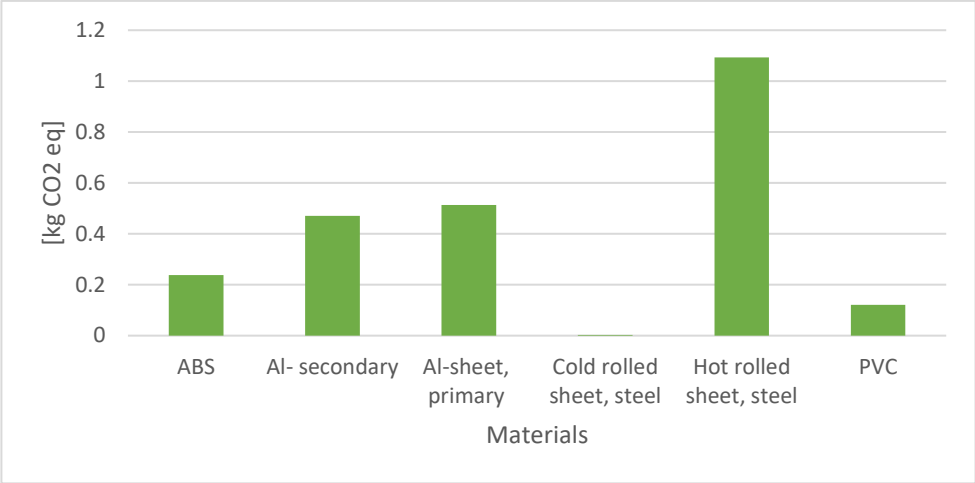

Figure 21. *10 cm edge length 1 mm thick box GWP kg CO2 eq*

CO2 offsetting through tree planting has arisen. In our case, the one-year operation of 1 sensor emits 24.4 kg of CO2 and 6.1 kg when using a bicycle. If 1 cubic meter of leaf area is able to sequester 590 grams of CO2 during a growing season (Radó 2001), a minimum of 10 and a maximum of 41 mature trees would be required. The sensor units are currently powered by mains power, but we are also planning solar operation. In this case, we also need to examine the environmental impact of the design and how reliable it is to operate in this case, as this is an important criterion for facility management systems.

5. Conclusions

During the development of the prototype of the low-cost sensor suitable for measuring air quality and other parameters and the development of the system, we sought to design and implement it from an environmental point of view in several respects. We have sought to strike a balance between environmentally friendly solutions and cost-effectiveness. The life cycle analyses performed have shown that the three cornerstones of our planned system are maintenance, the choice of the coating material that makes up the bulk of the device, and recycling. Based on the test results, the cover of the prototype is reworked both formally and in terms of material use. We strive to use less material while maintaining the expected conditions. We develop a maintenance process that minimizes its greenhouse effect. When selecting new materials, we take into account the possibilities of recycling and develop a methodology on the basis of which it is possible to classify which elements of the system are suitable for re-installation or calibration and which can no longer perform their function. In the business model of the system, we examine how and to what extent we can reduce the ecological footprint and CO2 emissions by planting trees.

Acknowledgment

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Frugality as a lever for sustainable design: a case on food aid distribution

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Abstract

To meet the unmet or underserved needs of people living in poverty, several programmes have been developed by governmental, academic, non-governmental and civil institutions. Various movements focused on sustainability and poverty reduction have generated a variety of concepts related to the creation of social well-being, as well as innovative technologies, in different areas and at different scales. Within this context, frugal innovation (FI) has been positioned in the literature as an essential element for the creation and promotion of social and economic sustainability through the improvement and generation of technological solutions, particularly those aimed at meeting the needs of the people at the base of the Pyramid. Due to its recent emergence, studies on frugal innovation are scattered across different disciplines. From the engineering perspective, frugal innovation has been largely oriented towards identifying criteria and attributes related to functionality, cost and optimization in product and process development. However, it has not been made explicit how to accurately integrate this innovation approach during the design process. In this study, we present a proposal for the operationalization of frugal innovation during the design and development of a technological solution. Within the Latin American context, Mexico is a country with constant economic growth. However, the country faces a series of challenges related to poverty and social inequalities in multiple dimensions. Nearly 52 million people live in poverty and their income is not enough to access the basic food basket. In this context and with the collaboration of a local food bank in Mexico, the idea of applying technological innovation to address the problem of food aid distribution arose. For the development of the solution, the Pahl&Beitz's design methodology applied in Mechatronic engineering was used as a framework for the integration of frugal criteria. These criteria were mainly implemented at decision-making points, particularly in the early stages related to the definition of system functions and the selection of its components. The implementation of these criteria allowed to obtain a virtual-experimental prototype that fulfils the main function of distributing and storing food. The main result

of this design case was the reduction of manufacturing cost by about 87% compared to similar machines in the international market. This proposal represents a social innovation (helping to distribute food aid) through a technological solution (a machine), since, until now, there are no similar projects in the Mexican context. The results of this study contribute to the literature on frugal innovation and design for the Base of the Pyramid from an engineering perspective, particularly in the way to implement the criteria associated with this innovation approach.

Keywords: frugal innovation, mechatronics, sustainability, design methods

1. Introduction

Currently, Mexico lives a situation where people's incomes are not sufficient to cover their basic needs. Approximately 24.6 million Mexicans live in food poverty and not have the possibility to buy products of the basic food basket (CONEVAL, 2018). Besides this, there is an ecological problem about plastic waste. According to the Mexican Chamber of Deputies (Diputados, 2017), every year, 90 million plastic bottles are thrown into public roads, rivers and seas. In working with a food bank in Mexico City, arose the idea of applying technological innovation to deal with these problems. By analysing the technical, social and environmental problems from the theoretical approach known as "design for the Bottom of the Pyramid BoP" (Prahalad, 2005), we propose the prototyping of a machine that fulfils two main functions, the distribution of food and the recovery of plastic and aluminium packaging. Our proposal represents a social innovation through a technological application, since until now; there are no similar projects to deal with these problems in the national territory. This proposal is consistent with the studies of Seyfang and Smith (2007), who argue that movements towards sustainability are generating a variety of social innovations, as well as innovative technologies, in different fields. Some authors have identified these movements under the name of Frugal Innovation (FI). Khan (2016) argue that the FI approach have the potential to create social sustainability through the improvement of technological solutions.

As an emerging discipline, frugal innovation has been mostly understood as a set of criteria that, if properly implemented, generate innovative solutions to the needs of the BoP (López Santiago *et al.*, 2019). However, it is still necessary to make more explicit the way in which these criteria are integrated during the development of a solution. In this article, we present a proposition for the integration of frugal innovation criteria in a classic design process in mechatronic engineering. We have taken the social and environmental problems of Mexico City as a design problem for our case study. Frugal innovation criteria were applied to improve the prototype, optimize the use of the employed resources and decision-making process. As a result, a real prototype has been developed. The implementation of the frugal innovation criteria allowed a reduction of approximately 87% in manufacturing costs compared to machines available in the international market. This project seeks to create social value through the application of technological development and to show that, through frugal innovation,

technological solutions can be successful in meeting the essential needs of the population in developing countries.

2. Needs satisfaction in BoP Contexts

Mexico is not the only country affected by poverty. In 2015 it has been estimated that about 46 percent of the world's population lives on less than 5.5 dollars per day and struggles to meet their basic needs (World Bank, 2018). Prahalad (2005) introduces the term "Bottom of the Pyramid (BoP)" to refer to this population and suggests a potential profitable market if products and services are developed to improve the quality of life in these contexts. However, transforming the poor into consumers does not solve the problem, it can even exacerbate it (Karnani, 2009; Pansera, 2013). In the other hand, BoP initiatives carried out by local actors seems to be more convenient, successful and resilient (Pansera, 2013). In the Mexican context, López Salazar (2015) describes food poverty as a phenomenon highly associated with the lack and inadequacy of income, especially the most vulnerable strata of the population. Local data shows that 45.5% of Mexicans live in poverty and 23.3% suffer from food poverty (The Hunger Project Mexico, 2016). Despite the existence of food assistance programs, the integration of technological initiatives is still required.

2.1. Frugal innovation in developing countries

Although most BoP studies are based on the market approach, meeting business development needs involves design activities. (Jagtap et al., 2014). From Prahalad's (2005) proposals, numerous approaches to innovation for developing countries has been developed. The literature suggests that innovation in developing counties can occur as process of frugal re-engineering of pre-existing technology (Radjou, Prabhu and Ahuja, 2012). This notion of frugal innovation can be viewed as an approach towards realizing social sustainability and fulfilling the United Nations' Sustainable Development Goals (Khan, 2016). Frugal Innovation approach has allowed the development of solutions in different sectors (Transport, Healthcare, Water, Bank, Energy, etc.) in formal and informal markets (Levänen et al., 2016; Hossain, 2017; Rosca, Reedy and Bendul, 2018). Frugal innovation has attracted the attention of researchers from different disciplines, as this approach is multi-faceted. According to Tiwari, Kalogerakis and Herstatt (2016), engineering sciences conform a discipline which shows a connection to frugal innovation where, in many cases, integrating frugality leads to achieve affordable excellence.

Pisoni, Michelini and Martignoni (2018) identify the different ecosystems where frugal innovations can be developed, a particularly interesting one is at the grassroots level. At grassroots, frugality is understood as minimizing the use of materials and energy. Products are more socially accepted since they are tailored to the specific requirements and needs of users (Pansera and Sarkar, 2016). In this ecosystem, innovators are part of the community where innovation is integrated. Sometimes, some external people and organizations (designers, engineers, NGOs, etc.) participate in collaborative design

activities (Smith, Fressoli and Thomas, 2014). In this context, frugal innovation in developing countries seems to be an interesting inclusive approach to the development of products and services aimed at solving real needs, in a collaborative manner, that is, including engineers, designers, associations, universities, etc.

2.2. Reverse vending as a technological initiative for environmental sustainability

In addition to poverty, Mexico faces an environmental problem linked to the high waste of packaging. In Mexico, recycling continues to be part of the strategies for waste management. However, it is estimated that only 50.4% of PET waste is recycled (Diputados, 2017). In addition, there is a high national consumption of aluminum cans of approximately 317 thousand tons per year (Treviño Aguado, 2012) (Treviño Aguado, 2012). According to Gaur, Mathuria and Priyadarshini (2018), many consumers do not recycle their waste as they are not motivated to do so. Reverse vending is an innovative concept that has been introduced in European and Asian countries in order to help collect recyclable materials, enhance recycling activities and improve waste management (Almeda Terrazas et al., 2018). A RVM will work by taking recycled waste inside the machine and gratify with something as a token of appreciation. In mechatronics, A RVM can be defined as a device that offers a certain commercial product for a given monetary value (Del Hierro Calvachi et al., 2013). Various educational sectors are working with RVM projects around the world in areas that require quick, innovative and efficient actions (Almeda Terrazas et al., 2018). The empirical works of Dace, Pakere and Blumberga (2013) show that this type of system positively influences users, giving them a motivation to take care of the environment through recycling. RVM approach could promote a type of fair trade in which poor people who work collecting packaging waste can benefit in some way (REAS, 2016). However, the overall benefits must also be weighed against the cost of developing such systems.

3. Integrating frugality in design

Engineering design is a discipline with a long tradition in developing design models (Kannengiesser and Gero, 2015). However, there are still few contributions on the integration of frugal innovation in this discipline (Lecomte, 2015). In this section, we will describe the research approach that was carried out to explore the integration of frugal innovation into the design process.

Frugal innovation is a global process, that is, it is necessary to consider the entire life cycle of the product. The idea is design taking into consideration the necessary means (materials, energy, process) to achieve a fair and adequate product adapted to the specifications defined by users (Rohmer, Merabtine and Bouzidi, 2017). Since this study has been carried out from the perspective of engineering and mechatronics design (Bradley et al., 1991; Pahl and Beitz, 2005), we propose to explore the technical aspects of integrating frugality criteria into a standard design process.

Our research approach includes three main stages (Figure 1). In the first stage, we focus on understanding how frugal innovation can be integrated into the design of a product. For this, we carried out a bibliographic analysis considering recent articles on frugal innovation and engineering. Once the articles have been identified, we select those that present frugality criteria with technical orientation and applicable at a product level. For the second stage, classical engineering design methods were considered for the functional analysis of the prototype. The systematic design approach proposed by Pahl and Beitz (2005) was selected due to its good positioning in the engineering discipline. Special attention was paid to the first three stages of the Pahl and Beitz's methodology (task clarification, conceptual design, and embodiment design).Finally, the selected frugal innovation criteria were applied as strategies to improve the prototype during decision-making in the design process, particularly in the selection of materials and electromechanical components.

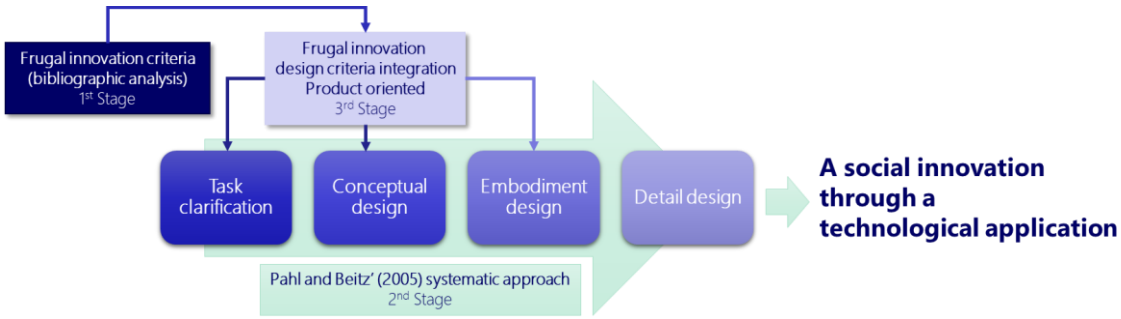

Figure 1. *Research approach proposed*

This research approach was followed for the development of the case study described in the next section.

4. Case study, prototyping a food reverse vending machine

In working with "*Alimento Para Todos* I.A.P", a food bank in Mexico arose the idea of applying technological innovation to deal with food poverty in Mexico City. Under this context, the design and development of a prototype of food Reverse Vending Machine (fRVM) was proposed. This system dispenses food in exchange of PET bottles and aluminum cans (waste packaging). The objective is to facilitate the distribution of food to people with limited resources and at the same time encourage recycling.

4.1. Selection of frugal innovation criteria

Frugal innovation is a young discipline and there are at least a dozen proposals that define it (Hossain, 2018). Advances in research on frugal innovation have made it possible to identify a series of criteria present in the majority of successful products and services in the BoP (Agarwal et al., 2017). It is important to note that frugal innovation criteria can be implemented at different levels, that is, they can focus on business models, process management and others as direct attributes of the products (Rosca,

Reedy and Bendul, 2018). For this study, we have prioritized product-oriented criteria from an engineering perspective. Weyrauch and Herstatt's (2017) works show that the way in which the attributes of frugal innovation are manifested in products depends largely on the user's environment and context. Weyrauch and Herstatt (2017) identify three essential criteria that must be met simultaneously: substantial cost reduction, concentration on core functionalities and optimised performance level. López Santiago et al. (2019) propose a list of eight key criteria of frugal innovation for products oriented to a BoP context (Affordability, Availability, Acceptability, Awareness, Aspirational, Functionality, Scalability and Sustainability). The integration of the criteria identified above implies a multi-criteria approach, that is, technical, social, economic and environmental factors. As a collaboration strategy, a meeting was held with all project participants (Alimento Para Todos I.A.P, students and supervisors) to select the most appropriate criteria for the prototype. It is worth mentioning that this selection was made considering the challenges of implementing those technical orientation criteria. The selected criteria are represented and described in Table 1.

Table 1. *Frugal innovation design criteria.*

	Frugal criteria	**Description**
A	Cost reduction Affordability	Use appropriate components in order to reduce the total manufacturing cost of the prototype by at least 30% compared to those already existing in the market.
B	Complexity	Avoid the use of very sophisticated components in the functions of the prototype and integrate simpler elements that fulfil the same task.
C	Easiness	A product must be user-friendly, easy to manufacturing and assembly.
D	Reparability Durability	Integration of devices and elements that are easy to replace, with accessible parts. Materials must be able to be recycled or reused at the end of life.
E	Functionality	Concentrate on the main functionalities, minimize the use of resources and have a user-friendly operation.

Since the frugal innovation criteria proposed in the previous table will drive the design, it is necessary to define an order of priority to identify solutions or features that should be incorporated into a final design. In order to make this priority definition, the Weighted Objectives Method (Cross, 2000, p. 139) was implemented (Figure 2).

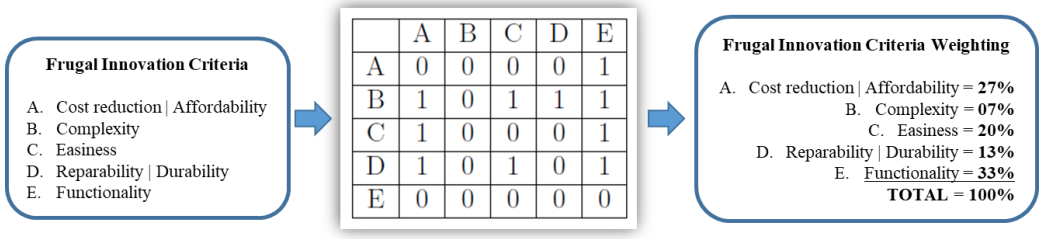

Figure 2. *Weighting strategy of the pertinence of each frugal innovation criteria*

4.2. Developing the fRVM

The Pahl and Beitz (2005) systematic approach describes designing as a sequence of four phases: (1) task clarification, (2) conceptual design, (3) embodiment design and (4) detail design. Taking into account that the study case is intended to explore the integration of frugal innovation criteria during product design, greater attention will be given to the first three phases of the Pahl and Beitz approach. Below we present how each of these stages were approached.

4.2.1. Task clarification and technical requirements

In the Pahl and Beitz approach, defining basic market demands is a key activity in the first stage. The meetings between the *Alimento para Todos* food bank and the design team made it possible to define the needs and the first activity was to define the main functions and tasks of the fRVM prototype. Under these considerations, the main functions of the fRVM are presented in the diagram of Figure 3.

Figure 3. *Flowchart of the main prototype functions.*

Once the main functions of the fRVM were defined, it was considered a scenario in which a user uses the machine, this in order to establish a series of characteristics and initial technical requirements. The relationship between user activities and technical requirements is described in Table 2.

Table 2. *User activities and technical requirements*

User activity	Technical requirements
The user enters the packaging in the prototype	a) Recognize the packaging as plastic or aluminium. b) Record the weight of the packaging. c) Reject the packages if they are not recognized, alerting the user with a signal.
Once the first packaging has been introduced, the user must press a button to be able to introduce extra packaging.	d) Store the packages that correspond to the material specified in separate containers, activating the corresponding mechanisms. e) Accumulate the weight of the packaging.
When the process of entering packaging has been completed, the food will be dispensed.	f) Select the food according to the type of packaging entered. g) Select the quantity of food to be dispensed according to the quantity of packaging entered. h) Actuate the mechanisms to dispense food.

4.2.2. Functional architecture and conceptual design

To implement the frugal criteria on the concentration on essential functions (Functionality, Ease and complexity), in this second stage, the technical requirements are grouped into four essential modules that make up the fRVM prototype. Each module represents a major function of the prototype and is composed of minor functions that allow the main function to be performed correctly. As suggested by Weyrauch and Herstatt's (2017, fig. 3), within each of the major functions identified, those minor functions that did not affect the main function were eliminated. Performing this debugging of minor functions indirectly allowed to save material costs. The main modules and their minor functions are presented in Figure 4.

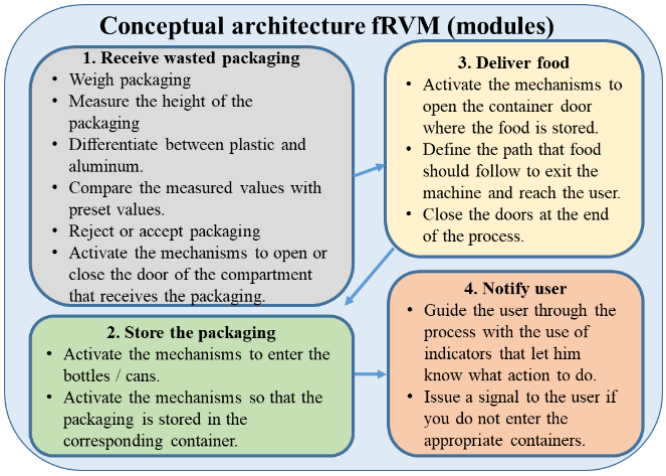

Figure 4. *fRVM main modules*

To identify the electromechanical components necessary to be integrated in the modules presented in Figure 4, it was proposed to map each one in the IDEF0 model. IDEF0 can be used to define the requirements and specify the functions to later design the setting in which it performs the functions (Feldmann, 1998). The modeling of functions with the IDEF0 diagram allows to systematically analyse the functioning of a system, focusing on the functions that are fundamental for its development (Alexander, 2010). Figure 5 shows a global analysis of the fRVM prototype in which each of the elements of the prototype (Inputs, Controls, Mechanisms and outputs) are presented.

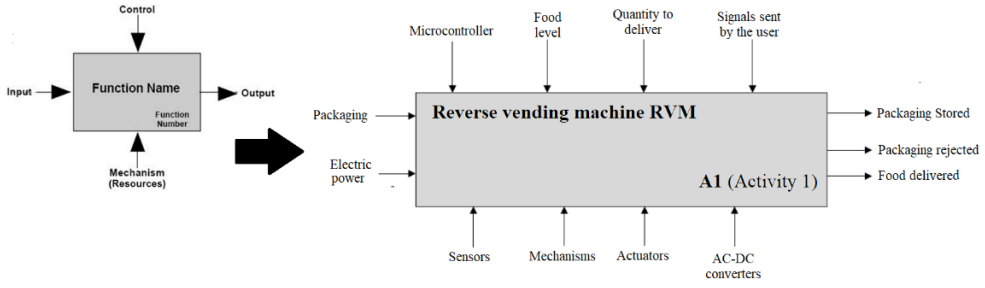

Figure 5. *Adaptation of the IDEF0 diagram for the analysis of the reverse vending machine prototype*

For each of the main modules previously presented, a diagram was made showing their interaction between them (Figure 6). On the left side are the inputs while on the right side are the system outputs. Controllers are illustrated at the top and actuator mechanisms at the bottom. All the components presented in the diagram are considered essential to carry out the sub-functions mentioned in each module as presented in Figure 4.

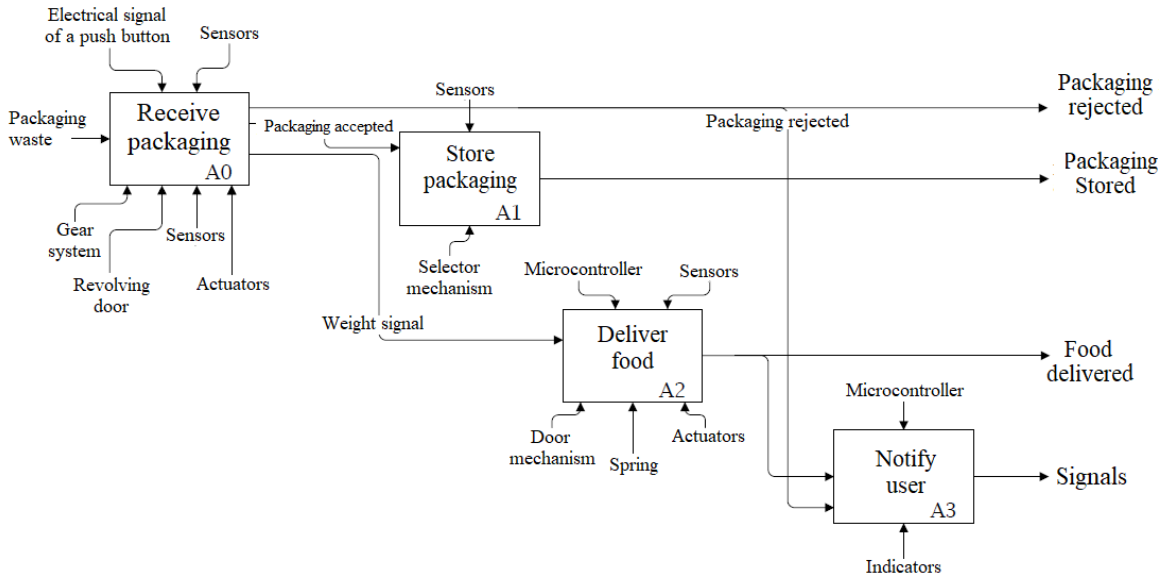

Figure 6. *IDEF0 diagram to represent the main functions of the prototype*

Once all the necessary mechanical and electronic components had been identified, a market analysis was carried out to identify the commercial components available and their prices. Those of national manufacture and territorial availability were privileged (local proximity). In the same way, to reduce the complexity and cost of the prototype, priority was given to components of low technological sophistication (push buttons, LEDs, buzzers, integrated circuits, transistors, microcontrollers, etc.) (Figure 7). In order to guarantee the quality and safety of the prototype, the data sheets were analyzed to see that these components comply with national and international norms and standards. Regarding the frugal criteria for reparability and durability, the use of commercial and locally available components ensures that the availability of spare parts in situations of corrective and preventive maintenance.

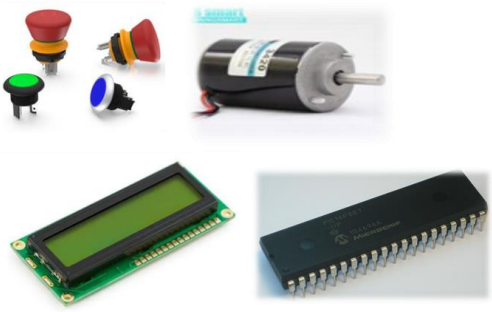

Figure 7. *Examples of the standard electromechanical components implemented.*

4.2.3.Embodiment design

In the third design stage in the Pahl and Beitz approach, calculations for structural dimensioning and arrangement of components in the prototype architecture were developed. CAD-type numerical representations were used to have a previous visualization of the prototype. The respective mechanical calculations on the resistance of materials were carried out manually and numerically. A CAD extract of the prototype is presented in Figure 8 (A. Global appearance, B. Dynamic simulation, C. Stress simulation).

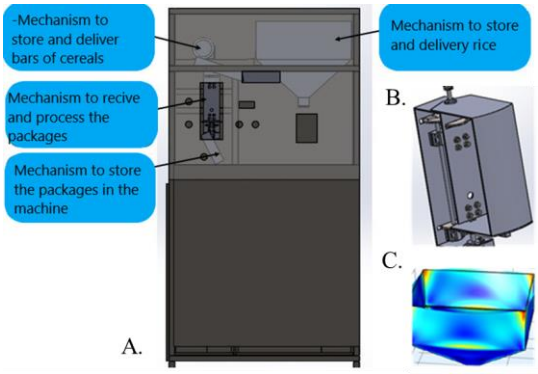

Figure 8. *CAD representations and simulation*

Once the CAD simulations had been validated by the design team and stakeholders, the manufacturing strategies were created. At this point the decisions were based on the criteria of affordability, cost reduction and Easiness (Table 1). As mentioned above, privileging local territorial resources is a pertinent strategy to reduce costs. Under these considerations, links were created with family and friends of the members of the design team, who have manufacturing workshops. These previous social ties facilitated trust, empathy and interest in participating in the project. Similarly, resorting to local workshops and suppliers allows the generation of jobs and income in local communities. Some of the components manufactured by local suppliers are shown in Figure 9.

Figure 9. *Components and elements manufactured in local workshops (A. Principal structure, B. Package classification system, C. Food hopper and D. food dispatch system)*

Once all the electronic and mechanical components had been assembled in the main structure, the prototype was put to tests to verify its correct operation. The tests were carried out on the university campus of the National Polytechnic Institute Mexico with students, professors and civilians. Cereal bars, rice and bean grains were used to test the food delivery system. PET bottles and aluminum cans at the end of their life were correctly selected by the classification system of the prototype. Figure 10 shows the final prototype in operation.

Figure 10. *Final prototype (front view).*

After the final assembly of the prototype, it is working properly as described in the technical specifications. We present the implications and limitations of this study below.

5. Implications and limitations

There are several implications in this study. At a theoretical level, although the recent contributions of frugal innovation suggest that its implementation can favour the generation of products and services suitable for the BoP, the criteria of frugal innovation still require a better understanding of "how to integrate them" in the design processes. Our study contributes to the literature on frugal innovation by presenting an implementation strategy of the criteria of this innovation approach. Our study proposed the Pahl and Beitz approach as a design process in which frugal innovation criteria can be integrated, but it is important to mention that this is not the only design model in the engineering sciences. Our study shows that it is necessary to carry out an integration analysis of frugal innovation criteria in order to select the most appropriate for a specific project.

In terms of practical implication, according to Zero Waste Scotland (2015), a low-cost Reverse Vending Machine is priced at approximately $ 8,900. Most RVMs are high-tech equipment and have a number of sophisticated functions such as security cameras, artificial intelligence for packaging classification,

control and barcode analysis. When considering frugal innovation criteria as drivers of design and decision support, the fRVM prototype in this article did not integrate sophisticated elements and, as a result, the total cost of manufacture was 770 USD (see Appendix A for a summary and detail of costs). This allows us to argue that the implementation of frugal criteria contributes to a better use of resources and a considerable reduction in manufacturing cost. Similarly, privileging territorial resources, both material and human, contributes to the creation of value in the communities. Since there are no similar projects in Mexico, it was not possible to estimate the cost with any national manufacturer. However, depending on the technological development, the typical cost in e-commerce of this type of machines ranges from 3000 to 6000 USD.

Similarly, our study has some limitations. In the first stage of the methodology, we focus on identifying frugal innovation criteria that could have the potential to be integrated into an engineering design methodology. However, the selection of these criteria was a complex task due to the multidisciplinary approach that research in frugal innovation has had. Most of these criteria can be applied at different levels, whether for the generation of business models, market strategies, design of services and products, etc. Another limitation is related to the design approach used. While Pahl and Beitz's systematic approach has become a benchmark in engineering design, its stages are complex and highly detailed, which could impede the flexibility required when developing a prototype in resource-limited contexts. This is why it is necessary to explore other more flexible product design methodologies with the potential to easily integrate frugal innovation criteria. The economic resources for the construction of our prototype were limited, this could be reflected in some aesthetic aspects of it.

6. Conclusions and further work

In this paper, frugal innovation has been presented as a new approach with the potential to create social sustainability through the improvement of technological solutions. Through the integration of product-oriented frugal innovation criteria into a traditional engineering design methodology, a virtual-experimental prototype of a food Reverse Vending Machine has been developed. The use of frugal innovation criteria has allowed us to estimate an important reduction in manufacturing cost. Compared to the highest price of a machine in the international market (6,000 USD), when applying frugal innovation to our prototype, there was an 87% reduction in the total cost (770 USD). This project seeks to create social value by applying technological development and to show that, through frugal innovation strategies, technological innovations in developing countries can be successful in solving the essential needs of the population. This project aims to address the problems that are of great relevance nowadays in Mexico City, food poverty and promote the culture of recycling. The results obtained will be a starting point for the construction of other prototypes oriented to a BoP context. Similarly, we propose as an agenda to analyse other design methodologies that can integrate frugal innovation criteria. We recommend that future contributions may focus on proposing strategies or

methods to integrate the frugal innovation criteria that were not implemented in our case study, especially those that are at the product level.

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Appendix A: Summary of the cost of the prototype.

Figure 11 describes the cost of raw materials, tools and devices used in the manufacture of the prototype. There are indirect costs such as energy consumption, transport, machine time and labor that were not considered due to the complexity of a detailed cost analysis. However, we hypothesize that including these aspects could increase the total construction cost of the prototype up to a maximum of 40%.

- Total approximate cost of manufacturing without indirect costs: 550.69 USD
- Total approximate cost of manufacturing considering 40% of indirect costs: 770.96 USD

Costs of raw materials for the manufacture of the prototype

Raw Material	Quantity	Unit Price (USD)	Total Cost (USD)
PTR profil 1.25", 6m	5	12.00	60.00
Steel angle of equal sides ¾", 6m	5	06.00	30.00
Structural Sheet Caliber 24, 4x10 ft.	4	15.00	60.00
Aluminium sheet Cal.10 3,4 914x 2440 mm	1	46.51	46.51
Stainless Steel Sheet Cal.10 3,57 x 914 x 2440 mm	1	124.51	124.51
PMMA sheet 5 x 90 x 90 mm	1	45.00	45.00
Steely shaft 12 mm in diameter and 500 mm in length	1	08.00	08.00
Steel spiral	1	35.00	35.00
		Total	409.02

Costs of tools for the manufacture of the prototype

Tool	Quantity	Unit Price (USD)	Total Cost (USD)
Drill bits	5	00.75	03.75
bow saw	3	01.25	03.75
Sandpaper	4	00.50	02.00
Electrode 308L-16	4	00.25	01.00
TIG WELD ER 70S-6 Pack	1	27.40	27.40
		Total	37.09

Costs of the devices used in the construction of the prototype

Devices	Quantity	Unit Price (USD)	Total Cost (USD)
Load cell	1	06.00	06.00
PIC16F887	2	03.00	06.00
AD620	1	05.00	05.00
Resistors	4	01.00	04.00
Capacitors	4	01.00	04.00
Zener diodes	5	01.00	04.00
Capacitive sensor	1	07.50	07.50
Ultrasonic sensor	1	03.00	03.00
Stepper motor 28by-48 with Uln2003 driver	3	02.50	07.50
Phenolic plate	4	00.50	02.00
Ball bearing type Sc8uu	4	02.07	08.30
Ball bearing type kfl08	2	02.70	05.40
Package of 5 straight gears (64T, 17T, 21T, 29T)	1	08.30	08.30
16x2 LCD	1	07.50	07.50
Lightbulb pilot	2	02.00	04.00
Buttons	3	03.60	10.08
Connection cables	1	05.00	05.00
Servomotor	1	07.00	07.00
		Total	104.58

Figure 11. *Description of the cost of the fRVM prototype*

A Case Study Analysis of the Furniture System From Sustainable Product-Service System Design Perspective

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Abstract

Studies on design for sustainability indicate that the concept of Sustainable Product-Service System (S.PSS) is a promising approach to bring radical changes in the production and consumption system with environmental, socio-ethical and economic benefits. The furniture system has been recently identified as one of the key sectors that should be addressed and improved for environmental sustainability and economic prosperity in the Circular Economy Action Plan (European Commission, 2020). In this respect, this paper presents a case study research aiming to explore and characterise the offer model of S.PSS when applied to the furniture sector as a promising win-win approach towards sustainability. The result indicates that applying S.PSS in the furniture sector can bring win-win benefits for a low environmental impact and a high economic value, even though with some peculiarities compared to the known general win-win S.PSS economic and environmental benefits. Some reflections are given concerning this approach in the socio-economic crisis taken by the Covid-19, which is made around the opportunities that S.PSS applied to furniture can extend the access to high quality and well-designed furniture to even low-income individuals and entrepreneurs.

Keywords: Sustainable Product-Service System, furniture system, Design for Sustainability, system innovation, Life Cycle Design

1. Introduction of the furniture sector's environmental impacts and possible solutions

The furniture production and consumption system is a resources intensive sector with high input and output related environmental impacts. Each year, around 42 million tons of furniture are produced, of which 57% are wood made furniture, 20% are upholstered furniture, 12% are metal made furniture, etc. (Tomaselli *et al.*, 2014; Forrest *et al.*, 2017). This means vast environmental impacts caused by the furniture sector in resources input and waste emission. As

a result, furniture has been recently identified as one of the key sectors that should be addressed and improved for more sustainable development (European Commission, 2020).

These negative environmental impacts of the production and consumption system accelerated research on the causes and solutions to these problems. Moreover, it has become a necessity to take radical steps towards sustainability in a systematic way. Former proposed method for product innovation, specifically environmental sustainability products design (even known as Life Cycle Design, LCD), is crucial to improve products' environmental performance concerning the life cycle processes (Vezzoli, 2018; Ceschin and Gaziulusoy, 2019). However, based on the production and sale of products in traditional business logic, manufacturers are usually not economically interested in optimising the sustainability along the product's life cycle, for example, extending product lifespan (Manzini *et al.*, 2003). From these aspects, it is necessary to move from product innovation to a more systematic approach. Researchers underline system innovations, which mean production processes and artefacts, patterns of consumption and access to goods and services are all under discussion (Brezet, 1997; Adams et al., 2015; Manzini, 2002). In this aspect, Sustainable Product-Service System (S.PSS) is a promising one (Manzini, 2002; Tukker, 2004; Vezzoli et al., 2014; Vezzoli et al., 2021; European Commission, 2020). The definition of a S.PSS is "an offer model providing an integrated mix of products and services that are together able to fulfil a particular customer/user demand (to deliver a "unit of satisfaction"), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the product/s and/or the life cycle services costs/responsibilities remain with the provider/s, so that the same provider/s continuously seek/s environmentally and/or socio-ethically beneficial new solutions, with economic benefits" (Vezzoli et al., 2021).

The research hypothesis of this paper, described in chapter 1, is that S.PSS for the furniture system could bring win-win benefits for environmental sustainability, economic prosperity and social cohesion with its own peculiarities.

The paper describes the S.PSS's general win-win benefits in chapter 2. Chapter 3 states the method for the case study; Chapter 4 describes the detailed information of a representative furniture S.PSS case and a cross-case analysis of 8 furniture S.PSS cases. In Chapter 5, the

paper presents the results interpretation of the case study analysis: furniture specific S.PSS types, S.PSS for furniture characteristics and the win-win benefits of S.PSS for furniture. Chapter 6 gives some reflections to overcome cases' limits and barriers. A special attention is given to the Covid-19 pandemic crisis. Chapter 7 summarises the main findings of this research and proposes steps for future research.

2. S.PSS general win-win benefits

Some authors (Vezzoli et al., 2021) proposed six win-win benefits of S.PSS. When products ownership and/or the economic responsibility for the life cycle performance remain with the providers (producers) who sells a unit of satisfaction rather than (only) the product, the providers (producers) have direct economic and competitive interest to reduce the products' and/or the services' environmental impacts through design and development. In other words, an S.PSS producer/provider is economically interested in design for 1) Product lifespan extension; 2) Product use intensification; 3) Resources (materials and energy) consumption minimisation; 4) Resources renewability/biocompatibility; 5) Material life extension (recycling, energy recovery, compost); 6) Toxicity/harmfulness minimisation.

3. Method for Case Study Analysis

The theory about the application of S.PSS in sustainable furniture design is quite limited. Some proposed furniture PSSs are not necessarily sustainable. The Case study method is selected in this research as coherent for studying new areas and issues where little theory is available (Eisenhardt, 1989; Yin, 2014).

Since evidence from multiple case studies is often considered more robust (Herriott and Firestone, 1983), multiple case studies are conducted in this paper. Selection criteria for cases and information analysis format are defined. Eight furniture S.PSS cases have been deeply analysed. Then a cross-case analysis is conducted to verify similarities and differences of S.PSS offer models of cases.

3.1 Aim and objectives of case study analysis

This case study analysis aims to verify and characterise S.PSS's win-win economic and environmental benefits into the furniture systems. In particular, verify whether and under what condition applying the S.PSS approaches to furniture design and offer makes the provider economically interested in improving furniture's environmental performance.

3.2 Collection and Cases selection criteria

This case study research of S.PSS applied to furniture is made over literature review and desk research. At first, a literature review is conducted with keywords 'furniture' or 'furniture design'; 'sustainable' or 'sustainability' or 'design for sustainability' or 'Product-service system'; 'case study' or 'case analysis' or 'case' with the google scholar tool to search best furniture cases. Then, desk research is conducted over three European Union-funded furniture projects, three research institutions' websites, more than 42 furniture companies' websites and five online interviews (or videos).

Based on the literature review and desk research, 22 sustainable furniture PSS cases come from 15 scientific papers, one book, one furniture project (Katch-e[1]), three research institutions (LeNS network[4], Ellen Macarthur Foundation[2] and Wrap[3]). All these cases are coherent with the general definition of the Sustainable Product-Service System (already presented in the introduction chapter). At last, eight sustainable furniture PSS design cases are selected as the best cases for this paper.

3.3 Analysis of cases

A case study format (see figure 1) is designed to collect and analyse case information, including the offered furniture products and services (i.e. the satisfaction unit), stakeholder configuration, sustainable benefits, etc. Specifically, the case study format is structured in the following sections:

[1] https://www.katche.eu/

[2] https://www.ellenmacarthurfoundation.org/

[3] https://wrap.org.uk/

- General information of the project including brand, location, contacts, start year, project state, video (interview or introduction), source of case's information;
- Furniture analysis: (i) furniture characteristics including category, main materials and life cycle design strategies (i.e. furniture use extension/intensification, material consumption reduction for furniture, material life extension for furniture, toxicity reduction for furniture, energy consumption reduction for furniture, resources conservation/biocompatibility for furniture). (ii) furniture description. (iii) sustainable benefits;
- Furniture PSS analysis: (i) System characteristics including providers, customer, S.PSS type, satisfaction unit, offered products, offered services; ownership of products and payment methods. (ii) System description. (iii) Sustainable benefits of the system, including environmental benefits, socio-ethical benefits and economic benefits. (iv) stakeholders interaction showed with system map (developed by the LeNs network[4], see figure 2);
- Limits and barriers of the system (if there are);
- Pictures to show products and systems.

Figure 1. *Case study format*

3.4 Cross-case analysis

[4] http://www.lens-international.org/

After analysing each case, cross cases analysis is conducted. The aim is to compare the S.PSS for furniture configuration, satisfaction unit, offered products & ownership, offered service & provider, payment method and sustainable win-win benefits.

4. The outcome of case study analysis

Eight cases are analysed according to the case study format. All cases' information has been recorded in LeNS network[4]. The following part recorded one representative S.PSS for furniture case to show how cases are analysed.

4.1 An example of furniture S.PSS cases - Furniture as a Service (GISPEN, the Netherland)

4.1.1 General information

Brand name	-Gispen
Producer/provider /alliance of providers	-Gispen
Company location	-The Netherland
E-mail	- info@gispen.nl
Website	- https://www.gispen.com/en/
Start (year)	-1916
State	-ongoing
Link to video	- https://www.youtube.com/watch?v=XxQwZtVGu-k
Source of information	- KATCHE project, (Bosch et al., 2017), (Pergande et al., 2012), (Zancul et al., 2011)

4.1.2 Furniture products analysis

i) Furniture characteristic

Furniture series (name):	Triennial seats
category	- chair
Main materials	-steel, textile, wood, foam
LCD strategies:	
Furniture use extension/ intensification	-use standard components and modular structure; design for easy disassembly;
Material consumption reduction	-none
Material Life Extension for furniture	-mono-material strategy; design for easy disassembly
Toxicity reduction for furniture	-none
Energy Consumption Reduction for furniture	-none
Resources conservation/biocompatibility	-none

ii) Short description of furniture products

All Gispen's furniture is suitable for FaaS, especially the modular collections, like Triennial seats (see figure 4). The Triennial seat is manufactured from 75% standard components universal for other furniture groups. For example, the backrest of a chair can be used for a bar stool. The design increases the usability of each component in future life cycles. The series is designed for easy disassembly. The backrest can be replaced or swapped on-site by one person within 10 minutes without causing any damages due to one screw connection. The textile cover is held by a zipper, which is easily upgraded on-site. Material blends are avoided, the frame (steel) and the cover (fabric) are detachable from the seat (wood and foam).

iii) Characteristics of the reduction of environmental impacts

The furniture is designed for disassembly, which could extend the lifespan due to possible repair and upgrade. Design for disassembly and mono-material design could support materials life extension for further recycling.

4.1.3 Furniture Product-Service System analysis

i) System characteristics

System configuration:	B2B or B2C
Provider/s (role)	-Gispen
customer/s (type)	-business or individual
S.PSS characteristics:	
Type of S.PSS	-result-oriented
Unit of satisfaction	-users have access to well design furniture and all-inclusive life cycle services
Offered product/s (related producer/s)	-office furniture
Ownership of the offered product/s	-Gispen
Offered service/s (related supplier/s)	- delivery, installation, maintenance (annual check-ups, regular cleaning), repair, upgrade, replacement and reconfiguration (when the users' needs change), take back and so on.
Access payment	-pay per month

ii) System description

Gispen is an office furniture manufacturer and provider that offers a 'Furniture as a service (FaaS)' solution (see figure 3) to users. FaaS is a subscription which leases office furniture and services with a fixed monthly fee. Gispen keeps the ownership and provides well-designed furniture (suitable for refurbishing and remade) with all-inclusive services of delivery, installation, maintenance (annual check-ups, regular cleaning), repair, upgrade, replacement and reconfiguration (when the users' needs change), take back and so on. The stakeholder

interaction is shown in figure 2. Customers pay per period of use which avoids costly fees for purchasing and services.

iii) Sustainable benefits of the system

Since the ownership is retained by Gispen, who gets paid per month, the longer the furniture last, the more benefits for Gaipen, so it is economically beneficial for Gispen to design furniture for life extension. The more the materials are recycled, the less cost of purchasing new materials, so it is economically beneficial for Gispen to design for material life extension.

4.1.4 System map

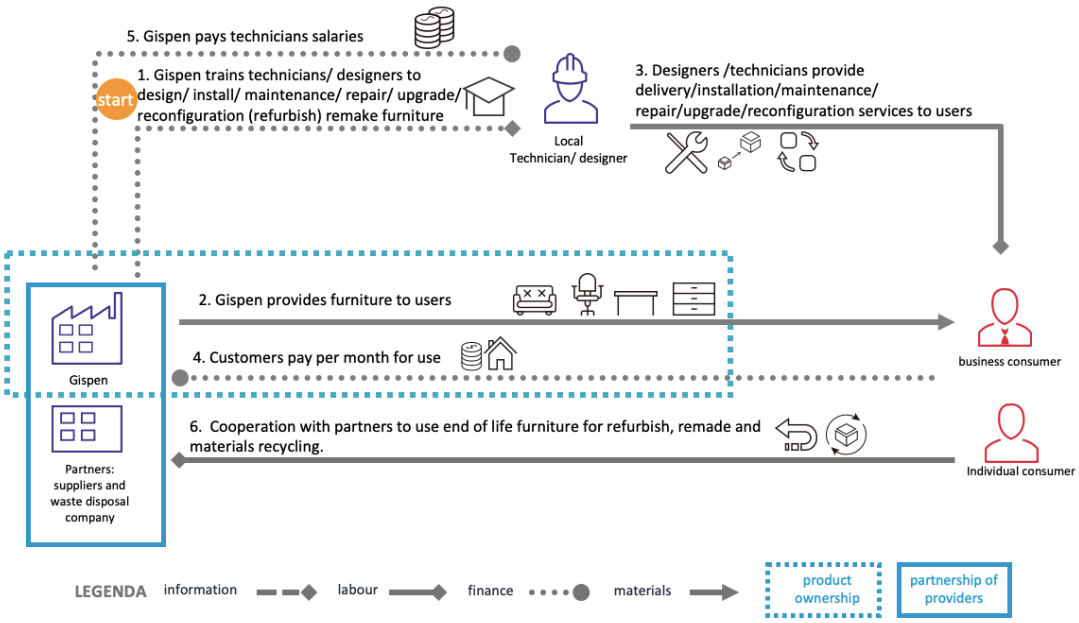

Figure 2. *Stakeholders interaction for Gispen case (system map)*

4.1.5 Pictures

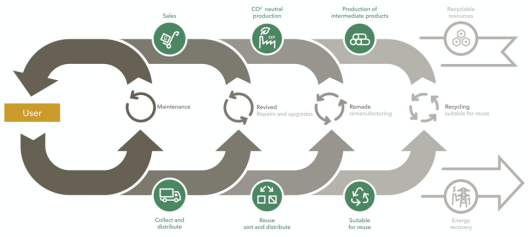

Figure 3. *Furniture as a service*

Figure 4. *modular Triennial seat*

4.2 Cross cases analysis

The cross-case analysis is shown in table 1.

Table1. *Cross analysis of eight S.PSS for furniture cases*

Cases	provider	S.PSS types	Satisfaction unit		payment	ownership	Sustainable potential (environmental)furniture
			Products and characteristics	service			
FAAS	Gispen (the Netherland)	Result-oriented	Office furniture (modular, easy disassembly; mono-material for each component)	All-inclusive service: delivery, installation, maintenance, repair, upgrade, replacement, reconfiguration, take back.	Pay per month	The provider (Gispen)	i) Furniture life extension; ii) Material life extension
Take back service	Rype Office (UK)	Product-oriented	Office furniture (recycled/recyclable material, remade component)	Office layout and interior design, delivery and installation, take-back service	Pay a fixed fee for furniture and services	The customer	i) Furniture life extension; ii) Material life extension; iii) Resources renewability
Enable users for ergonomic needs	BMA (Norway)	Care-oriented	Ergonomic chair (modular structure, designed for disassembly)	Customised ergonomic sitting services: personal instruction (through tools and app), technical maintenance and cleaning services	Pay per period	The provider (BMA)	i) Furniture life extension; ii)Material life extension
Workplace sharing	Regus (Italy)	Result-oriented	Office furniture and supporting equipment	All-inclusive service: installation, maintenance, repair, upgrade, replacement, reconfiguration, and end-of-life treatment.	Pay per period	The provider (Regus)	i) Furniture use extension; ii) furniture use intensification iii) Resources (materials and energy) consumption minimisation; iv) Resources renewability
On-site assemble	IKEA (Sweden)	Product-oriented	Household furniture (flat packed, easy assembly and disassembly)	Service (video and text instruction) for on-site assembly, design service	Pay a fixed fee for furniture and services	The customer	i) Energy consumption reduction (during transportation)
Production based on pre-determined demands	Shangpin Home (China)	Product-oriented	Household furniture (modular furniture)	Customised design, delivery and installation	Pay a fixed fee for furniture and services	The customer	i) Resources (materials and energy) consumption minimisation
Cohousing	Cohousing (Italy)	Result-oriented	Household furniture and equipment	All-inclusive service: installation, maintenance, repair, upgrade, replacement, reconfiguration and end-of-life treatment.	Pay per period	The provider (cohousing)	i) Furniture use extension; ii) furniture use intensification; iii) Resources (materials and energy) consumption minimisation; iv) Resources renewability
Facilitating locally made/well-designed furniture	Open Desk (UK)	Product-oriented	Office furniture (local produced)	access to furniture design, connection to local craftsman	Pay a fixed fee for furniture and services	The customer	i) Resources (materials and energy) consumption minimisation; ii) Resources renewability

5. Results Interpretation: a refined definition and classification for S.PSS when applied to Furniture systems

5.1 Classification of S.PSS for furniture

Many researchers (Manzini *et al.*, 2003; Tukker, 2004; Vezzoli, 2007; UNEP and Delft University of Technology, 2017) classified PSSs into three categories: product-oriented PSS, use-oriented PSS and result-oriented PSS. When analysing former cases, it emerges that a refined classification for furniture S.PSS is needed to well describe different offers in the furniture sector. The type of S.PSS for furniture is thus being redefined as:

- *Product-oriented S.PSS for furniture* is 'S.PSS adding value to the furniture's life cycle'. To be specific, a company/organisation (an alliance of companies/organisations) provides furniture and additional all-inclusive services, i.e. design, maintenance, repair, upgrading, substitution, reconfiguration and furniture end-of-life treatment, etc., to guarantee life cycle environmental performance of the furniture which is sold to the customer. The customer owns the furniture, but the responsibility is reduced during use and end of life stages, and pays all-inclusive the furniture with additional services, like the Rype office take back service case.
- *Care-oriented S.PSS for furniture* could be defined as 'S.PSS enabling furniture care platforms for customers'. To be specific, a company/organisation (an alliance of companies/organisations) provides access to furniture and/or furniture care tools with support services, enabling customers to care furniture, e.g. customers are enabled to care for design, delivery, installation, adjustment, maintenance, repair, upgrading, substitution and reconfiguration, etc. In this case, the customer does not own the furniture and/or furniture care tools but operates them to obtain a specific furniture use/care 'satisfaction'. She/he pays per use of the furniture and/or furniture care tools, like the BMA case.
- *Result-oriented S.PSS for furniture* could be defined as 'S.PSS providing furniture and full services to customers'. To be specific, a company/organisation (an alliance of companies/organisations) provides access to furniture, with all-inclusive life cycle services, e.g. furniture/interior/layout design, delivery, installation, maintenance, repair, upgrading, substitution, reconfiguration and end-of-life treatment, etc. The customer does not own the furniture. The provider carries out life cycle services, being paid per satisfaction unit. Like the Gispen/Regus case.

Table2. *The comparison among different types of S.PSS for furniture*

	Product-oriented S.PSS for furniture	Care-oriented S.PSS for furniture	Result-oriented S.PSS for furniture
Product	Furniture	Furniture and tools (and/or platform)	Furniture
Services	All-inclusive additional services	Enabling life cycle services	Life cycle full services
Ownership	Customer	Provider(s)	Provider(s)

Payment	Pay for furniture and all-inclusive additional services	Pay per access to furniture and enabling life cycle services	Pay per access to furniture and life cycle services
Examples	i) Additional take back service (Rype Office); ii) On-site assembly (IKEA); iii) Production based on pre-determined demand (Shangpin home); iv) Platform facilitate locally made furniture (open desk)	i) Enable users for ergonomics needs/Leasing (BMA)	i) Co-living; ii) Co-working; iii) furniture as a service/leasing (Gispen)

5.2 S.PSS for furniture refined definition

For what we have analysed and proposed in previous chapters, a refined definition of S.PSS could be given when applied to furniture: "S.PSS for furniture is an offer model providing an integrated mix of furniture and services that are together able to fulfil a particular customer/user demand (to deliver a "unit of satisfaction"), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the furniture and/or the life cycle services costs/responsibilities remain with the provider/s, so that the same provider/s continuously seek/s environmentally and/or socio-ethically beneficial new solutions, with economic benefits" (adopted from Vezzoli, et al., 2021).

5.3 Sustainable Furniture Product-Service System environmental and economic win-win benefits

5.3.1 S.PSS for furniture facilitates furniture use extension

As far as S.PSS for furniture provider is offering the furniture, retaining the ownership and being paid per satisfaction unit, or offering all-inclusive furniture with its maintenance, repair, upgrade, reconfiguration, substitution and end-of-life treatment, the longer the furniture or its components last (environmental benefits), the more the furniture producer/provider avoids or postpones the disposal costs plus the costs of pre-production, production and distribution of new furniture substituting the one disposed of (economic benefits), see figure 5. Hence, the furniture producer/provider is driven by economic interests to design for lifespan extension of furniture by applying furniture LCD strategies, including: facilitating furniture maintenance, facilitating furniture upgrading and adaptation, designing furniture for reliability, facilitating/enabling furniture reuse and remanufacturing or designing for disassembly.

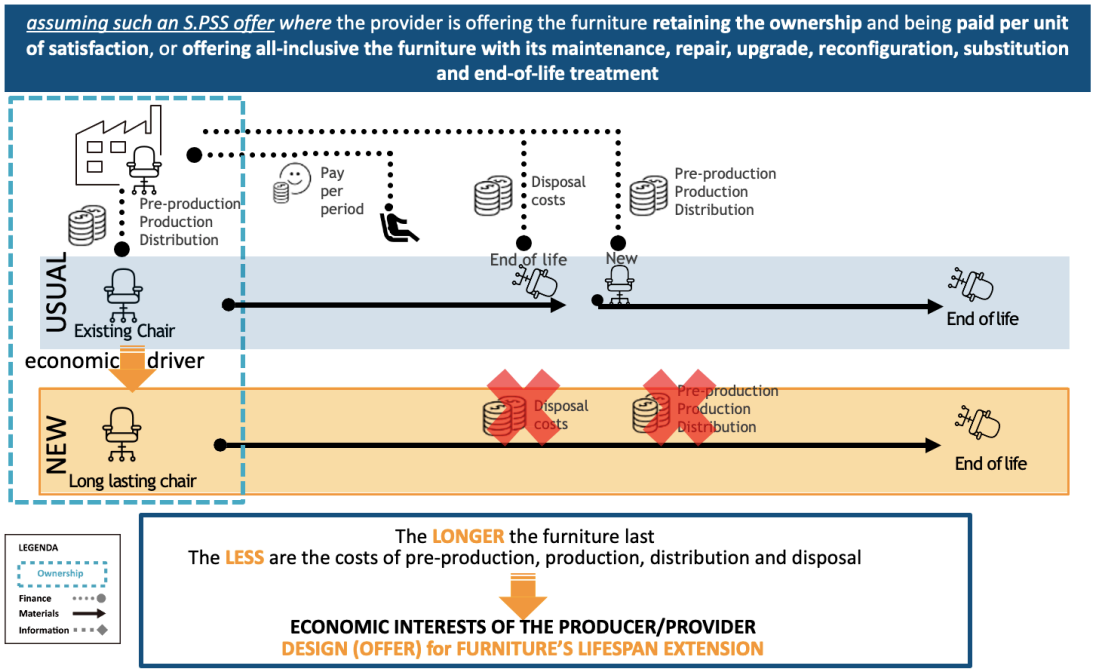

Figure 5. *the win-win benefits of S.PSS for furniture (furniture life extension)*

5.3.2 S.PSS for furniture facilitates furniture use intensification

As far as the S.PSS for furniture provider sells a shared use of furniture to various users, the more intensively the furniture is used (environmental benefits), the higher the profit (economic benefits). Hence, the furniture producer/provider is driven by economic interests to intensify furniture use. See figure 6.

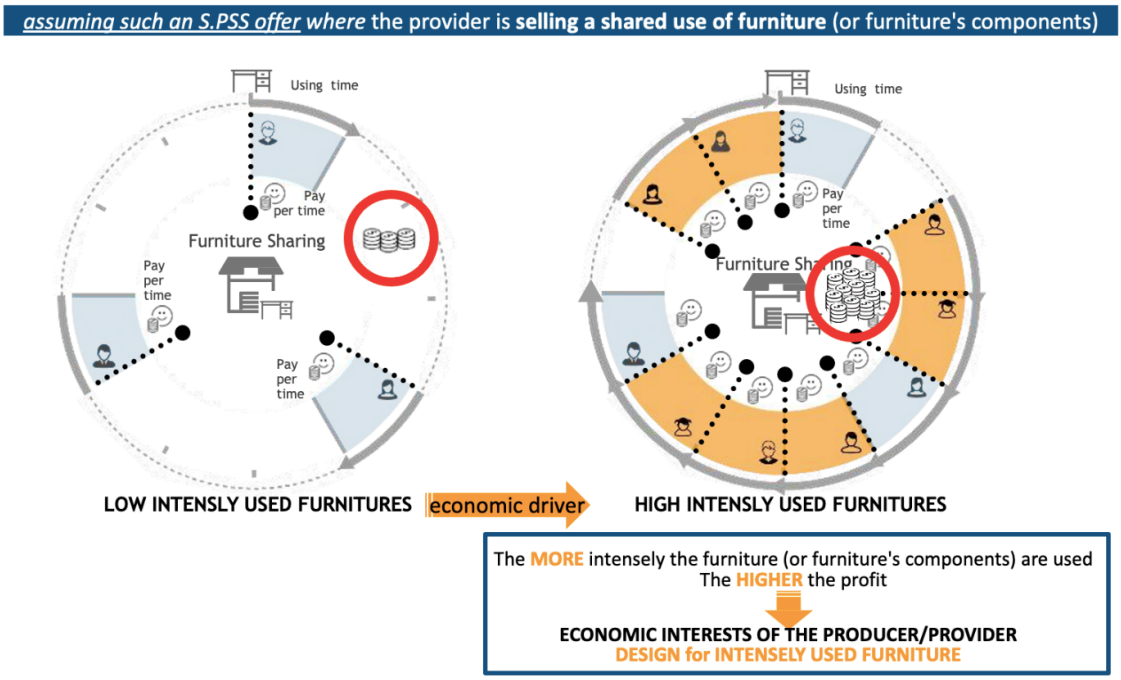

Figure 6. *the win-win benefits of S.PSS for furniture (furniture use intensification)*

5.3.3 S.PSS for furniture facilitates material life extension (recycling, energy recovery)

As far as the S.PSS for furniture provider is selling all-inclusive furniture with its end-of-life treatment, the more the materials are either recycled or incinerated with energy recovery (environmental benefits), the more costs are avoided of landfilling, the purchasing of new primary materials or energy (economic benefits), see figure 7. Hence, the furniture producer/provider is driven by economic interests to design for material life extension (recycling, energy recovery etc.), by applying furniture LCD strategies, including adopting the cascade approach for furniture; selecting materials with the most efficient recycling technologies; facilitating collection and transportation of disposed furniture; identifying furniture materials; minimising the number of non-compatible furniture materials and/or facilitating their separation.

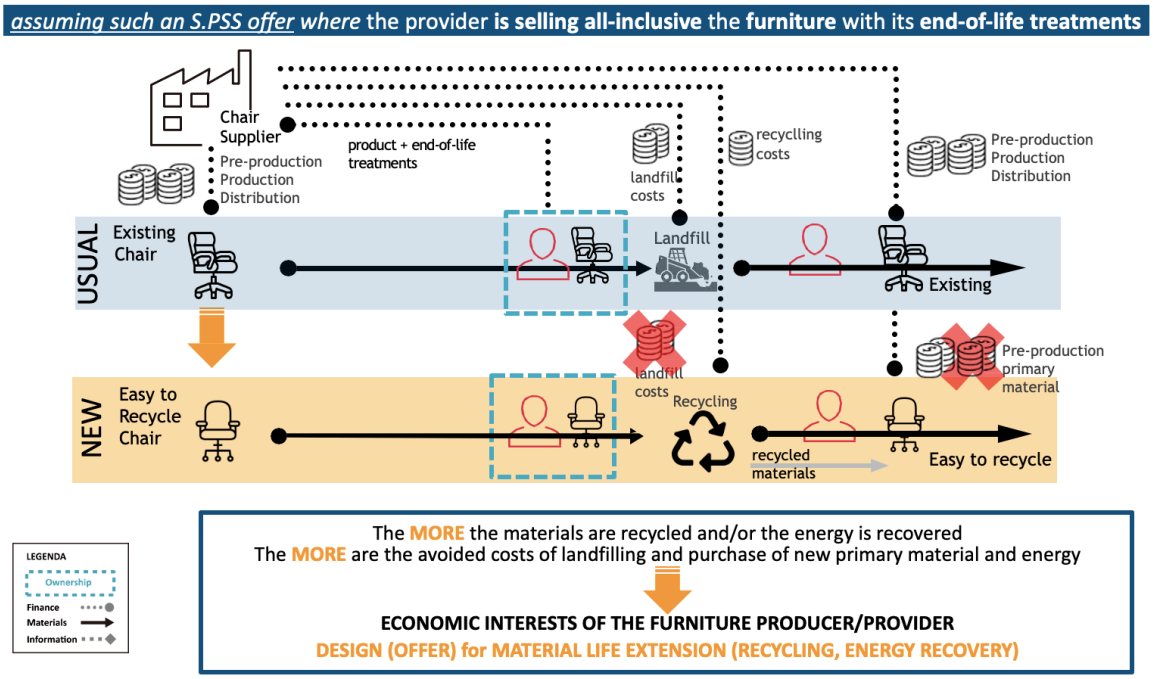

Figure 7. *the win-win benefits of S.PSS for furniture (material life extension)*

5.3.4 S.PSS for furniture facilitates resources consumption minimisation

As far as the S.PSS for furniture provider is selling all-inclusive access to furniture and responsible for the resources (i.e. materials and energies) it consumes during its life cycle stages, the higher the resources efficiency in all furniture life cycle stages (environmental benefits), the higher the profit (economic benefits), see figure 8. Hence, the furniture producer/provider is driven by economic interests to design/offer furniture and/or services that minimise resources consumption by applying furniture LCD strategies, including minimising the material content of furniture, minimising scraps and waste, minimising or avoid packaging, minimising material consumption during use and minimising energy consumption along the furniture life cycle.

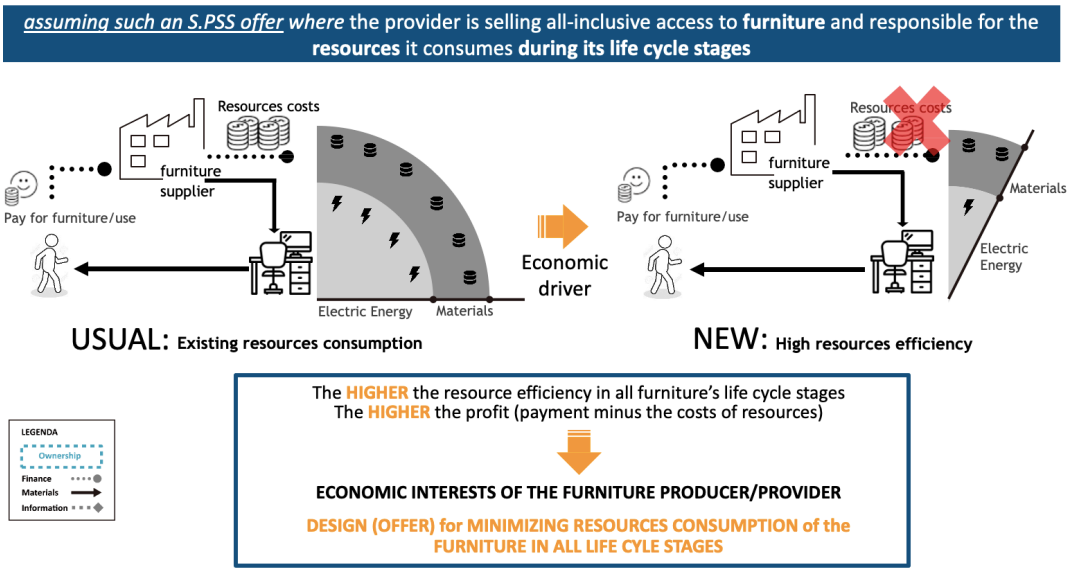

Figure 8. *the win-win benefits of S.PSS for furniture (Resources consumption minimisation)*

5.3.5 S.PSS for furniture facilitates resources renewability/biocompatibility

When we enlarge the furniture system to include some type of energy/materials consuming furniture in use, such as a workstation, and the S.PSS for furniture provider has an all-inclusive offer of furniture and resources during use, with pay per period/time/satisfaction (e.g. furniture and energy production unit), the higher the proportion of passive/renewable sources (environmental benefits), the higher the profit, i.e. the payment minus (among others) the costs of sources (economic benefits). Hence, the furniture producer/provider is driven by economic interests to design (offer) for resources renewability. See figure 9.

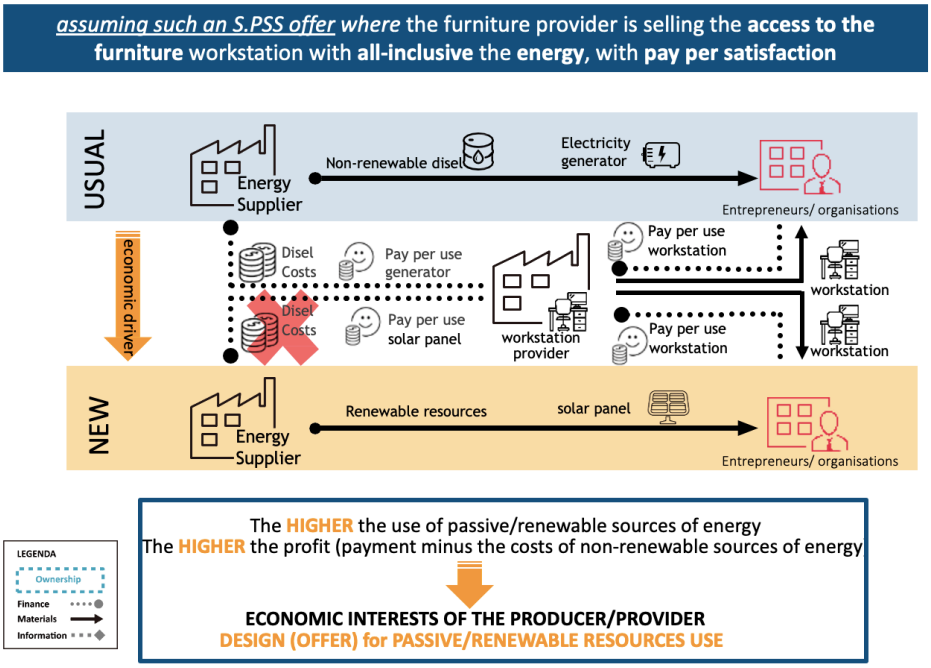

Figure 9. *the win-win benefits of S.PSS for furniture (Resources renewability/biocompatibility)*

In summary, S.PSS for furniture 1) designs a particular furniture satisfaction unit and all related furniture and services; 2) designs the interactions of the stakeholders (i.e. offer model) of a particular furniture satisfaction system. As a result, within S.PSS for furniture offer, providers continuously seek environmentally new beneficial furniture solutions for economic reasons. In other words, the financial interest of the furniture provider (manufacturer) fosters the design of environmentally sustainable furniture by adopting furniture LCD strategies, see figure 10.

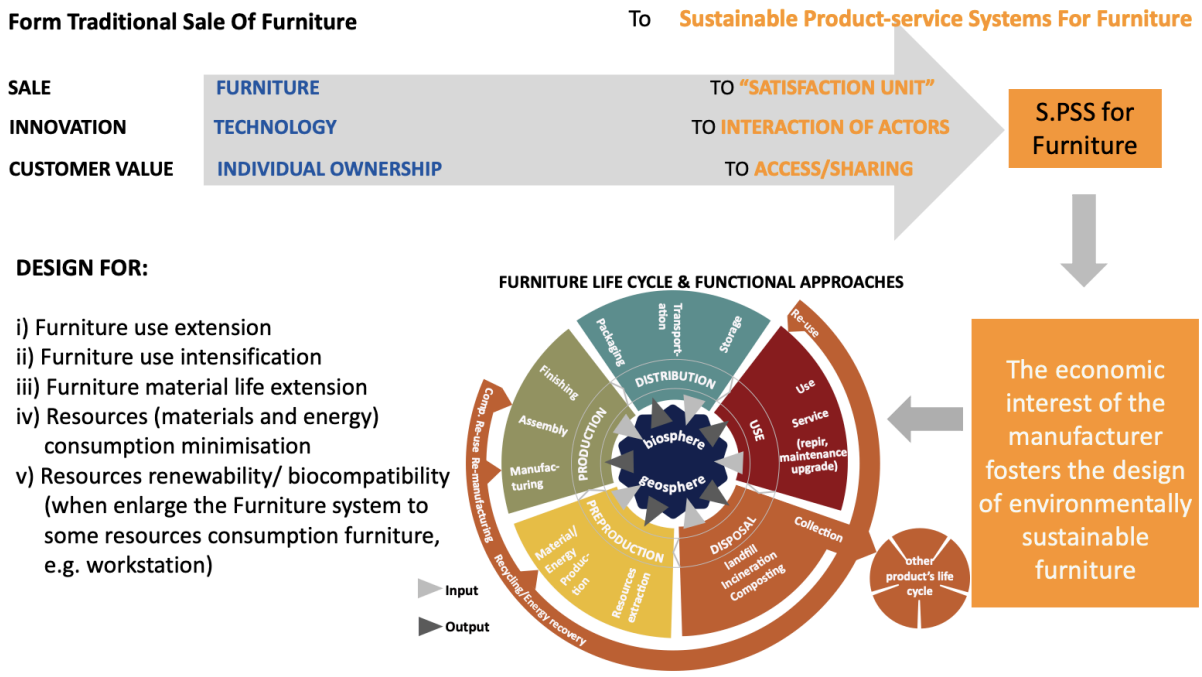

Figure 10. *S.PSS for furniture as a model that makes furniture LCD economically relevant for the manufacturer/provider (adapted from Vezzoli et al., 2021)*

6. Discussion

Although all researched cases have some win-win benefits among the formerly mentioned aspects, not all furniture cases could be fully and thoroughly considered as well-conceived S.PSS. Here are some key elements that should be considered: 1) The ownership and payment methods. With S.PSS for furniture offers, the ownership of furniture and/or life cycle responsibility retained by the provider who gets paid per satisfaction unit and thus economically interested in conducting furniture LCD strategies. 2) The role of producer and provider. If the same furniture manufacturer offers services, the provider/producer has the economic interest in offering low environmental impact furniture and the direct opportunity/capability to intervene in the furniture design processes (e.g. furniture leasing in the Gispen case), i.e. adopting some of the LCD strategies.

This analysis focuses mainly on the win-win environmental and economic sustainability benefits. Socio-ethical sustainability is another key benefit from S.PSS for furniture worth further research and

scientific debate. This is even more true under the current Covid-19 pandemic crisis which increases poverty and inequality on a global scale. A shift towards Sustainable Product Service-System where the ownership of the product and/or the life cycle services costs/responsibilities remain with the provider have been studied worldwide as promising locally-based sustainable and resilient models envisions a promising characteristic of a "new normality", sustainable for all (Vezzoli, 2021).

S.PSS for furniture could be a promising approach to deal with social equity problems. The research assumes that, with (care-oriented and result-oriented) S.PSS for furniture, providers offer access to furniture and all-inclusive services, rather than only the furniture ownership to final users, being paid per use of furniture and life cycle services. This offer would avoid furniture purchasing costs, which is frequently too high for low and middle-income users. Thus, furniture would become accessible to even low and middle-income users. Second, This offer would avoid cost for furniture maintenance, repair, upgrade, reconfiguration and end-of-life treatment, which is frequently very high for low and middle-income users. As a result, users could avoid interruption of furniture use.

7. Conclusion: envisioning a pivotal role for the designer

The design may play a crucial role in envisioning a new generation of sustainable furniture systems within the former framework. This case study analysis mainly verifies and characterises five main win-win environmental and economic benefits of S.PSS into the furniture systems. The S.PSS for furniture offer models need to be designed by adopting S.PSS design approaches and tools.

- Adopting a "satisfaction-system" approach to design a particular "furniture satisfaction unit" and its related furniture and services.
- Adopting a "stakeholder configuration" approach to design the interactions of the stakeholders of a particular furniture satisfaction system.
- Adopting a "system sustainability" approach to design such stakeholder interactions (offer model) that providers continuously seek after both environmentally and socio-ethically new beneficial furniture solutions for economic reasons.

Finally, a set of available S.PSS tools could be used for furniture system design, and some tools need research work for specification to be used in the furniture sector. For example, the Sustainable Design Orienting toolkit[5] (SDO toolkit) for which a set of furniture system-specific guidelines and checklist should be redefined.

According to what is stated by the European Commission (2020), furniture is a critical impacting sector, and up to 80% of products' environmental impacts are determined at the design stage. Designers can and must play a crucial role, which could be done by adopting "product-as-a-service or other models

[5] The SDO toolkit contains a series tools to support general S.PSS design, which could be find in http://lens-europe.eu/tools/view/3.

where producers keep the ownership of the product or the responsibility for its performance throughout its life cycle."

Finally, to help achieve a fruitful understanding of the opportunities, it is relevant to develop a sustainable furniture design orienting scenario as an essential part of the reference framework for promising future sustainable furniture S.PSS. The scenario has four visions that could represent future furniture system design possibilities (in the form of polarity diagram, storyboards and videos). Each vision represents a Sustainable win-win configuration, combining socio-cultural, organisational and technological factors, fostering solutions with a low environmental impact, high socio-ethical quality and a high economic value.

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Posters

The 27th International Sustainable Development Research Society Conference
13–15 July 2021
Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis
Mid Sweden University
Virtual Conference, Sweden

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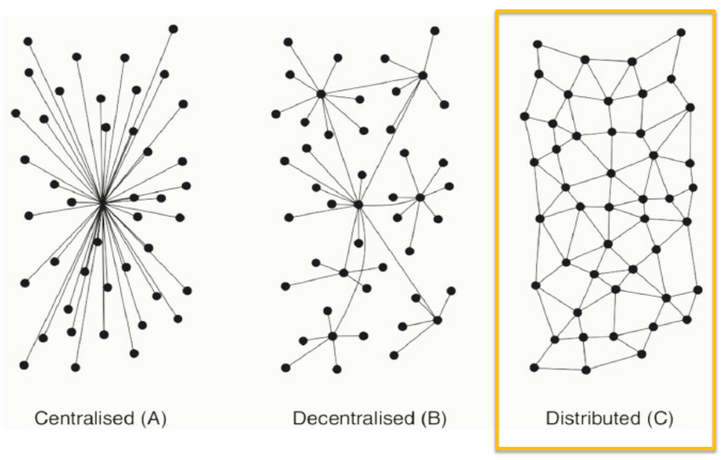
Vernacular Design as a source of innovation to contribute for a distributed economy model

INTRODUCTION

The distributed economy model, with small-scale value-adding units synergistically connected in a network and serving local needs near or at the point of use, offer a more promising scenario to achieve a more sustainable society.

Covid-19 pandemic has confirmed the higher level of resilience of those communities and organizations adopting the distributed economy concept.



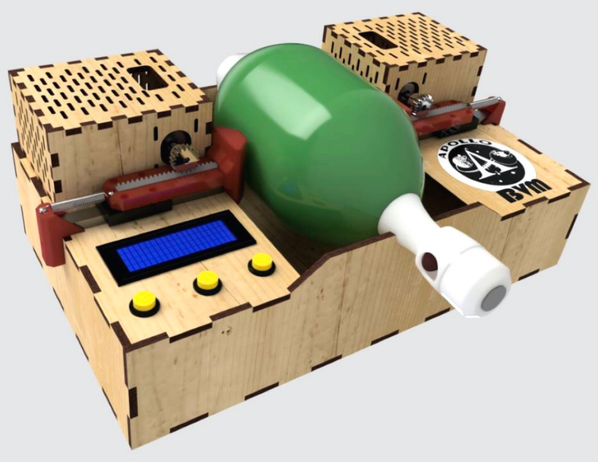
Yet, the limited access to products and services and the rise of teleworking had an impact on the generation of several improvised solutions to everyday problems.

This kind of manifestation, based on solving a problem adapting local resources and knowledge, will be considered as vernacular design. These vernacular solutions could be seen as a reservoir of innovative knowledge with great potential to benefit others with similar problems.

ANALYSES

It was possible to observe improvised manifestations being produced and disseminated mainly through digital fabrication. Most importantly, this knowledge is openly available for others to reproduce, adapt and share it again. In this case, the main motivator to innovate was the pandemic and its restrictions. Some projects have the same practical function but with different formats and models, showing some problems recurrence and the opportunity to disseminate projects in order to save other user's efforts in creating a new solution.

In this sense, it is assumed that there is a larger repository of inventions that still remain anonymous, within their creators. One of the barriers that possibly cause this is the lack of knowledge, mastery and access to digital communication technologies, which end up being fundamental tools in this process.



CONCLUSION

The analysis has emphasized the economic dimension of sustainability, achieving as a target the SDG+ 8, 11 and 13, confirming the following implications of the distributed paradigm: a) better fulfilment of local needs, allowing on-demand production and reduction of marketing costs due to customer proximity; b) a higher level of customization and faster delivery of product/service changes; c) shorter, more flexible and smaller supply chains, with sharp reduction in logistics costs, lead-time, waste and capital investment; d) better monitoring of product performance, with higher local control over production; e) valorizes the local economy, integrating local competencies and infrastructure into the design process, increasing the bargaining power of local providers and encouraging open source innovation.

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5. Production, Consumption and Innovation

5c. Circular economy

Abstracts

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Minimization or precaution for sanitary waste? Answers from life cycle assessment studies.

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Abstract

Waste management is a hot topic today: it requires careful reflections to solve the great dilemma between waste minimization, coherently with circular approach, and risk reduction for workers and citizens, coherently with precaution principle. Within this dilemma, sanitary waste is very critical: it involves ad hoc collection, transportation and pre-treatment processes that require huge costs and produce high environmental impacts which are however inevitable to reduce the danger to human health in final treatment steps. At the same time, reduction of sanitary waste is not always possible due to the delicate operating procedures in which they are generated. Moreover, the quantity of sanitary waste is progressively increasing by virtue of disposable therapeutic and surgical techniques that ensure high sterility.

In the last decade several scientists have been asking questions about convenience of reduction of environmental impacts related sanitary waste, decreasing the quantity produced and testing recycling options. However, the need to guarantee safe health and medical procedures and precautionary methods of waste collection and treatment remains, in order to avoid creating greater risks for public health. Faced with the dilemma of reducing waste in favor of the circular economy or increasing it in favor of the precaution perspective, the life cycle approach can be the keystone. This is what is highlighted by the critical review of recent scientific literature inherent of themes “circular economy” and “precaution” in “sanitary waste management” through the “life cycle assessment”. From the literature analysis it is possible to identify the main environmental impacts associated with sanitary waste, the most common treatment options, and the environmental benefits derived by their recycling. Results demonstrate that environmental impact evaluation through the entire life cycle of sanitary waste can be resolutive to understand if and how reduction or reuse or recycling is environmentally convenient rather than replacement of sanitary materials and products.

The research conclusions can support decision making in implementing more effective strategies to choose the best compromise between precaution and minimization about sanitary waste, to safeguard the health both of environment, workers and citizens, pursuing at the same time the SDGs “sustainable cities and communities” and “good health”.

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Transitioning to a regional circular economy: exploring stakeholder perspectives in North Humberside, England and Styria, Austria.

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Abstract

Resource security, environmental and economic benefits which may stem from a circular economy are attracting significant interest from policy and other stakeholders at the regional scale. Previous research in the area of industrial symbiosis suggests that the role of the region is likely to be an important scale for fostering collaborative resource efficiency initiatives. This research critically analyses the interplay between firms and local agencies, in order to understand the influences on transitioning to a circular economy within a particular locality and thereby addresses the spatial distribution of benefits from a circular economy. This paper asks how do the priorities and values of companies compare to aspirations of local public agencies in terms of circular economy development, with a particular focus on the local region? We explore findings of empirical research focusing on both Hull (England) and Graz (Austria) on developing a circular economy in medium sized industrial cities. Notably, the borders of cities are porous and include the surrounding regions, where many organisations are based. Both regions appear to be on a transition to cleaner forms of production, as illustrated by the 'Energy Estuary' in Hull and the 'Green Tech Valley' in Graz. Semi-structured interviews were undertaken (online) with policymakers across various scales and businesses located in the region of North Humberside and Styria to explore CE initiatives from multiple stakeholder perspectives. Initial findings suggest there are divergent views on developing circular economy activities between local stakeholders. Local policy sees the circular economy as a way to improve the economic and environmental performance of the region. While business seek to foster circular economy initiatives between supply chain partners, who tend to be globally distributed. This is likely to raise operational challenges for developing regional level circular economy collaborations. More work is needed to ensure policy and business interests are better aligned when fostering circular economy initiatives at the regional level, in order to promote prosperous communities.

Key words: Circular Economy, Resource Efficiency, Supply Chains, Regional Development, Economic Development.

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Recovery of Sn, W, Ta and Li from tailings as an example of sustainable mining

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Abstract

Recovery of Sn, W, Ta and Li from tailings as an example of sustainable mining

Metal mining processes may cause changes in environment, freshwater availability, soil degradation and water pollution with severe consequences for human health and biodiversity. Due to the growing ecological awareness and care for the environment, entities involved in the extraction of minerals are taking more and more actions to reduce the negative impact on the environment during their operations.

In this work main focus is on mining of tantalum, tungsten, tin, lithium in European union countries from primary resources and tailings in Europe. These metals are critical raw materials for EU and they are essential in the energy and digital transformation. They are used, among others, in the construction of renewable energy technologies, which seem to be environmentally friendly. However, if their extraction and reprocessing will entail a large negative impact on the environment, their eco-friendliness may be questioned. If they are not extracted and used sustainably, we would just transfer the climate pollution to the air, soil and water and our efforts to make the planet cleaner turn out to be ineffective. Therefore, some new mining strategies are required.

To ensure the increasing demand for minerals in the following years, mining companies are using new digital tools such as multiscale modelling and simulation to develop environmentally sustainable processes. The challenge for mining companies, is to produce more minerals at lower cost and with lower impacts and the highest safety. There are many startups and companies that strive to move the science forward and develop a novel extraction and process technologies for lithium and other metals. Moreover recovery of these metals from old tailings are analysed in EU projects i.e. MSP REFRAM or the ProMine Project.

A new shift from fossil fuel to renewable energy sources, technological development and the accompanying increased metal demand is a big challenge, but it triggers new opportunities and a large investment into R&D in order to search new solutions how lower costs, increase efficiency, decrease mineral consumption and reduce the negative effects to the environment through land conservation and reduced emissions.

It is also important to emphasize that activities related to sustainable metal mining fit perfectly into the system of the circular economy (CE), which is currently being implemented throughout Europe. The European Commission (EC) is currently placing great emphasis on the development of this topic. This is an important aspect of the analysis, as the EC indicates that with a new industrial strategy, a transformation leading to climate neutrality can replace the current dependence on fossil fuels with a

dependence on raw materials. What is also worth emphasizing is the fact that activities in line with the concept of CE are supported by the EC through financial support in research and development projects.

Acknowledgements: This paper is support by EIT Raw Materials, iTARG3T (Innovative targeting & processing of W-Sn-Ta-Li ores: towards EU's self-supply) project, project number 18036.

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Agricultural resources and transformation pathways, a dynamic route to wealth and circular economy.

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Abstract

Agricultural resources and transformation pathways present a dynamic route to wealth and circular economy. Yet, it remains one of the major challenges for sustainability owing to neglect, ignorance and under-utilisation. In Nigeria, agriculture is a major contributor to environmental pollution and deforestation. Chemicals used in production of fertilisers affect the environment. Expansion of farmlands result in deforestation. Both processes affect life on land and below the soil. Apart from crop farming, some people undertake livestock farming. Wastes from such activities are dumped in places that result in pollution and risk to human health. How may we turn the situation around to enable us take advantage of the huge potential of Agricultural resources and transformation pathways?

This paper is primarily motivated by high level of poverty, hunger, unhealthy living and unequitable quality education faced by young people in Africa. And despite opportunities offered by agricultural resources. Agricultural resources such as land, water, equipment, manure processing, animal diversity, vegetative cover, renewable energy sources, climate and ecosystem services and handling facilities that are supposed to contribute to the environmental and economic sustainability, in support of life on earth are underutilized and invariably contribute to environmental pollution and deforestation. The idea of circularity is missing in the ways majority of people approach farming, we have not taken agriculture as an integrated project where wastes from one sector are used as resources in the other sector. The idea of circularity provide a transformation pathways towards ensuring the agricultural activities aimed at ending hunger, do not destroy the environment. Also, it helps to use earth's resources judiciously guiding against waste. The data are derived from the results of observations and interviews, as well as visuals are used to map out agricultural resources and circularity.

This paper therefore presents findings on the review and analysis of Agricultural resources and transformation pathways as a means to end poverty in all its forms, end hunger, achieve food security and improved nutrition, ensure healthy lives and promote well-being for all and finally ensure an inclusive and equitable quality education and promote lifelong learning opportunities for all youths in Africa based on the idea of circularity built into consideration that will directly address global environment and are directly relevant to sustainable development goal indicator. 1:1, 2:2, 4:4, 5:5, and 6:6. The conclusions of this paper are: (i) full utilization of agricultural resources (ii) zero tolerance for waste i.e. all waster should be recycled. Finally, Agriculture is a major sector towards achieving economic, social and environmental sustainability.

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Waste Governance in light of Actor Network Theory: The case of Zero Waste Institute Brazil

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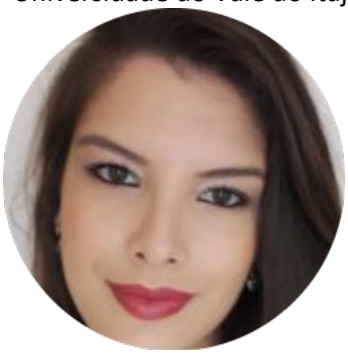

Msc Karolina Gomes

Abstract

Issues related to waste management depend on all levels of society to have effective governance. The joint action of governments, municipalities, companies, civil organizations, and consumers must be aimed at in order that long-term results are met. Therefore, knowing the role and importance of each of these actors, the Zero Waste Institute Brazil (Instituto Lixo Zero Brasil - ILZB) appears in Brazil as a non-governmental institution that intends to form a coalition among all fronts with the objective of making them aware so that they participate in the change for a society with less garbage and better use of waste. This article analyzes ILZB from the perspective of Network Theory and describes how symbiosis works among all the actors involved with the Zero Waste movement. Thus, it is intended to extend the dissemination of the concept of waste reduction in a consolidated model to more actors in Brazil and other countries, through a case study. One of ILZB's main activities is to mobilize ambassadors in all states of Brazil who are agents of replication of the Lixo Zero concept, through a social mobilization methodology whose form takes the form of interventions and events to mobilize various actors and sectors of society. Other international initiatives already point out that working for Zero Waste in the industry requires a network approach, and everyone involved must aspire to a common vision to achieve it, making the best use of a range of existing prevention approaches, tools, and technologies waste and develop new ones to make improvements to the entire system.

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Scenarios of the energy transition in Poland towards circular economy – case of the photovoltaic sector

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Abstract

The photovoltaic (PV) sector is constantly developing, which is proven by large-scale adoption of photovoltaic modules. This trend will continue as we strive for the decarbonization of the energy system, which is supported by a circular economy (CE) concept that aims to increase resource efficiency and reduce waste generation. Energy transition to renewables is associated with some changes in patterns of material use. Low-carbon energy technologies, including PV, even though they do not use primary raw materials for operation are significantly more metal intensive than conventional technologies, which mostly depend on fossil fuels. Therefore, the transition to a non-fossil energy system would require the access to a wide range of metals, which resources are limited. What is more, the PV modules have a limited lifetime, thus the volumes of end-of-life (EoL) panels will increase in the near future. This raises concerns how ensure secure supply of materials and how to manage such a large amount of wastes, which are full of valuable materials that can be recovered and reused as secondary material. Therefore, there will be a need to implement strategies to close the loop starting from the beginning of the product development process up to the proper „waste" utilization and recycling of materials used in the production of such a system. The effectiveness of these activities will determine how sustainable solar PV technology would be within its whole life cycle. Starting from the delivery of raw materials and production stage, through service life and decommissioning with activities related to the disposal. Recycling of waste materials is a crucial element of these strategies, because in this way it is possible to recover valuable materials and prevent the release of harmful substances. However, the circular economy is not only about end-of-life modules and waste management. The circular economy concept gives a lot of opportunities for government, industry, businesses as well as for consumers to rethink the traditional model of consumption and change business models in order to obtain better economic, environmental and social outcomes. This work investigates the material flows within the PV industry and the recovery potential of valuable fractions through recycling and recovery, highlighting the strengths and weaknesses of the transition to a circular economy. It focuses on determining the demand for materials for the production of photovoltaic modules based on different scenarios, taking into account policies and requirements in terms of the energy transition, supported by a circular economy that should be implemented to cover the demand for solar electricity until 2100. This has resulted in the definition of bottlenecks in PV supply chain, taking into account the availability of metals, which resources are limited.

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Developing a holistic and panoptic framework for analysing circular economy

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Abstract

Circular economy (CE) has become fundamental in accelerating the efforts towards sustainability. CE was first proposed by Leontief in 1928, as way to understand causal relationships in the economic dimension. Recently, CE has mainly focused on environmental issues i.e. closing the material cycle through recovery (3Rs to 9Rs). Literature on this topic has increased over time and a number of bibliometric studies have been carried out. However, the majority of these studies used bibliometric indicators focusing on descriptive analyses of scientific outputs, particularly on yearly trend, keyword co-occurrence, and/or coauthorship.

This article adopts a combination of a nested approach, with grounded theory's constant comparative analysis as the overall analysis method and a bibliometric analysis within it. A total of 4,045 documents from CE during the period 1999–2019 were retrieved and analysed against an initial framework composed by different levels (economic issues, recovery and CE levels). The iterative process helped to improve the economic category, changing the level category into a scope one, and adding two new categories (scientific collaboration and themes). The results obtained were integrated to propose the holistic and panoptic framework for analysing circular economy for analysing circular economy, which consists of the integration and interconnection of three main components: (1) economy, with cost, productivity, distribution, value creation, and value added; (2) recovery loops from the 3Rs to the 9Rs; and (3) the scope of CE activities, including assessment, review, individual, organisation, process, sector, cluster, and country/region. In addition, assessment and review are transversal categories within scope.

This paper provides depth to the understanding of the economic, environmental and scope interlinkages of CE literature, so as to better position the CE theory and practice and to detect gaps that should be addressed. Moreover, the study highlights the importance for CE to achieve its potential in helping societies become more sustainable. Thus, theory and practice must take a holistic approach that integrates the economic and environmental dimensions, the scope of CE, and collaboration.

This research is linked to SDG12 Responsible Production and Consumption, 12.5 (By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse); target 12.6 (Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle), and 12.a (Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production).

This study contributes to accelerating progress towards SDGs, as more research of CE is needed to examine how corporations can enhance their adaptive capacity, so they can meet sustainability and their company's needs in times of crisis.

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Examining the integration of Circular Economy-based Practices in Central Public Sector Organisations' Activities

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Abstract

The Circular Economy (CE) is generally examined as an opportunity to transform the current unsustainable linear economic system and to tackle its environmental and social challenges by redesigning the way organisations provide goods and services, rethinking how society consumes and use those resources in a way that maintains their value at the highest level for as long as possible in the economy. In this context, the public sector is mostly recognized as a significant actor of the CE transition having the potential to enable the implementation of a sustainable CE through governmental interventions and policy-making initiatives impacting both companies and citizens. However, there is a lack of studies considering the public sector at organisational level and how CE principles are and can be applied in the operational and strategic activities of public sector organisations. Moreover, survey studies are still underexplored as a methodology in CE research and especially at the micro level of organisations. In order to fill those research gaps, the aim of this study is to characterize the current state of engagement of central public sector organisations in CE practices and strategies at organisational level. In order to fulfil this aim, this research is taking a case study approach by sending an online questionnaire survey to the organisations pertaining to the Portuguese Central Public Administration. Descriptive statistics and frequency analysis are used to evaluate the level of engagement of central public sector organisations in an array of CE practices and strategies. Applied to a public sector context, this questionnaire survey has the potential to bring awareness to stakeholders and practitioners working on sustainability and CE issues in public administration as well as to increase the understanding of how the public sector is taking up the concept internally. The complete results of this research are ongoing and forthcoming.

The proposed abstract contributes to "SDG12+Targets:12.2; 12.5; 12.7"; SDG16+Target:16.6". The proposed abstract contributes to the topic of the conference in the sense that since the beginning of the current crises due to the global pandemic, the importance of the leadership role of governments has been especially highlighted. As having the moral duty to lead by example, public institutions should aim to be efficient, accountable and transparent organisations. In particular, the public sector should more than ever strive to achieve and plan for the sustainable management and efficient use of their resources namely through innovative changes for sustainable public procurement procedures. The results obtained will support public sector organisations in accelerating their transition towards more sustainable and circular practices.

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Network orchestration in sustainability transitions – first insights from the circular economy transition in the Dutch textile sector

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Abstract

For the global fashion system to become more sustainable and to make better use of this planet's finite resources, a sustainability transition is necessary, which includes the incorporation of circular economy principles in production and consumption patterns. Sustainability transitions require deeply rooted changes of socio-technical systems, which includes changes in artefacts, technology, regulations, production practices and user behavior. In addition to developing products and technologies that enable a more sustainable and circular use of resources, actors need to strive for socio-cultural changes, such as user perception and behavior, as well as creating markets.

A wide range of actors is necessary to achieve these changes, such as government actors, companies, research institutions, NGOs and user groups. In different constellations, these actors collaborate in 'system-building networks' to achieve transition goals. Such goals could for instance be achieving enabling changes in regulation, co-creation of products, knowledge development, infrastructure development or market creation through innovative business-models or procurement policies.

System-building networks are managed or steered by so-called 'network orchestrators'. Network orchestrators assemble networks and manage their growth toward network-level collective gains. Because the outcome of a sustainability transition is often uncertain, network orchestrators need to navigate their networks in a changing environment towards evolving or changing goals. They try to align the goals of their network members in order to bundle efforts toward the transition goals they are working towards.

In this paper, we study the transition to circularity in the Dutch textile sector. We focus on the roles and functions of network orchestrators in the transition towards a circular textile industry. We use an embedded case study method. Four key networks in the Dutch fashion industry are studied, which are interlinked by their actors and their common vision to make the Dutch textile sector circular.

Preliminary findings are that system-building networks are orchestrated by not one, but two or more actors, which collaborate closely. There are several roles in network orchestration, and these can be distributed among several network actors. Examples of these roles are: Project manager, content driver, chairman, opinion leader, workshop facilitator, spokesperson.

Next to these roles, we also identified different functions that a network fulfills, for example knowledge exchange or coordination, business model development or connecting actors in the field. These functions are related to system-building goals, i.e. the networks fulfill a functionality in reaching certain

transition goals and thereby steering the sustainability transition in the textile sector. Our aim is to generate a typology of network orchestrator roles and connect these to network functions.

We contribute to the literature on network orchestration and the literature on sustainability transitions. Moreover, we generate insights for practitioners involved in circular economy transitions.

This paper is related to SDG 12, esp. 12.2. and 12.5. This contribution relates to the conference topic, because network orchestrators accelerate the progress toward SDGs by stimulating and enabling the transition to sustainable production and consumption patterns.

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Evolution of CE through IS in Spain: analysis of implementation strategies among different regions

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Abstract

For the past few years, industrial symbiosis (IS) and more recently the circular economy (CE) and have become key factors for the generation of tools that stimulate the different economic sectors to integrate sustainability within their operation and business models. The industrial symbiosis (IS) framework at its core refers to exchanging waste with a focus on industrial facilities that deal with managers and other stakeholders within the value chain. This means that IS in the CE may be seen as a business model innovation to gain value from turning waste into valuable resource. These key factors are oriented to maintain the value of their resources along their value chain, so that a transition from a linear production system to circular systems could be achieved. This transition to a circular economy is also the goal of the European Commission's Green Deal
as it will result in the increase of Europe's economic competitiveness, sustainability, resource efficiency and resource security. In some cases, CE has been implemented based on concepts such as the recovery and reintroduction of secondary materials in production and consumption activities in order to close the cycles and thus maintain the value of the materials. As part of the circular economy, industrial symbiosis is the way in which different industries cooperate for generation of networks in which those industries can work, exchange and share different resources in order to reduce the waste generated in each industry and add value to that resources.

In Spain, the development of these IS projects is becoming a priority for its autonomic communities which are developing plans and policies to help companies to recover their waste and secondary raw materials. Those projects are part of a broader circular strategy in the country, that has an objective of reduction of 30% the national consumption of materials in relation to GDP, taking as reference 2015 (España Circular 2030).

This document compares the situation of the IS projects in different autonomic Spanish communities. This analysis has been made by the investigation and identification of the projects conducted in each of the communities in order to identify the evolution from a linear to circular system through IS and how they have been integrated them within their regional strategies, its alignment with European Union objectives and their commitment to a new economic system Also interviews with agents that participate in those projects where conducted in order to identify which aspects are crucial within the development of project and what is their perspective regarding changing to a new economic system and its future challenges. According to the information gathered, this paper shows the actual situation of the autonomic Spanish communities and its principal characteristics regarding the circular economy and how they are made within the territory. The research shows how Spain is responding towards its responsibility to a sustainable economy.

SDG objectives and targets:
1. Ensure sustainable consumption and production patterns 12.5 & 12.7
2. Strengthen the means of implementation and revitalize the global partnership for sustainable development 17.6

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MEASURING CIRCULARITY THROUGH LCA AND CE INDICATORS: A CASE OF AN ELECTRONIC EQUIPMENT

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Abstract

During the last years, the concept of Circular Economy (CE) has become of crucial interest in public policies, business strategies and among the scientific community, due to the need of moving from a linear economy towards a system in which reducing resources use and considering wastes as valuable products is a priority. Nevertheless, among the international scientific literature focused on the measurement of CE at micro-level and, in particular, product level, there are contrasting ideas about the use of proper methods and indicators to be adopted for assessing circularity. The sector related to the electronics and electronical equipment is continuously focusing on producing and providing products characterized by durable materials, such as plastics and metals. Despite this, the disposal of electronical products, without following the bases of the CE concept, contributes to a higher amount of energy and resources used as well as to the loss of their embodied value. In this context, the early-stage study here presented is aimed to evaluate the circularity performance of a switchboard used for controlling an electric pump. In particular, the analysis is carried out by applying both, the Life Cycle Assessment (LCA) method and specific CE indicators commonly applied for assessing circularity at micro-level. In addition, the suitability of such method and indicators for evaluating CE performance of electronical equipment is also evaluated. The LCA is a standardized method that allows assessing the potential environmental impacts of a process, product, or service by following a life cycle approach, from raw materials extraction to the end of life. The assessment of product's circularity through LCA can be put in practice by including the so-called avoided productions in the analysis. The inclusion of the avoided products means evaluating the environmental benefits due to the substitution of a conventional product with an alternative one that satisfy the same function. Regarding the CE indicators, the analysis is focused on the application of the Material Circularity Indicator (MCI) developed by the Ellen MacArthur Foundation (EMF), Material Reutilization Score (MRS) provided by the Cradle-to-Cradle Products Innovation Institute (C2C) and Circular Transition Indicators (CTI) proposed by the World Business Council for Sustainable Development (WBCSD). The data adopted for carrying out the analysis and related to the production stage and transport activities of the switchboard ad its components have been directly obtained through questionnaires submitted to a company operating in Sicily (Italy). The raw materials used in the production process are from both virgin and recycled sources. On the contrary, data related to the end-of-life stage has been obtained by means of scientific literature and assumptions. The expected results will firstly allow to evaluate the environmental and circularity performance of the product object of the analysis, secondly, to highlight the usefulness of the LCA method in measuring CE strategies, and, thirdly, to provide a critical discussion related to the combined application of the LCA method and CE indicators.

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Analyzing and contrasting the discourses and policies of the circular economy in different European cities

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Abstract

The Circular Economy (CE) concept has recently become a popular discourse in the public private, academic and social sectors alike. However, the concept remains contested, often unclear and ill-defined, and its practical implementation remains a large societal challenge. Cities and urban areas play a central role in the CE as they are directly in charge of key sustainability policies such as waste management, water provision, transportation, housing, industrial development and energy and infrastructure provision. Urban circular economy policies thus have a key impact on the metabolic stocks and flows of resources, waste, capital, labor, knowledge, energy and materials that societies process (the so-called urban metabolism). Considering that urban areas currently consume 60–80% of natural resources, produce 50% of global waste and 75% of greenhouse gas emissions, CE policies at the city level are crucial to address the manifold social-ecological challenges of the 21st century. In this context, European cities have developed a wide diversity of new CE policies and projects, with many different and often contrasting CE discourses and perspectives. Yet these initiatives remain poorly researched, compared and critically analyzed. This research thus aims to address this research gap by analyzing and comparing the policies and discourses of the CE in different European cities in order to draw key lessons and recommendations. It does so by conducting a critical literature review on CE policies in cities, as well as a comparative policy and discourse analysis of city level CE plans and strategies through document analysis and interviews with various societal actors. The literature review, case-selection and data collection will be finalized by June 2021. At the ISDRS conference first findings will be reported. We expect that this research will help improve the understanding of CE implementation at the city scale and lead to valuable insights for academics and practitioners alike.

Keywords:

Circular economy, urban planning, circular society, policy analysis, discourse analysis, urban metabolism, degrowth, sustainability.

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Keeping plastics packaging in the loop – policies and supply chain structures

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Abstract

Among the many effects of the COVID19 pandemic, increasing use and appreciation of plastics packaging (e.g. due to hygienic aspects) has been observed. This trend is currently reinforcing the challenges for EU member states to reach the European Commission's plastics packaging waste treatment targets, which are set to a recycling rate of 50% by 2025, whereby material is considered recycled as soon as it enters an effective material recycling process and if the material is recycled back into plastic. At the same time, for low-value products such as plastic packaging, little economic incentive to promote recycling exists. Therefore, primary plastics are usually preferred over recycled ones. It is thus the aim of this study to examine external factors, such as political factors or power structures, since they are of particular importance in systems that favour the use of primary materials from an economic perspective.

To do so, the study uses a two-step real-time Delphi method with experts (35 in round 1, 20 in round 2) along the supply chain of plastics packaging. The real-time Delphi method is an adaptation of the conventional Delphi method, which allows for real-time and dynamic interaction between participants. While in the first round, different factors were collected and rated, the second round served as prioritization and confirmation.

Results suggest that policy support plays a crucial role in the plastic packaging sector. Specifically, standardization and harmonization, tax policy and fees, extended producer responsibility and deposit schemes, as well as different quotas or bans are seen as potential leverage points towards a more efficient circular plastic packaging economy. Respondents also provided specific suggestions for each category. For example, the intended harmonization of extended producer responsibility schemes is perceived as an important legislative factor, which – if combined with ecomodulation of fees – can foster a circular transition. Structural changes could be accompanied by further monetary (dis-)incentives (such as higher costs for waste incineration or an increased CO_2-tax for raw oil) or quotas (such as minimum recycled content quota, or incineration ban). The results furthermore revealed insights on power structures within the plastic packaging supply chain. Downstream actors such as waste separators or recyclers do, despite their importance for a circular plastic packaging economy, have only limited decision-making power within the supply chain. Therefore, a more intensive exchange between those downstream and upstream actors, such as plastics converters and brands, is encouraged. Additionally, it was found that practitioners views on circular economy options other than recycling remain limited. The results of this study provide useful insights for the research community (e.g. use of the real-time Delphi method, policy development), as well as for policymakers and practitioners.

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Are food production innovations always sustainable? An exploratory analysis of aquaponic systems

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Abstract

The continuous increase in food demand related to population growth, together with the inefficient use of resources for food production, requires a transition and acceleration progress towards Sustainable Development Goals, especially in time of crisis. The agri-food system is facing global environmental, social, and economic challenges that require innovative solutions. Aquaculture systems have become imperative because fish demand is rapidly increasing. Since they generate high amounts of nitrogenic and phosphoric wastewater, innovative pollutants abatement systems are needed.

Aquaponics is one of them and consists of a food production system that, integrating hydroponic production and aquaculture, uses nutrient-rich water from fish culture to irrigate and fertilize vegetables.

Due to its characteristics, aquaponics is therefore a sustainable food production system with less dependence on energy and material inputs compared to conventional production systems; specifically, this technology involves the cultivation of vegetables without the use of soil and with a significant decrease in water consumption.

The main aim of this study is to assess if aquaponics is able to increase the overall economic value of both aquaculture and hydroponics products, while closing the food-water-energy cycle within a circular bio-based economy. Numerous different fish species have been reported to be produced in commercial aquaponics in Europe, but feasibility on an industrial or small scale and its competitive advantage is still debated.

This study is based on an exploratory methodology to assess the sustainability of aquaponics systems compared to the traditional aquaculture and agriculture systems, in relation to specific fish and crops and to examine whether economic aspects may facilitate or humper the further development of aquaponics as a technology for sustainable food production. We will also discuss possible scenarios emerging by the state of implementation of these food production systems.

Aquaponics research could be surely considered part of a sustainability strategy. Considering that aquaponics relaxes the pressure on natural resources, if government implemented effective policies to ensure large-scale plants, a real and eco-sustainable access to food could be achieved. Aquaponics

systems, however, should be monitored and submitted to strong regulations regarding the food safety operational risks.

The study represents an original contribution to understand if aquaponics is a change driver in itself strong enough to bring about a radical shift towards responsible consumption and production (SDG 12), or if it is able to generate positive effects only in particular context.

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Universities driving sustainability: Exploring pathways to a circular economy of plastics in a time of crisis

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Abstract

The Covid-19 crisis struck as universities and other organisations were responding to an international environmental crisis of plastic pollution. Concern for marine pollution amongst other impacts provoked both practical and research examinations of pathways to reducing plastic use. The emergence of a further crisis, with highly visible impacts (literally a matter of life and death), has sparked a renaissance for single-use plastics. However, when the Covid-19 crisis arose, the environmental crisis was not resolved and the need for sustainable change remains unchanged. What are the implications for a university campus that went to great lengths to reduce plastic use on campus in the last years?

The study explores the constitution, drivers and challenges of a circular transition on campus. Further, the research examines what and how practices got interrupted by the pandemic, how the campus recovers, and sustainability efforts resumed. In the research project, the University of Hull is used as case study to explore social practices on campus concerning sustainability and circular economy. The research project builds on practice theory and ethnographic research methods. Observation methods on campus are utilized, interviews and surveys conducted with the university population and experts and affiliated stakeholders of the university are included in the data collection.

First findings at the University of Hull show that established environmental practices introduced by plastics initiatives in recent years gave way to the implementation of new hygiene measures. At the

moment it seems that the environmental focus is surpassed and incidental next to the immediate health concerns.

The research project relates to the implementation of SDGs **Target 11.6** 'By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management' and **Target 12.5** 'By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse. The research project relates to the Conference's theme by exploring progress towards sustainable development in times of crisis in the context of university campuses.

Keywords: Circular economy, plastics, campus sustainability, social practice theory

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Role of Green Innovative Projects in Achieving the Sustainable Development Goals in Nigeria

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Abstract

The role of youths in providing sustainable solutions and the driving sustainable development initiatives in Nigeria cannot be overemphasised. The intellectual and youthful energy of these young people when harnessed can create novel and innovative goods, products, systems and services that can be competitively priced to meet and satisfy societal needs through restorative design; promotes the use of renewable energy, eliminates the use of toxic chemicals, maximises wastes through the superior design of materials, products, systems, and business models and achieving the global goals. In the spirit of leaving no one behind, it is apposite to know that everyone has the duty of providing sustainable solutions to the protracted sustainability challenges in Nigeria.

The Green Innovative Challenge covers a wide variety of undertakings that mostly focused on rethink, refuse, reduce, repurpose, reuse and recycle of waste among others. Furthermore, the high quality of life and liveability are demanded in cities through rapid urbanization and massive population growth has led to divergent challenges such as the increase in the poverty rate, the incidence of disease outbreak as a result of indiscriminate waste management, economic hardship and unemployment, slum residency, social inequality and instability, incessant crimes environmental and climate change challenges among others which threaten global green growth and green economy. It is, therefore, imperative to raise green innovative champions to tackle environmental challenges and create innovative solutions to drive sustainable development and green economy which is the core of the Sustainable Development Goals (SDGs).

Therefore, the green projects aim at entrenching the culture of caring for the environment in the students, and also to promote youth entrepreneurship along with green businesses.

Keywords:

Green business, green growth and green economy, sustainability, Sustainable Development Goals (SDGs) waste management

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Pathways of the circular economy in Luxembourg: Towards business as usual or inclusiveness?

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Abstract

The circular economy is one of the currently discussed frameworks in research to achieve sustainable development. Despite many theoretical drawbacks, the circular economy serves multiple governments in Europe and elsewhere as an umbrella concept for economic developments that are people, planet, and profit friendly. In Luxembourg, the circular economy was qualitatively analysed over the past four years from multiple perspectives.

Based on 75 exploratory and semi-structured interviews, participation in local events and extensive documentary material, the analysis reveals three main interpretations.

First, the circular economy in Luxembourg follows an entrepreneurial-functional approach, driven by economic interests. Second, the circular economy's understanding as a tool towards sustainable development through technology, digitalisation, and connectivity is path-dependent and fits well with other prominent buzzwords as green growth, eco-innovation, cleantech, smart buildings, smart cities. Third, the implementation of circular economy projects are public-private-partnerships that testify how blurred the lines between the civil society, the state, and the private sector are.

These findings conclude that the circular economy is just another buzzword-concept that serves policy in Luxembourg to align its economic diversification policy. For the ISDRS 2021 conference presentation, new business models based on the product as a service principle will serve as examples to illustrate ongoing transitions towards a circular economy in Luxembourg. So far, implementations that are already in operation mainly focus on the transportation sector and provide sharing, pooling or pay per use solutions. However, some authors suggest complementing Luxembourg's strategy towards a circular economy with rationales from, e.g. the post-growth/degrowth debates to comply more comprehensively with the sustainable development goals.

The contribution will discuss how alternative approaches such as the concept of sufficiency or the sharing economy could contribute to an inclusive circular economy in Luxembourg. Different scenarios will present and discuss prospects of the circular economy's future, considering the viewpoints highlighted by the interview data and other studies.

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Synergies and trade-offs between European bioeconomy strategies and Sustainable Development Goals (SDGs): Development of a multi-criteria decision analysis framework

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Abstract

An increasing amount of countries in the European Union (EU) have now commenced the implementation of bioeconomy strategies and documented these efforts in their national strategy papers. The bioeconomy is further at the center of European sustainable development strategies and contributes to many Sustainable Development Goals (SDGs). Due to the integrated nature of SDGs and the associated targets, progress towards one target is also linked through complex feedback loops to other targets. We outline which SDGs and targets need to be prioritized when implementing a bioeconomy according to EU policy concepts. We, therefore, apply a multi-criteria analysis decision framework that assesses interlinkages between SDGs and bioeconomy indicators.

The methodological approach is a combination of recent publications and guidelines on SDG and bioeconomy implementations. We apply a range of complementary qualitative and quantitative methods within the assessment framework, including baseline assessment, benchmarking, correlation analyses, literature review, network analyses, and policy gap analysis. For our data-driven analyses, we develop a unified SDG database and fill the *FAO Bioeconomy indicator framework* with data from various official sources. On the one hand, our results will add to the debate on how bioeconomy implementation strategies in the EU benefit or hinder the fulfillment of the 2030 Agenda and where prioritization is needed. And on the other hand, how the approach to achieve the SDGs by 2030 in Europe can contribute to achieving EU policy bioeconomy priorities.

Since the world is currently no on track to meet the SDGs until 2030, bioeconomy strategies can function as enablers to drive for rapid progress. However, an unsustainable bioeconomy can certainly hinder those synergistic developments. Therefore, we detect those bioeconomy and sustainable development strategies that cause trade-offs and require revision. This creates intervention points for a successful implementation of the bioeconomy and 2030 Agenda in the EU.

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Circular economy as a postulate of non-financial reporting in the SME sector, a way to accelerate the implementation of SGDs

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Abstract

In accordance with the applicable legal regulations, the disclosure of non-financial information is an obligation imposed on public interest entities and large companies (Directive 2014/95 / EU). This is primarily about key non-financial performance indicators related to the company's operations and information on employee issues and the natural environment. In the course of their activities, the above-mentioned entities cooperate with enterprises from the SME sector, which means that it is not possible to effectively implement the applicable regulations on non-financial reporting without involving micro, small and medium-sized enterprises in this process.

The only solution that makes it possible to implement the objectives underlying the above-mentioned legal regulations is the requirement that non-financial reporting should cover the entire production chain, in line with the concept of a circular economy that takes into account all stages of the product life cycle, starting from its design, through production, consumption, collection. waste until its management. The aim of the study is to identify the need to implement non-financial reporting in the reporting of micro, small and medium-sized enterprises in the aspect of the circular economy.

The research method used was the recognition of regulations in the field of non-financial reporting and a review of domestic and foreign literature (IFAC, 2017; Thompson P., 2019; Weber, T., Stuchtey, M. (Hrsg.), 2019; GRI, IOE, , Big Impact - Making the Case for SME Sustainability Reporting; Deloitte, 2018). It also presents the main conclusions of a report published by the European Federation of Accountants and Auditors for SMEs (EFAA) on the study of non-financial reporting requirements for the SME sector in Europe (EFAA, Survay, 2018).

The summary of the considerations are recommendations for micro, small and medium-sized enterprises and the identification of the need to develop research in this area, taking into account the fact that the SME sector has a great influence on the implementation of sustainable development goals in large entities. The postulate of non-financial reporting in the SME sector, in line with the assumptions of the circular economy, may be an important and effective action supporting acceleration of the implementation of SGDs.

Full papers

Quality in Circular Economy: Consumer and the perceived value

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Abstract

The concept of Circular Economy has become a widely used concept among scholars and practitioners with great variety of definitions, depending on the sector or field, which it refers. In the latest literature reviews Circular Economy has been defined as a paradigm of sustainability, which aims to replace the concept of "end-of-life" for the concept that encompasses the 4R-Framework (reduce, reuse, recycle and recover) and all its variants, operating at different levels such as micro, meso or macro, with the ultimate goal of achieving sustainable development, which at the same time brings environmental, economic and social improvement to current and future generations (Kirchherr et al., 2017). However, in order to achieve this new paradigm, circular economy needs the implication and cooperation of consumers. Consumers need to be involved throughout the value chain, being aware that circular products have higher value that those produced in linear systems, even when it is made from secondary materials. Based on this concept, the aim of this article is to analyse the perception of quality of consumers in the products/services offered through the Circular Economy. Not in a comparative way between a product/service obtained in a circular way versus the same obtained in a linear system, but as the value perceived by the consumer. Therefore, a review of the literature of three key concepts will be carried out: Circular Economy, quality and consumer, in order to obtain a clear idea of the quality perceived by the consumer and relate it directly to the perceived value. Once reviewed, it is planned to give rise to the quality concept as a perceived value in the field of the circular economy and thus be able to develop this concept and its relevance within the paradigm of the circular economy. Regarding the SDG approved by the United Nations, this paper is related to the SDG nr. 12 Responsible Consumption and Production by target 12.5 and nr. 13 Climate Action by target 13.3. The article fits with the topic of the conference "Accelerating progress towards the SDGs in times of crisis" as it aims to develop knowledge and increase awareness of citizens, as agents-consumers, can promote more responsible and sustainable consumption and production.

Keywords: Circular Economy, quality, consumer, perceived value, literature review.

1. Introduction

The concept of Circular Economy (CE) has received an increasing attention in recent years. Up to the present, the best-known economic model is the linear model, based on continuous growth and high use of resources, also known as "take, make and dispose" (Kirchherr et al., 2017; Ness, 2008). Therefore, it is a model based on economic development, where neither the recuperation of materials nor the production respectful with environment or people, among others, has been taken into account (Arnedo-Lasheras et al., 2020). This is why the linear model is reaching its limits of physical capacity. For that reason, practitioners and academics are looking for a new concept to redefine economic growth, emphasizing the benefits that it can generate to society, dissociating it from the consumption of finite resources and waste.

The paradigm of the circular economy has been widely studied and analysed by scholar and practitioners, as a way to increase sustainability in the economic system (Elia et al., 2017; Urbinati et al., 2017). One of the most known definitions of CE was given by Geissdoerfer et al. (2017), who state that CE is a regenerative system, in which resource input and waste, emissions, and energy leakage are minimized by slowing, closing and narrowing material and energy loops. This can be achieved through a design of maintenance, repair, reuse, remanufacturing, refurbishing and recycling. To this definition, Kirchherr et al. (2017) add that the different levels in which CE can be found are micro level, meso level and macro level. These levels exist with the single goal of fulfilling a sustainable development, creating environmental quality, economic prosperity and social equality, in order to benefit the current and future generations. However, in the last four years the concept has been highly analysed and studied (Bauwens et al., 2020; Katz-Gerro & López Sintas, 2019; Patwa et al., 2021; Prieto-Sandoval et al., 2018).

Although there is a high interest in this type of economy, there are some items that still lack research. One of those important and indispensable elements is the consumer. In relation to consumers, there is an interesting aspect to analyse and is the perceived quality of their purchase based on CE. Perceived quality is directly related to satisfaction, loyalty or even trust. Sweeney & Soutar (2001) state that the result from the perceived quality and the expected performance of products or services represents the quality value, or otherwise called, perceived value. According to Lee et al. (2021), the perceived value is positively related to the intention of purchase. In the case of the CE, which takes into account processes of recycling, reuse or refurbishment among others, this perceived value can derive from other factors.

The aim of this research is to fill the gap in the literature through a systematic literature review to understand the implication of the consumer in the CE and how the consumer perceived the value of CE products.

This paper is divided into five sections. Following this introduction, Section 2 describes the method for performing this review. Section 3 presents the results of the main findings. Section 4 discusses the main findings of the review. Finally, Section 5 presents the conclusions of this paper.

2. Methods

In this paper, a systematic literature review has been performed in order to provide a comprehensive overview of literature related to the topics mentioned in the first section. Systematic literature reviews can be classified in three different ways: domain-based, theory-based and method-based (Paul & Criado, 2020). In this case, we have followed a domain-based review, and specifically a hybrid review, based on the structured review and the bibliometric review (Paul & Criado, 2020). The main objective of performing a hybrid review is to be able to analyse the results from different perspectives, increasing the robustness of the data (Akhmedova et al., 2021).

To conduct the literature review, we followed the three stages state by Tranfield et al. (2003). These three indispensable stages when making a systematic literature review are: planification, conduction and reporting of the review. In the planification stage, we considered the keywords and prepared the structure of the review, allowing for a reliable database as Web of Science (WoS). In the conducting stage, we have identified and selected the studies; and finally in the reporting stage, which is presented in Section 3, we have incorporated the findings and the results according to our main objectives.

2.1. Stage I: Planning of the review

During this stage, we defined the topics and keywords in which we have focused our research. The keywords used are divided into 3 different main topics. The first keyword is “Circular Economy”, which is directly related to the main topic of this research. The second selection of the keywords has been done considering the “Consumer” concept; in this case it has been used a group of different keywords, or search terms, related to this topic and CE such as “sustain* consum*” or “green consum*”. And to end, the third group of keywords, or search terms, used is the one related to the quality and value, that we are trying to identify in CE models and industry. The search string used is showed in the Figure 1:

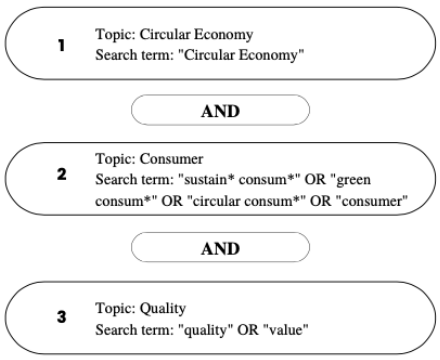

***Figure 1**. Search terms for search string*

To guarantee the reliability of our research, we have used the Web of Science database, which is the most well-known platform formed by a wide collection of bibliographic databases, citation and also references of scientific publication of any discipline of knowledge (Hirsch, 2005; Paul & Criado, 2020; Shepherd & Günter, 2010).

2.2. Stage II: Conducting of the review

Based on the search terms of Section 2.1., we identified the main relevant research using Web of Science. After taking into account only our research and area domain (Social Science and Business Economics) and considering peer-reviewed journals articles published until April 2021, the total number of papers identified under these criteria was 126. So as to limit the review process of publications, abstracts were manual-filtered using relevant keywords (“consumer preferences” OR “consumer acceptance” OR “consumer switching behaviour” OR “circular behaviour” OR “value creation” OR “consumer perception” OR “consumer attitudes” OR “environmental behaviour” OR “consumer decisions” OR “costumer role” OR “purchase intention”), which resulted in total 63 articles. After the manual supervision of the abstracts, the complete reading of the articles was carried out, removing a total of 12. This disposal was done due to the lack of direct relationship with consumer, quality and value. This is why the total number of articles reviewed has finally risen to 45. Figure 2 shows the process followed by PRISMA (Page et al., 2021).

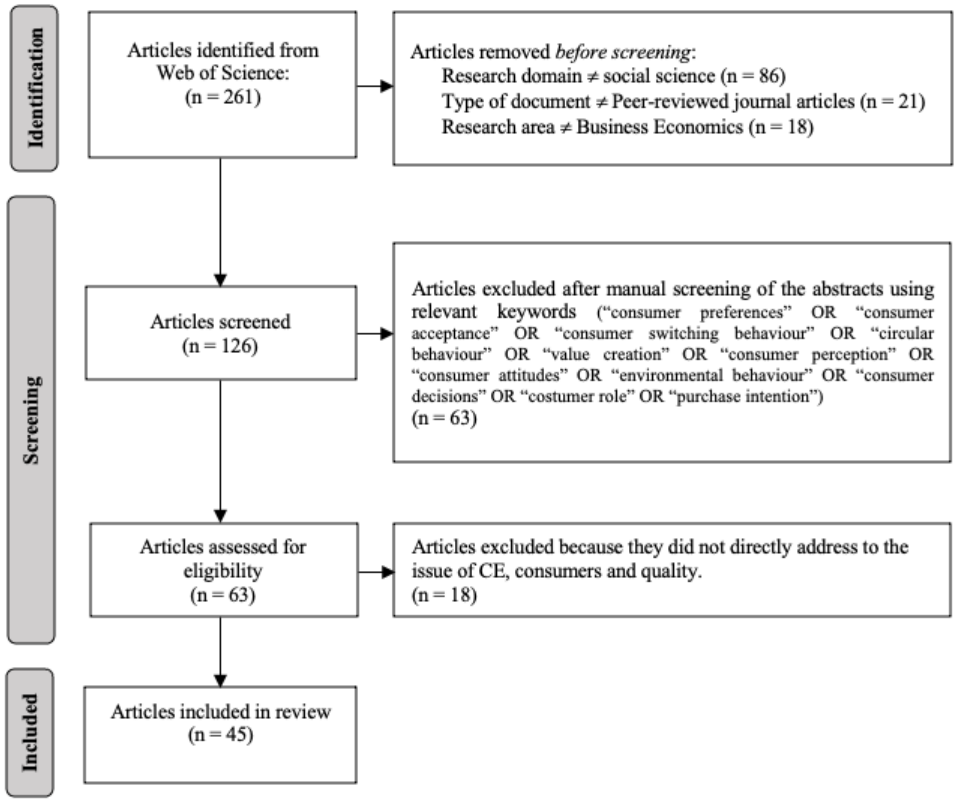

***Figure 2**. PRISMA flowchart*

3. Results

This section is divided into three different subsections. The first subsection is a descriptive analysis of the recollected data, the second one is regarding the results obtained from the systematic literature review regarding the consumer's implication in the CE and the last one regarding the consumer and the perceived value.

3.1. Descriptive analysis

The purpose of descriptive analysis is to give preliminary results about the data review. Regarding the Stage II: Conducting the review, a total of 45 publications have been taken into account. From these and as shown in Figure 3, the oldest publication was from 2016 and the most recent one is from January 2021. The 67% of the publications were published between 2019 and 2020, so it can be state that it is a new topic, susceptible to be analysed.

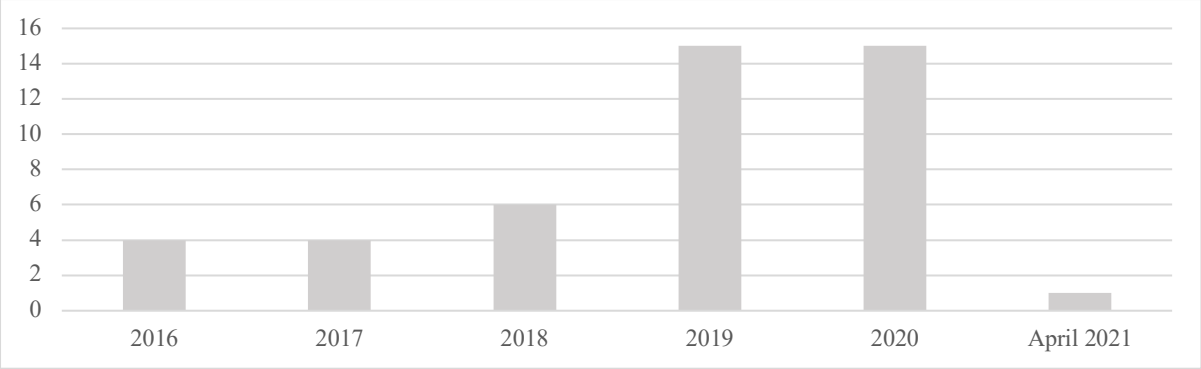

***Figure 3**. Total selected publications – by publication year*

Regarding the journals in which the selected papers have been published (Figure 4), the 49% of the publications come from four different journals: Journal of Cleaner Production (9), Sustainability (6), Management Decision (6) and Business Strategy and the Environment (4), which average of the Journal Impact Factor (5 years) is 4,849. As it can be seen, there are a huge variety of Journals due to the conceptual difference between the topics that we are analysing. The journal with more selected articles is Journal of Cleaner Production, which has an Impact Factor (5 years) of 7,491.

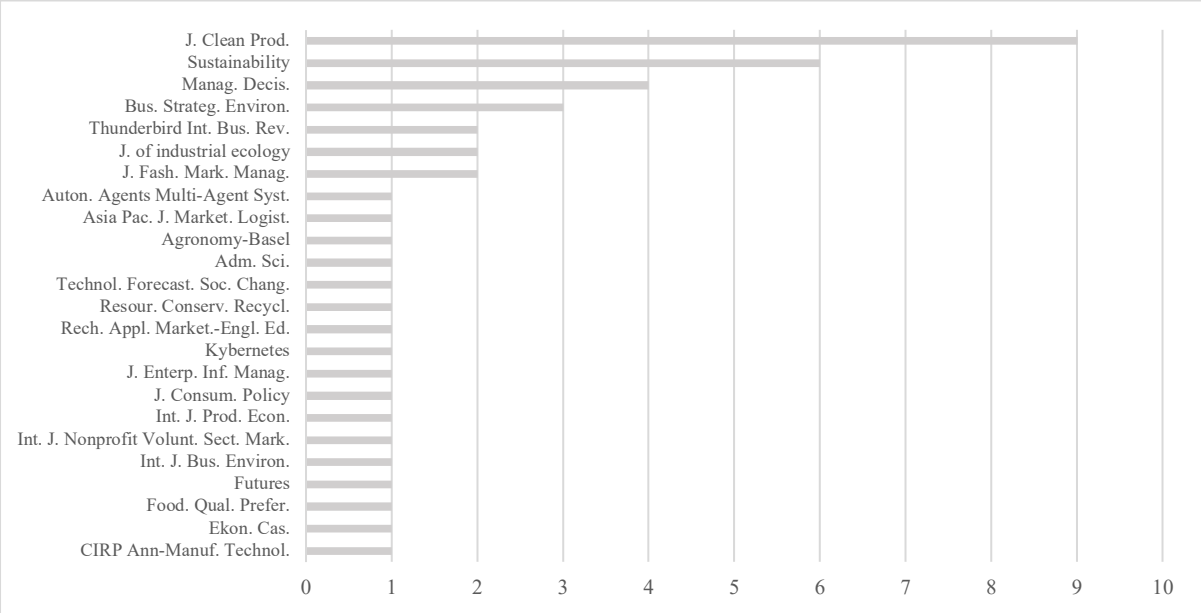

***Figure 4**. Total selected publications – by Journals*

Finally, and before entering into the content of the publications analysed, the descriptive analysis is complemented with a VOSViewer scrutiny. VOSViewer is an open-access software available at www.vosviewer.com, which allows to construct and visualize co-occurrence networks of important

items extracted from scientific literature. From the figure 5, it can be identified three main areas of research in the literature: (1) sustainability and consumption, which addresses to the consumer in the CE and other sustainability models. (2) quality and information, which shows the problematic of the information and the knowledge of the consumers regarding the CE and the quality and (3) behaviour and perceptions, which talks about consumer's behaviour related to CE products.

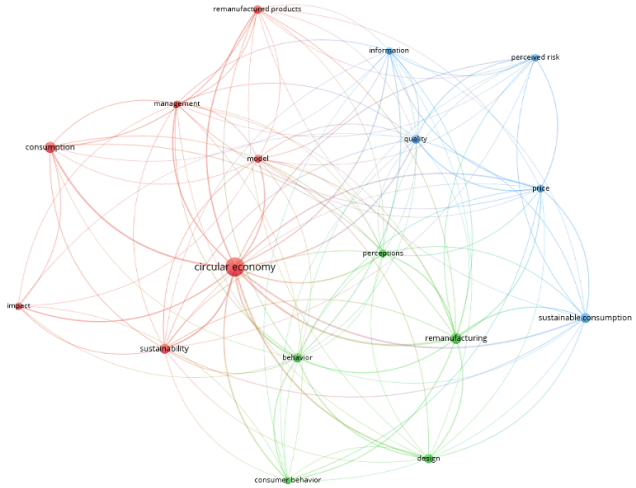

***Figure 5**. Total selected publications - by topic*

3.2. The involvement of the consumer in CE

The circular economy goes beyond simply recycling, reusing or remanufacturing, among others. There is a key element that needs to be analysed, as is the case of the consumer. The selected papers discuss consumer behaviour and attitudes towards circular economy (Hazen et al., 2017; Perez-Castillo & Vera-Martinez, 2021; Sharma & Foropon, 2019; Wastling et al., 2018; Zhu et al., 2019) and the vast majority of them are focused on the remanufactured, recycled or refurbished products (Grasso & Asioli, 2020; Sabbaghi & Behdad, 2018; Van Weelden et al., 2015; Y. Wang & Hazen, 2016). However, relevant consumer data and its involvement in the CE can be obtained, which is presented and analysed in the following paragraphs.

Vehmas et al. (2018) state that consumers are very interested in taking care of the end of life of the products, due to the power of decisions that they have with the life of the product. Even though, at the same time, consumers like to be informed about the beginning of the life of the product, but they are not so influenced, as they cannot decide about this topic. Moreover, consumers do not only worry about the end of life, but also are impressed by ethical and environmental issues regarding the products that they purchase (Singh & Giacosa, 2019; Vehmas et al., 2018). For them, sustainable attributes are also decisive for increasing the purchase intention. Attributes such as key resources, activities, company's

partners or even channels (Viciunaite & Alfnes, 2020). From the point of view of Calvo-Porral & Lévy-Mangin (2020), for consumers it is also very relevant the image and the guarantee of the product acquired, fact that corresponds to what Magnier et al., (2019) state, that one of the main issues that consumers should deal with is the quality of the purchased products. For consumers when deciding whether or not to buy a green product is due to the erroneous image they have about quality, which they consider that in green products decreases.

The transition from the linear model to the circular one need contextual changes, particularly it is considered that this transition should be accompanied by the changes in consumer behaviour (van Loon et al., 2018). The consumer behaviour affects directly to the purchase intention and switching intention (Shao, 2019). As regards the specific case of circular economy, there are two main elements, which affect to the purchase intention: knowledge of the environment and micro-level factors. On one hand, the knowledge and the consciousness that the consumer have about the environment, is crucial for the purchase intention of the consumer (Sharma & Foropon, 2019; P. Wang & Kuah, 2018). Perez-Castillo & Vera-Martinez (2021) considered that the effect of environmental and green benefits can also affect the purchase intention, and can serve as an important motivation for new buyers (Rizos et al., 2016; Singhal et al., 2019). On the other hand, micro-level factors are composed of social, cultural and personal values, which the more human side of the consumer and its purchase intention (Hazen et al., 2017). Although there is a positive relationship between these factors and the purchase intention, this is reduced by the lack of information that the consumer has (Grasso & Asioli, 2020; Matsumoto et al., 2017; Shen et al., 2019; Singhal et al., 2019; Vehmas et al., 2018).

Consumer have not enough information about the purchased products (i.e. the impact that has the purchase done or how can affect the contribution made to the environment), what can make that consumers have not fulfilled their pshycological, social and even cultural needs. And at the same time, this lack of information and fulfilment make to consumers barriers in the diffusion of the CE (Singh & Giacosa, 2019). However, the barriers have to be removed with information from the companies to the consumers and the increase of the knowledge of the consumers (Fogarassy et al., 2020). Besides, a factor that is directly related to the possible barriers that consumers have, is the educational stimulus, which Singhal et al. (2019) expound that can mitigate the negative perception that consumers have about products related to CE. To this, Y. Wang et al. (2020) also stablish that the more the consumer know about the product and the followed processes, the more the consumer changes its attitudes towards CE products. In addition, Fogarassy et al. (2020) state that without consumer's commitment, behaviour and attitudes the CE and sustainability can not function. Because, these two concepts, CE and sustainability, can only contribute to the society if consumers participate on them.

Lieder et al. (2017) expounded that consumer in CE is perceived as integral part of the business, due to the relevance of consumer's acceptance in the business and in the society. At the same time, consumers

play a critical role, since their decisions determine whether or not to purchase the product (Calvo-Porral & Lévy-Mangin, 2020). To that, Aboulamer (2018) added that consumers are so astute with sustainability and have started demanding to companies to be more sustainable.

Camacho-Otero et al. (2018) defines consumption, what can be directly associated to consumers, is anonymous, political, connected and based on multiple values. Anonymous because in some cases the consumer is not the owner of the product due to the low interest of consumers to have ownership of assets and products (Aboulamer, 2018). Political due to the changeable behaviour that consumers may have regarding government incentives and policies (Hazen et al., 2017). Connected is directly related to the necessity of the consumer of being aware of the CE and the importance of its participation in the loop, with the intention of becoming on the stage (Singh & Giacosa, 2019). And finally based on multiple values, due to consumers evaluate the perceived risk, the perceived quality and also the perceived value that they received of the use of the product (Souza et al., 2020).

3.3. The consumer and the perceived value

The selected publications treat quality as a differentiating element between products related to CE and those that do not. As mentioned in section 3.2., one of the issues the consumers have to deal with is the quality of CE products (Magnier et al., 2019), although environmental knowledge can mitigate this false association of comparability of product quality (Singhal et al., 2019). Even so, the quality is the forefront of the consumers' minds (Y. Wang & Hazen, 2016). Whereas one of the aspects addressed in the selected publications is the value; the perceived value of the consumer and the creation of it (Kuzmina et al., 2019; Salvador et al., 2020; Souza et al., 2020; Viciunaite & Alfnes, 2020; Y. Wang & Hazen, 2016).

Following with the knowledge, mentioned in the previous section, in this case is also relevant. It is considered that the green knowledge plays a role in determining the perceived value, this knowledge can be described as the understanding of the fact that by recycling used components and subsequent remanufacturing, a lot of resources and energy can be saved. (Michaud & Llerena, 2010; Y. Wang & Hazen, 2016). At the same time, when consumers have information about processes and products, they want to commit to value co-creation and contribute to the value proposition of the companies engaged in the CE (Kuzmina et al., 2019). This is also analysed by Viciunaite & Alfnes (2020), who detail that consumers are interested in having solid value propositions, which not only affects them, but also the environment.

In addition to the knowledge that consumers can acquire, they also expect to be informed by companies about the effect that their behaviour has. For this reason, Vehmas et al. (2018) state, it is crucial that consumers have trust in the company in order to receive information about the processes and thus

improve the value of the product. The elements for which consumers are most concerned and therefore want to receive more information are the product, the quality and also the guarantees (Matsumoto et al., 2017).

4. Discussion

Based on this literature review, it can be stated that the consumer takes care of the environment and is working on the sustainability consciousness. The consumer is concerned about the effect that the purchase of the products may have on the environment, but it has not enough or necessary information to take the appropriate actions. It can be seen that the consumer is a great stranger to the field of sustainability and CE, but with a very positive attitude and behaviour. So, it can be express, that if it received more information and was considered a part of the loop, it would increase its involvement. Moreover, this lack of knowledge implies that sometimes barriers are created between consumers and products related to CE, creating a false image of the products and also causing consumers not to see these products as an alternative to the lineal consumption. Even if the consumer is considered an integral part of the business due to the decision-making power to purchase the product, it does not play as important role as the one we initially deemed: either because of the lack of information, involvement or lack of analysis of the consumer.

Regarding quality, in the beginning it has been assumed that quality was considered as a differentiating factor and not as a characteristic of value, trust or satisfaction. But once the review done, it can be verified that there is a gap in this part of the literature, since it talks about quality, but not in-depth and without giving detailed information about the impact of this concept in the perceived value. Because of that, and in relation to these two elements another gap is detected, and it is the lack of literature about the perceived quality and the consumer in terms of CE. Therefore, it cannot be verified the implication of the quality in consumer's behaviour. Thus, considering that there is still no robust literature on the relationship between these two concepts, or at least in the field of social science.

The literature review also shows that the analysed publications dealt with products whether recycled, remanufactured or refurbished, but speaking in any case of the services that can be provided from CE. So, it could be established, that there is an interesting line of future research regarding new business models or other ways to collaborate in the loop of the CE.

5. Conclusions

This systematic literature review has provided an overview and investigation of the existing literature regarding the consumer and the quality in CE. This review shows that the consumer is a key element in the loop of the CE, but at the same time, it is unaware of the effect that its involvement in the society and in the environment can have, since it is established that its involvement is indispensable due to the

decision-making power that it has. In addition, it is concluded that there is actually no research on quality based on CE, and as a consequence on perceived value.

For practitioners, it should be taken into consideration that consumers are in the process of knowing the model and therefore need to be informed about the effect of their purchases, as they contribute to the environment and make them aware of the need to participate in this model, because their attitude is necessary for the proper functioning of sustainability. By raising consumer awareness, barriers or prejudices will be reduced, generating positive results for companies and consumers, as well as for the environment.

For researchers, the consumer is an important element to analyse, because depending on attitudes and behaviours can evolve and generate new cases of study. Regarding the binomial quality and consumer in the field of CE seems the great unknown. Although both are important elements to analyse, it is observed that there is no robust literature of these two concepts, thus there is a lack of studies on this subject.

Finally, different limitations can be seen in this study. First, only data extracted from the Web of Science platform has been taken into account. Second, only data regarding social science has been analysed. Third, the subjective evaluation and understanding of the search is based on the analysis of researchers.

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Human Development in Circular Economy: a new conceptual framework for sustainability

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Abstract

To solve the problems related to deep inequalities and the mismanagement of natural resources, the Circular Economy (CE) has been proposed as a new paradigm of Sustainable Development (SD) capable of achieving the Sustainable Development Goals (SDGs). However, attention has been drawn to the lack of social aspects in CE which has led scholars to the question of how this model addresses historical development problems, such as poverty, hunger, inequality, and injustice. To fill the social gaps, some researchers have proposed to include elements of development theories (e.g., Human Development-HD) in the CE. In the same vein, this research delves further into the relationship between CE and HD, and asks how to incorporate into the CE model the social perspective of HD and Human Scale Development (HSD), particularly the concept of Good Living? Thus, this research aims to develop a conceptual framework that integrates these concepts in the CE model. To achieve this, we carried out a narrative literature review of 130 documents which included books, academic papers, and reports on CE, HD, and HSD, which allowed us to build a new CE framework. As a result, we propose i) a conceptual framework that articulates to the current CE model the social elements of development, and ii) a tool to identify social indicators that allow assessing the impacts of CE on people's wellbeing. We believe the proposed framework could accelerate the progress towards SDGs by being a comprehensive proposal that understands the importance of development in all aspects, and the key role people and communities play in the thinking of sustainability solutions.

Keywords: Circular Economy, Human Development, Human Scale Development, Good Living, Sustainable Development.

1. Introduction

Since 2006, the interest in Circular Economy (CE) as a new Sustainable Development (SD) paradigm has increased thanks to the fact that it proposes to minimize waste and pollution through the use of waste by implementing reduce, reuse, and/or recycling strategies (Geissdoerfer et al., 2017). This has led academics and practitioners to understand the CE as a model that allows the achievement of Sustainable Development Goals (SDG) (Reike et al., 2018). Moreover, several countries worldwide and international and regional organizations, such as the United Nations (UN), the Organization for Economic Cooperation and Development (OECD), and the European Union (EU), have begun to formulate and implement policies for the transition to a circular system.

In the CE literature, some studies have identified that CE models only tangentially include the social dimension and that there is no clear understanding of the contribution of CE to human well-being (Alaerts et al., 2019; Kirchherr et al., 2017; Reike et al., 2018; Rodriguez-Anton et al., 2019; Schröder et al., 2020). This shortcoming is characterized by three elements: i) the existence of multiple definitions and interpretations of CE, which makes its implementation more difficult (Kirchherr et al., 2017; Korhonen et al., 2018a; Millar et al., 2019; Reike et al., 2018), ii) the lack of clarity about the relation between CE and SD (Geissdoerfer et al., 2017; Kirchherr et al., 2017; Reike et al., 2018; Rodriguez-Anton et al., 2019; Schroeder et al., 2019), and iii) the lack of social indicators in CE, which allows not only to evaluate but also to guide, from the design, the CE proposals.

To fill these social gaps, some scholars have developed proposals that seek to incorporate elements of development theories (e.g., Human Development-HD) in the CE model. In the same vein, this research delves further into the relationship between CE and HD, and asks how to incorporate into the CE model the social perspective of HD and Human Scale Development (HSD), particularly the concept of Good Living? Thus, this research aims to develop a conceptual framework that integrates these concepts in the CE model. The paper proceeds by explaining the methods used for this research. Then, we present the findings of the study. Thereafter, we provide a discussion of the findings, and finally, we offer some conclusions.

2. Methods

To achieve the main objective of this paper, we caried out a narrative literature review of 130 academic documents and reports from international organizations and governments, dealing with the subject of CE and its social aspects. Documents on HD, HSD and, Good Living were also reviewed to search for possible relationships between these concepts. The search was done through Scopus, Web of Science, Google Scholar and, Redalyc. Once the narrative review was made, a critical analysis of the new elements that would bring a social vision of development to CE was carried out, which served as the basis for the central proposal of this paper.

3. Results

3.1. CE and its social gaps: How to recover the social dimension?

Today there is a consensus about the fact that the linear economic model generates negative impacts on the environment, since it is based on the belief that resources are abundant, unlimited, available and, easy to dispose of (Reike et al., 2018). In contrast, the CE model proposes to keep products and materials at their highest level of application, minimizing their environmental impact (Comisión Europea, 2014), through strategies that promote a circular thinking system, materialized in the fact that products, once consumed, are recycled, repaired or reused (Preston & Lehne, 2017). Thus, the CE offers a practical solution to global and local problems, allowing the living of the human being within the limits of the ecologic planetary systems (Schröder et al., 2020). Thanks to its capacity of achieving high levels of sustainability (Schroeder et al., 2019), CE has been included in the national policies of 17 countries, 9 regional plans, and it has been presented as a new approach to achieving the SDGs, especially in non-industrialized countries (Preston & Lehne, 2017; Schröder et al., 2020).

Nevertheless, the CE model still has some gaps regarding the social dimension of development. The first, is the fact that there is a plurality of CE definitions which makes its implementation difficult (Murray et al., 2017; Reike et al., 2018), and has caused that the social aspects of SD being ignored (Geissdoerfer et al., 2017; Kirchherr et al., 2017; Millar et al., 2019; Moraga et al., 2019; Moreau et al., 2017; Murray et al., 2017; Reike et al., 2018; Sauvé et al., 2016; Schröder et al., 2020). The second gap is the lack of clarity in the relationship between CE and SD, especially with the SDGs, given that the focus of CE has been mainly on the technical and environmental aspects (Reike et al., 2018). Finally, a third gap is the lack of social indicators that can measure CE impact on human well-being. In this regard, Alaerts et al., (2019) consider that to ensure that CE contributes to SD, new monitoring frameworks for the implementation of the CE model are necessary, which allow reviewing how social issues are affected (well-being, quality of life, satisfaction of needs) during the transition and after. According to these authors, without such indicators, there is a risk of a more CE portraying poor environmental and/or social performance, despite many well-intentioned actions and statements.

3.2. Main concepts associated to the social dimension of development: a contribution to the CE

The concept of development has been one of the most important throughout history, and nowadays it is understood as the search for quality of life and well-being of people, through strategies that take into account social, economic, political and, cultural processes (Gudynas, 2003; Zamora, 2005). However, as a concept, it has taken on several meanings, from its identification with economic growth (1940-1960) to its relationship with the protection of the environment (1960-1990), and with the human development of the individuals (1990-2000). Nowadays, these three branches of development are incorporated into the SDGs, so reviewing these schools of thought allows us to identify the main concepts of the social dimension of development.

3.2.1. Theory of Economic Development and Development Economy (1940-1960)

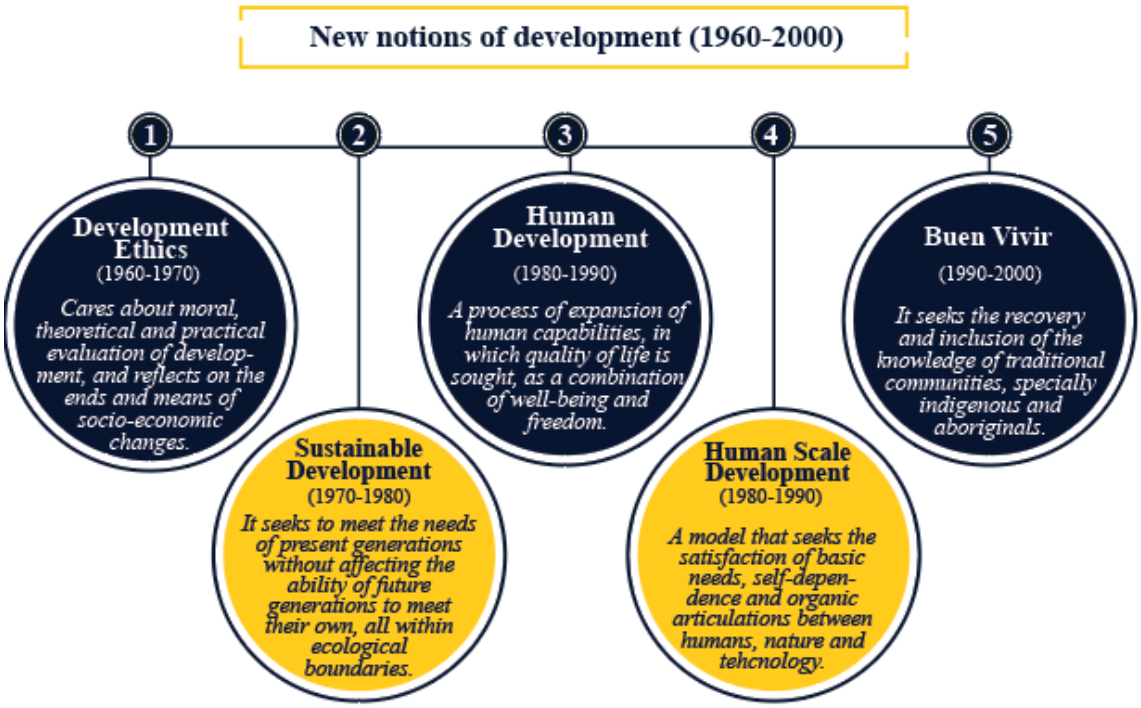
The end of World War II meant for many countries the restructuring of their economies (Hobsbawm, 1998). In this context, the theory of economic development, which deals with the improvement of economic conditions in low-income countries, was strengthened (Pedrajas, 2006). It was thanks to this conception that economic growth was directly related to the development (Griffin, 1999) and it was argued that the former was a condition for achieving the latter (Schuldt, 1995). This is understood from the western logic that has related consumption to satisfaction and personal and social well-being, ignoring or invalidating different worldviews, cultures, ways of life and imposing this thought as the only way to human well-being. Because of this SD still distinguishes between developed countries and "underdeveloped" or "developing countries.

As a result, the traditional understanding of the concept has been "the growth of an economy, throughout which new technologies are applied, social transformations take place and the quality of life of citizens increases with the consequence of a better distribution of wealth and income" (Pedrajas, 2006, p. 48). However, in non-industrialized countries, these results were not visible, because despite having high rates of economic growth, enormous inequalities still existed (Pedrajas, 2006). This led to the emergence of the development economy which argues that the development models should be consistent with the context of each country, this exalting the need for participation in the making of development strategies (Hirai, 2017).

3.2.2. New notions of development (1960-1990)

High inequalities, growing concerns about social aspects of development, and the negative impacts on the environment as a result of economic activities led to the search for a development model focused on human well-being and not economic growth, which led to the emergence of new notions of development (see Figure 1). These new conceptions were the result of the concerns of various theorists for the moral, theoretical and practical evaluation of development, which resulted in the creation of a shared ethic (Zamora, 2005) configured as "an applied project of philosophy to reflect on the ends and means that accompany the socioeconomic changes in poor countries and regions" (Pedrajas, 2006). This new ethics, which emerged in 1960, changed the approach to development, as it ensured that wealth is not an end in itself, but a means to achieve development and that both practices and theories present ethical and evaluative dimensions that must be taken into account when proposing and implementing a specific development model (Zamora, 2005).

Figure 1. *New notions of development (1960-2000)*



This development ethics helped in the evolution of SD's concept, which was created as a proposal to reconcile the social, economic, and environmental aspects of development, to seek a just economic and social growth that is ecologically viable while protecting Nature (Gudynas, 2003). This is reflected in the definition of SD presented in the report titled *Our Common Future*, published in 1987, as a development model that seeks to meet the needs of present generations without compromising the capacity of future generations to meet their own (Brundtland, 1987). But, despite this being the most complete definition at the moment (Lèlè, 1991), this definition has been criticized for being ambiguous, contradictory (Langhelle, 1999), open and malleable, which allows it to be used for diverse interests, in many cases far away from the core of SD (Purvis et al., 2018).

In this vein, Gudynas (2003) found three tendencies of sustainability in the proposals of SD, with different interpretations of the concept: *Weak Sustainability, Strong Sustainability and, Super-Strong Sustainability*. *Weak Sustainability* considers that SD is only possible through technology and technical knowledge, going so far as to argue that with them, functions of nature can even be replaced; *Strong Sustainability* understands nature as irreplaceable and necessary, so growth should never exceed natural limits; and *Super Strong Sustainability* values Nature for its intrinsic value and not for its usefulness. This last trend implies the generation of proposals about new development approaches, with profound changes in production processes and in how traditional concepts are understood. It recognizes then that decision-making on development is essentially political as it requires the argumentation between different positions, for which expanded active citizenship is required, which is no longer understood as

mere political participation or exchange in the market and begins to see how the presence in collective spaces, where the individual contributes responsibly to the construction of development strategies.

Nowadays, the predominant focus on the environment was broadened to include issues of human well-being. The needs approach began to form in the 1970s, after the World Conference on Employment, of the International Labor Organization (ILO), where the relationship between development and satisfaction of human needs was discussed (Hirai, 2017) and it was proposed that the central focus of development should be the satisfaction of needs (Hammarskjöld, 1975). This was the starting point of two of the great theories of development that exist today and that changed the focus of development, from the material to the human: Human Development (HD), as a process of expansion of human capacities (PNUD, 1990), and Human Scale Development (HSD), as the search for the satisfaction of needs, the self-dependence of communities and the organic human-nature-technology articulations (Max-Neef et al., 1989) . For these theories, it is necessary to recover the human dimension in development, which is why a change in the shared values of society is imminent.

During the eighties, the evolution of HD in the international scene went through several round tables done by the United Nations Program for Development (UNDP), where the central topic was to place the human being at the center of the discussion on economy and development. This was achieved thanks to the inclusion of the capabilities approach, developed by Amartya Sen and Keith Griffin, which emphasized the centrality of human initiative and individual and collective creativity, which depend on the democratization of development processes (Hirai, 2017). Their intervention in the round table of Amman in 1988 allowed the inclusion of their work in the international practice of development, recognizing that "the capability approach requires the bottom-up planning by the participation of all sectors of society for effective policies" (Hirai, 2017, p.11). With this in mind, the HD became the banner of the UNDP and was defined as a process in which human opportunities are expanded, taking into account two aspects that need to be balanced: i) the formation of human capabilities and ii) the use of these (PNUD, 1990). Besides this, the UNDP posed the Human Development Index (HDI) as a measurer of well-being, which "seeks to measure the level of human capabilities […] the set of options available to a person and, ultimately, the freedoms they enjoy" (Griffin, 1999, p. 16-17) and thus review the levels of inequality, poverty, and development from a non-economic point of view.

The institutionalization of HD is achieved thanks to the fact that the capabilities approach is a normative framework "for the evaluation and assessment of individual well-being and social arrangements, the design of policies, and proposals about social change in society" (Robeyns, 2005, p. 94). Amartya Sen raised this approach from a reflection on human diversity, in which he realizes "the enormous physical, social and cultural differences that surround human beings" (Pedrajas, 2006, p. 300). Thus he finds that "there can be abundant availability of food in a society, without it necessarily granting the right to use it, with what can occur – in apparent paradox - massive famines" (Schuldt, 1995, p. 53). Because of this, the economist wanted to create a new justice and development theory that is not only guided by

the available tangible goods in an economy, since "there is evidence that the conversion of goods to capabilities varies from person to person substantially, and the equality of the former may still be far from the equality of the latter" (Sen, 1979, p. 219).

In his vein, Sen defines the concept of capabilities as "a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another" (Sen, 1992, p. 40). To this concept, he adds the functionings as ways of being and doing (states and actions) that are constitutive of a person's life (Sen, 1992). With this in mind, Sen articulates a new understanding of the quality of life that moves away from utilitarian concepts and implies the combination between wellbeing, as what a person can do, and freedom, which are the options that a person has to choose from (Pedrajas, 2006).

At the same time, the capabilities approach was being developed, the need for social participation in the entire development process emerged in Latin America, as a condition for the realization of HD in the subcontinent (ECLAC, 2016). In this Ibero-American context, the Human Scale Development (HSD) approach was proposed by the Chilean economist Manfred Max-Neef and other collaborators, who considered that humanizing the economy was achieved through the emphasis on micro-organizations, local spaces, and relationships on a human scale as a strategy to think about the ways of a political order supported by a democratic culture (Max-Neef et al., 1989). This new approach was described in the following manner:

> …such development is focused and based on the satisfaction of human needs, on the generation of growing levels of self-reliance, and on the construction of organic articulations of people with nature and technology […] However, these pillars must be sustained on a solid foundation which is the creation of those conditions where people are the protagonists in their future. If people are to be the main actors in Human Scale Development both the diversity as well as the autonomy of the spaces in which they act must be respected. (Max-Neef et al., 1989, p. 12-13).

The HSD approach presents three main concepts: needs, satisfiers, and goods. Max-Neef et al., (1989) define the former as finite, classifiable, and equal in all cultures and periods. This allows to organize them in two categories: existential needs, which represent the Aristotelian vision already worked out by Sen (being, doing, having, and in interacting); and the axiological needs: subsistence, protection, affection, understanding, participation, idleness, identity, freedom (Max-Neef et al., 1989) and transcendence (Max-Neef, 1992). These needs have "a twofold character: as deprivation and as potential" to the extent that "needs engage, motivate and mobilize people, they are potential and eventually may become a resource" (Max-Neef et al., 1989, p. 26). As for satisfiers, they "define the prevailing mode a culture or a society ascribes to needs" since they are related to "everything which, by representing forms of Being, Having, Doing and Interacting, contributes to the actualization of human needs" (Max-Neef et al., 1989, p. 26-27). These satisfiers can be enhanced by tangible goods, which behave in three different ways: i) they are modified according to episodic rhythms, ii) they

diversify according to and within cultures, and iii) they diversify amongst social strata (Max-Neef et al., 1989). This differentiation between needs and satisfiers is necessary, in order not to fall into the commodity fetishism, which consists of thinking that needs can only be satisfied through tangible goods (Pedrajas, 2006).

Another goal of HSD was to develop useful tools that could be implemented in the development process, which is why the authors build the matrix of needs and satisfiers which serves as an instrument of policy and, action, and can be used for purposes of diagnosis, planning, assessment, and evaluation of development strategies (Max-Neef et al., 1989). This matrix is provisional, open, and subject to change as necessary, that is, it can be carried out by each person or group according to their culture, time, place, and/or circumstances, to avoid the creation of strict models and immovable of development.

3.2.3. New alternatives to development (1990-200)

In the nineties, a wave of leaders and thinkers interested in the need for alternatives to development posed the concept of Good Living, understood as the fullness of life. This concept has become a platform that seeks to recover the knowledge of traditional communities, especially indigenous and aboriginals, to raise awareness about the fact that development is not a linear or unique process and that there are many different ways of well-being, for which the decolonization of knowledge and respect for diverse culture is important (Gudynas, 2011a). What Good Living ultimately seeks is to respect and include the diverse ways of life in an alternative vision to classical development and to end activities that exceed the ecological limits of the planet. In this respect, the platform of Good Living gathers many visions that share some particular expressions, such as another ethic to recognize and assign values, the decolonization of knowledge, the abandonment of the rationality of manipulation and instrumentalization, a vocation oriented to the encounter, dialogue or interactions between different knowledge, alternative conceptions of Nature, applied communities and a place for experiences and affections (Gudynas, 2011b). Thus,

> …The immediate goals of a program towards Good Living should be focused on two objectives that keep the same relevance: zero poverty and zero extinction of native species. The eradication of poverty and stopping the environmental debacle appear as urgent measures, and where both go hand in hand and are equally urgent. (Gudynas, 2011b, p. 17).

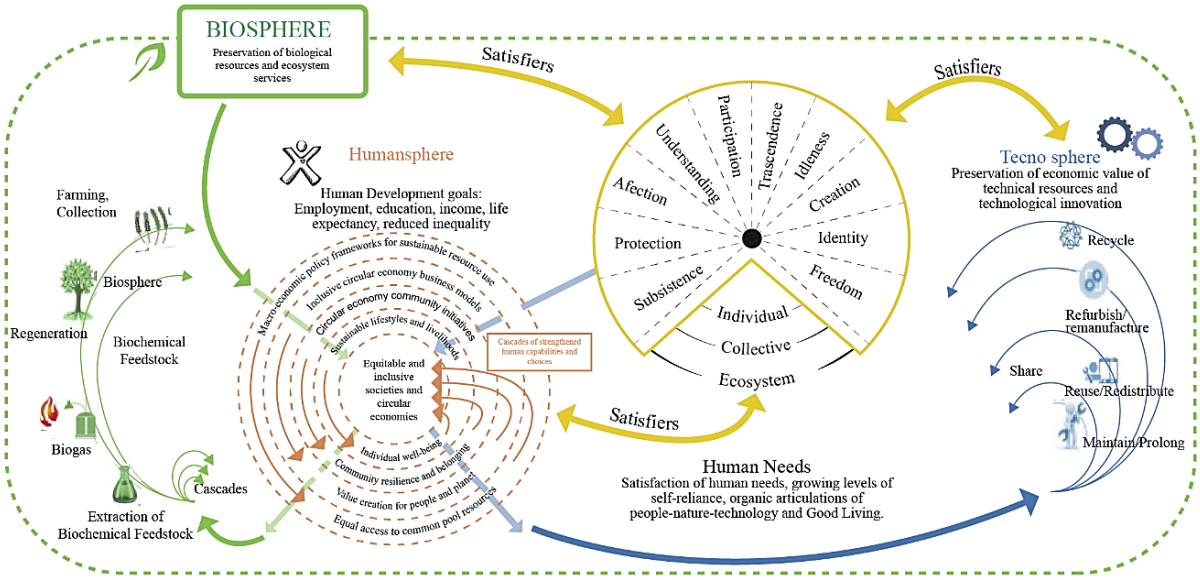
To summarize, there are four key elements in the social dimension of development. These are i) the importance of satisfaction of human needs, ii) quality of life, participation, and inclusion, iii) the respect for nature, and iv) the necessity for a change of values. These allow us to think on a more participative CE, that seeks the quality of life. Because of this, the four elements mentioned are included in the proposal of this research, which puts forward a redesign of the conceptual framework of CE, to expand the social dimension of CE.

3.3. Proposal for a new social approach for CE

One of the problems identified in the CE literature is that despite CE is presented as a new paradigm of SD that reaches the SDGs, social aspects are still not taken into account in the more traditional vision of CE, which only focuses on the role of the companies within the production chains, the new designs, the use of resources and the generation of employment (Kirchherr et al., 2017). For this reason, thinking about a more humane CE focused on people's needs and their development is an innovative idea. The first step on this path was taken by Schröder et al., (2020) with their proposal to achieve inclusive and diverse societies and circular economies, that enable "low-income groups to take ownership of their own futures" (Schröder et al., 2020, p. 4) which almost always will involve a process of participation, consultation, briefing, discussion and interaction about the CE. This is a reminder that "the issues are not just technical and the preserve of experts but closely related to the lives and experiences of the people most affected" (Schröder et al., 2020, p. 4). The proposal of these authors is an advancement in the attempt to incorporate the human being in the perspective of CE and allows us to understand that a prosperous CE would have as a final objective "to ensure the well-being, reduced inequality and prosperity of all its citizens" (Schröder et al., 2020, p. 7).

An analysis of this proposal makes it evident that there are opportunities for improvement, if the key elements of the social dimension of development, mentioned above, are taken into account. On the one hand, these authors talk about the importance of satisfaction of human needs, but do not define them explicitly or make a differentiation between them and satisfiers and may fall into the commodity fetishism. This can be solved by implementing the HSD since it shares with the holistic vision of CE the focus on needs and the search for an articulation between people, nature, and technology. On the other hand, Schröder et al., (2020) raise the need for inclusion, recognizing that all people have skills and knowledge that can contribute to the creation of circularity strategies and raise well-being as the ultimate goal of CE. This vision can be further expanded by including the concept of Good Living which seeks the recovery and inclusion of traditional knowledge and the recognition that there are various forms of well-being (Gudynas, 2011b). Finally, the element of participation becomes fundamental to achieve the above, so it is possible to think about using the matrix of needs, presented by the HSD, to design, implement and evaluate CE strategies, turning human needs into feedback channels to measure the impacts of CE on human well-being. Thus, the satisfaction of human needs, diversity, and participation are at the backbone of the proposal of this research, which gives way to a more inclusive model, where the expansion of human capacities (HD) and the satisfaction of needs (HSD, SD), all this within the limits of ecosystems (HSD, Good Living) are sought (see Figure 2).

Figure 2. *Framework for a CE focused on the quality of life*



Starting from the framework proposed by Schröder et al., (2020), we propose, in the first place, to represent the dimensions of SD from a bio centric perspective, characteristic of a *Super-Strong Sustainability* (Gudynas, 2003), through which the biosphere passes to contain all human systems, according to the postulates of HSD (Max-Neef, 2007). Second, the wheel of human needs (Max-Neef, 1992) is incorporated, which relates needs and satisfiers, which in turn become feedback bidirectional channels through which systems interact, allowing not only feedback from the results of CE through social needs, as raised by Alaerts et al. (2019), but also a way to design and implement CE strategies and measure their impacts on human well-being and the ecosystem.

For example, in the relation between *Humansphere* and Human Needs, the following are taken into account: i) the vision of the human being as part of nature (Lemille, 2020), ii) the sustainability ethics that seeks the protection of Nature for its intrinsic value, and iii) the necessity of a plurality of knowledge and social and environmental justice. This relationship first passes through the processes of participation of the matrix of needs, which allows discovering which tools, for example, can be implemented in the first cycle proposed by Schröder et al. (2020) that contains the macroeconomic policy decisions, so that they are consistent with the economic and social conditions of each community. This would generate results that can be evaluated in the *Humansphere* - Human Needs relationship, through the satisfiers and the results they deliver. Thus, the *Humansphere* - Human Needs relationship is the one that contains the essential elements to achieve social and environmental justice, and equity since both dimensions consider the human being as an actor of development and as a subject capable of participating actively.

Linked to the above, the Human Needs – *Technosphere* relationship can become the means for the inclusion of diverse knowledge since this relationship is based on the diagnosis of tangible goods available for the satisfaction of needs, the last step of the methodology for applying the matrix of needs.

This step allows a social cost-benefit assessment, as proposed by Schröder et al. (2020), not to fall on a material reductionism and universalization of the results, since what for one community is a benefit, for another it may be a cost. Thus, the inclusion of knowledge is done through the recognition of traditional community practices that can contribute to waste management techniques. In contrast, the *Technosphere* – Human Needs relationship is the means to prioritize reduction, as the most important pillar of CE (Geng et al., 2012) and to reduce recycling and reuse, since these require more and better technologies, which brings two dangers: automation, as a necessary process for the conversion of solid waste into raw material, and the use of polluting technologies in EC strategies (Geng et al., 2012). With the focus on human needs, these two dangers can be controlled by reducing confidence in technology as the only solution for waste management and it is sought that these technologies do not become inhibiting or destructing satisfiers, using the matrix of needs.

3.4. Circular Economy indicators

By using the matrix of needs in CE, we can fill the gap of social indicators in the monitoring frameworks that exist today (Alaerts et al., 2019; De Pascale et al., 2021; Geng et al., 2012; Moraga et al., 2019; Muñoz et al. 2018; Padilla-Rivera et al., 2021; Saidani et al., 2019; Van Hoof et al., 2018). For example, Muñoz et al. (2018) found that, although the existing indicators are economic, environmental, social, and even of governance, most emphasize materials, solid waste, and the economy, while ignoring categories like education, gender, health, urban planning, the person and security. So, although it is estimated that CE can improve well-being and equity in society, monitoring frameworks do not have any tools to measure these changes. To solve this problem, this research proposes the use of the HSD matrix of needs as a useful tool in the design, implementation, and evaluation of CE strategies, to allow development and CE actors to keep on the radar, the human needs, and capabilities, to aim, from the beginning, to achieve the quality of life on Earth.

Thinking about indicators that result from the application of the matrix of needs can strengthen the participation component in CE and create a bridge between its levels (micro, meso, macro). For this, in this research, we propose an example of how the identification of satisfiers found in a CE focused on well-being can generate social indicators for CE (see Table 1).

Table 1. *Proposal of social indicators for the CE*

	BEING	HAVING	DOING	INTERACTING	INDICATOR	MEASUREMENT
SUBSISTENCE	Physical and mental health, equilibrium, sense of humor, adaptability	Food, shelter, work, fair payments, renewable energy, capacities, resources	Feed, procreate, rest, work, adapt to the environment, reduce, reduce and/or recycle	Living environment, social setting, open spaces	Green Jobs	Number of green jobs out of the total new positions
					Food security	Tons of waste reused out of the total of waste generated
PROTECTION	Care, adaptability, autonomy, equilibrium, solidarity, empathy	Insurance and health systems, savings, social security, rights, family, work, resilience, capabilities	Cooperate, prevent, plan, take care of, cure, help, to preserve	Living space, social environment, dwelling, green spaces, safe work environment	Land use and access to resources rights	Proportion of the adult population with secure land tenure rights
AFECTION	Solidarity, respect, tolerance, passion, sensuality, sense of humor, happiness, empathy	Friendships, family, partnerships, relationships with nature, capabilities	Make love, caress, express emotions, share, take care of, cultivate, appreciate, to trust	Privacy, intimacy, home, spaces of togetherness, green spaces	Trust in institutions and between groups	Degree of trust in institutions and between groups
UNDERSTANDING	Critical conscience, receptiveness, curiosity, empathy	Literature, education and communication policies, environmental education policies, shared ethics	Investigate, study, experiment, educate, analyze, meditate, to diversify, to include	Settings of formative interaction, schools, universities, academies, communities	Education and training	Quantity of programs of knowledge exchange
					Shared values and norms	World Values Survey
PARTICIPATION	Adaptability, receptiveness, solidarity, willingness, determination, dedication, respect, passion, sense of humor, happiness	Rights, responsibilities, duties, privileges, work, diversity, capabilities, strong institutions	Become affiliated, cooperate, propose, share, dissent, obey, interact, agree on, express opinions, to create	Settings of participative interaction, collaborative systems, local democracy	Social and economic inclusion	Perception of inclusion
					Participation and democracy	Proportion of direct participation
IDLENESS	Curiosity, receptiveness, imagination, recklessness, sense of humor, tranquility, sensuality,	Games, spectacles, clubs, parties, peace of mind, ecological and cultural diversity, relationship with nature, capabilities	Day-dream, brood, dream, recall old times, give away to fantasies, remember, relax, have fun, play, imagine	Privacy, intimacy, spaces of closeness, free time, surroundings, green spaces	Cultural tradition	Total expenditure on the preservation, protection and conservation of cultural and natural heritage
CREATION	Passion, determination, intuition, imagination, autonomy, inventiveness, curiosity, personal and collective creativity	Abilities, skills, method, work, capabilities	To work, invent, build, design, compose, interpret, finance	Productive and feedback settings, collaborative systems	Recognition of career office	Number of progressive schemes that strengthen recyclers' organizations
IDENTITY	Sense of belonging, consistency, differentiation, self-esteem, assertiveness, empowered, active citizen	Symbols, language, religion, habits, customs, reference groups, sexuality, values, norms, historical memory, work, diversity, ethics, rights	Commit oneself, integrate oneself, confront, decide on, get to know oneself, actualize oneself, grow, participate	Social rhythms, everyday settings which one belongs to, maturation stages, community systems, local work placements	Collective purpose / Life project	Degree of familiarity of CE strategies with community life projects
FREEDOM	Autonomy, self-esteem, determination, passion, assertiveness, open-mindedness, tolerance	Equal rights, Social and environmental justice, equitable distribution, fair payments, shared ethics, capabilities	Dissent, choose, be different from, run risks, develop awareness, commit, disobey, participate	Temporal/spatial plasticity, collaborative and community systems	Freedom of association and collective bargaining	Increased compliance with labor rights.
					Fair trade relations	Number of fair trade producers
TRASCENDENCE	Autonomy, self-esteem, willing, spirituality	Autonomy, spirituality, relationships, unity in diversity, inner peace	To meditate, share, ritualize, build, trust	Churches, cultural and spiritual centers	Personal and collective spitiruality	Number of hours a day dedicated to spirituality

The exercise was carried out identifying, first, the satisfiers generated by the CE model proposed in this article, and second, taking into account the findings of Padilla-Rivera et al. (2021) and different indicators used in the international system. The result is a set of 21 indicators that can be included in the CE monitoring frameworks, with examples of measurement methods, taking into account the SDGs and other measurement parameters of the international system and experiences of various development agencies. The indicators were reviewed through the analytical lens of the community indicators manual, which establishes certain selection criteria for the definition of social indicators, including relevance, validity, credibility, measurement capacity, etc. (AtKisson et al., 1997).

4. Discussion

The exercise in Table 1 is exploratory and many measurement options can emerge from the participatory process carried out in identifying satisfiers. In addition, it is important to highlight that the identification of indicators and their measurement methodologies must be done by an inter and multidisciplinary group, with the participation of civil society and public and private organizations, to avoid falling into strictly economic indicators or those that respond to standards of the western economic model. The matrix presented has the same characteristics as those defined by (Max-Neef et al., 1989), that is, it is open to modification so that the forty boxes can be filled in by the different communities and development actors so that together they can find relevant indicators for their specific context.

The indicators presented in this proposal are important because they broaden the social vision that exists in the CE. For example, thinking that EC generates *green jobs*, understood as decent jobs that contribute to preserving and restoring the environment, characterized by reducing environmental impacts, being socially fair, and producing economic opportunities (OIT, 2016) allows us to identify what kind of jobs are desirable in a thriving CE. Furthermore, the ILO has identified that these types of jobs help to indirectly achieve gender equality (SDG 5) (OIT, 2015a) and SDGs 6, 13, and 17, and directly achieve SDGs 1, 4, 7, 8, and 12 (OIT, 2015b). Thinking about green jobs as an element to improve the environmental and social conditions of a specific community, also allows materializing the idea of the *Humansphere* exposed by Lemille (2020) on the roles of humans in a new economic model.

For its part, including a *food security* indicator with a system thinking allows not only to contribute to the achievement of SDG 2 but also to transform its approach to take care of the means of production, seeking to achieve SDG 13, 14, and 15, since the food production is a constant social and environmental challenge due to various factors such as “water consumption, greenhouse gas emissions, high energy consumption, tremendous waste production and high demand for food and its uneven distribution” (Padilla-Rivera et al., 2021, p. 106). This idea has already been explored by the Ellen MacArthur Foundation, which highlights that a CE for food emulates natural regeneration systems, achieving the

use of waste as raw material, sustainable production, urban-rural relations, and markets with healthier products (The Ellen McArthur Foundation, 2018, p. 22).

In addition to the above, it has already been made clear that a successful transition to a circular system depends on the change of values shared by society (Schröder et al., 2020), so it is important to include indicators such as training and education, trust between groups and in institutions, shared values and norms, to measure, not only the impacts on well-being but the viability of the transition towards an inclusive CE. In addition, an interesting opportunity offered by CE is to seek the social and economic inclusion of various groups in society, urban and rural. An example is found in the countries of the global south, where recyclers' communities have become a key community in the recovery of usable material in large cities (Cerón, 2018). Understanding this, a CE can and should recognize the trade of these communities and include them and their knowledge through progressive schemes that strengthen recyclers' organizations in the generation of new technical solutions for the CE (Tovar, 2018). With all of the above, the door is opened to respect for the collective purpose and life project of various communities, through the measurement of the degree of familiarity that CE projects have with processes of collective purpose and community life projects, to understand if CE can effectively increase the sense of community, participation, and cooperation, as has been stated in the literature (Padilla-Rivera et al., 2021).

Finally, applying the matrix of needs in the CE seeks that development actors take the communities into account throughout the process of transition to a CE. This is important because "it is only by generating self-reliance, where people assume a leading role in different domains and spaces, that it is possible to promote development processes with synergic effects that satisfy fundamental human needs" (Max-Neef et al., 1989, p. 49).

5. Conclusions

CE has been accepted as a new model that allows the achievement of the SDGs for all countries. However, it has been concluded that it is still necessary to strengthen the social aspects of the model and clarify its relationship with SD. This becomes an interesting opportunity for a multi and interdisciplinary work that seeks to incorporate social elements of development into CE to address the well-being of people in a relationship directly proportional to their relationship with the environment, with others, and with themselves. But, filling the social void that CE has, creates the need to find which are the main elements associated with the social dimension of development, and thus identify which ones can enter CE. This is the reason for the present investigation, in which common points were found between the existing proposals for the incorporation of social aspects in CE, and the theories of HS, HSD, and Good Living. These are i) the importance of human needs, ii) participation and the inclusion of different knowledge and iii) the need to change values, to achieve a quality of life. Thus, it is expected

that this research contributes to the construction of the CE so that it becomes a holistic tool that allows the achievement of all the SDGs.

This first exploration allowed us to redesign the CE model to integrate these concepts and tools, which ended in the construction of a conceptual framework that redefines the vision of sustainability, to understand that human beings are part of ecosystems and therefore limited by their capacity to sustain life on Earth, thus making CE a true paradigm of SD. The proposed diagram places the wheel of Human Needs in the center, in constant relationships with the *Humansphere* and the *Technosphere*, all within and in relation with the Biosphere, thus avoiding epistemological reductionism. Finally, by including the wheel of Human Needs, the difference between need and satisfier is made explicit, avoiding falling into commodity fetishism. With this, we managed to go from a traditional CE proposal to a definition of circular systems that seek *Super-Strong sustainability*.

Now, the main tools of this proposal are the matrix of needs and the ethics of development, since they allow, through the participation of communities, to identify useful social indicators in the transition to a CE. To illustrate this, an example was made of the process of identifying social indicators, which resulted in a set of twenty-one (21) indicators that allow a diagnosis of the distance between the current system and a more circular and inclusive system, which look for equitable, resilient, and diverse societies that allow the expansion of people's capacities, the achievement of well-being and the satisfaction of the needs of everyone and everything.

Thus, this research becomes a contribution to the construction of the EC so that it becomes a holistic tool that allows the achievement of all the SDGs. This construction of the concept is important because the CE has already captured the attention of the private and public who have taken the CE as an opportunity to achieve SD. A future advance of this research is the empirical application of the model proposed, especially the matrix of needs in the diagnosis, implementation, and evaluation of CE strategies, to obtain better feedback of the social impacts of CE, through a holistic vision of fundamental human needs. We believe the proposed framework could accelerate the progress towards SDGs by being a comprehensive proposal that understands the importance of development in all aspects, and the key role people and communities play in the thinking of sustainability solutions.

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Weaving Circular Ties: Network empowerment for the Social Enterprise-led Development of Inclusive Circular Cities

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Abstract

Circular economy (CE) is a transformative paradigm, which has received a lot of attention among policy-makers and practitioners in recent years and is rooted in concepts such as resource efficiency and cleaner production. Despite the rapid growth in research on the CE, the dominant discourse surrounding the development of the CE in practice primarily focuses on business-as-usual and resource-related economic processes whilst overlooking social and relational aspects. This paper thus proposes a more holistic approach to the CE, which recognizes the role of mission-driven social enterprises (SEs) and their networks, viewed together as circulatory systems, in harnessing the socio-ecological premises of CE thinking and practice. In doing so, it draws upon the Social Network Analysis approach and semi-structured interviews with 38 SEs spanning the textile & crafts, wood & furniture, electronics, food, housing, hygiene & cleaning, elderly/women and ethnic minorities sectors in the city of Hull, UK.

In focusing on SE networks, this paper acknowledges the importance of the relational context for the local development of the CE. This is because the quality and provision of SEs' products and services depend on their cross- and multi-sectoral relationships with the private, public and social sector organizations. More importantly, SE networks can be 'woven' in such a fashion that they foster knowledge spillovers and enable resource flows for the local development of the CE. This paper thus represents 'ego-networks' (i.e. ties of each particular SE) that are embedded within the broader SE landscape. It then explores how these same network constellations not only embody, but could also be potentially reconstructed to embody symbiotic relationships between environmentally-, CE-, socially- and/or commercially-oriented enterprises in order to foster socially inclusive CE development. We contend that integrating considerations of SEs' organizational attributes and their social and spatial positioning, which, in turn, impact the content of SEs' ties and network heterogeneity, offers new insights into the underlying power-relations and associated variegated levels of trust within the social circular enterprise ecosystem, yet in a given institutional context. Crucially, these aspects need to be scrutinized due to their impact on SEs' performance outcomes and, ultimately, on the development of a socially inclusive CE at the urban scale.

Keywords: Circular economy, Social enterprise, Networks, Social Network Analysis, Social inclusion

1. Introduction

Social enterprises (SEs) are expected to experience significant further development over the next years due to widening socio-economic inequalities, growing environmental crisis and opportunities created by the development of Circular Economy (CE) practices and principles (Deloitte 2018). While SEs vary in terms of their legal-organisational forms, they often have limited resources to develop activities and interventions that promote social change, especially in their early development stages (Daniele, 2009). However, even though limited resource base may constrain delivery of their missions, it also stimulates the development of socially innovative ways of doing and procuring things. By promoting frugal social innovations, whereby the complexity and costs of producing goods and delivering services are significantly reduced through the use of second-hand materials (Kuo, 2014), SEs can play an important role in driving the local development of the CE, which is understood as regenerative practices whereby '*resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling*' (Geissdoerfer et al., 2017:6).

In order to access necessary materials, SEs form both formal (i.e., supported by legal agreements and contracts) and informal (i.e., concerning friends and relatives) networks of interdependent and interconnected actors across social, public and private sectors. In addition to procuring necessary material resources, such connections to diverse actors enable SEs to access pools of skills, knowledge, ideas, financial capital and labour, all of which are subject to (non-)monetary transactions and exchanges, and not only underpin but can be also leveraged to facilitate the development of the CE practices. SEs' networks are hence circulatory systems and important transmission channels for the flows of (in)tangible resources across the capitalist (i.e. formal/regulated) and alternative (i.e. informal/unregulated) economic spaces (Lekan et al., 2021).

This paper emphasizes the presently underexplored role and potential of networks in driving a transition toward a more socially inclusive CE. Drawing upon the social network analysis theory, it investigates how SEs could build what Baker (2014) defined as 'new pipes' (i.e. connections facilitating or constraining flow of resources), and use those new or already existing pipes to develop new circular activities or diffuse already existing circular practices across the city. It makes claims on how the use of new pipelines (actor-networks) could create novel local impact pathways and community infrastructure comprising shared values, resources, capabilities, interests, identity and needs in a geographically bounded space. In doing so, it adopts a holistic understanding of the broader network interactions, which are underpinned by variegated levels of trust and vary in terms of transferred and/or exchanged content.

Drawing upon a case study of SEs in the City of Hull, England, this paper uncovers 'ego-networks', i.e. (in)formal ties of each particular enterprise, which are embedded within the broader SE landscape and enable to identify already-existing CE practices. This in turn enables us to (1) identify some of the key actors that can facilitate CE transition in the city, and (2) unveil the broader social *circular enterprise ecosystem* in which SEs are embedded. The visual representation of networks in a given temporal context is complemented with considerations of geographic proximity and its impacts on (in)tangible resource flows and, to some extent, the socio-spatial distribution of benefits associated with socio-circular practices. Crucially, the adopted relational and dynamic approach to SE networks enables to uncover the underlying power-relations, which have implications for the local and socially inclusive CE development. The adopted systems approach is also consistent with the principles of industrial ecology (Deutz and Lyons 2015) that are analogously applied to the SE ecosystem context. The paper then sheds some light on how these same network constellations not only already embody, but could also be potentially reconstructed to embody symbiotic relationships between environmentally-, CE-, socially- and/or commercially-oriented enterprises in order to foster socially inclusive CE development.

2. Literature Review

2.1 Social Enterprises and the CE

SEs differ from traditional non-profits by having a trading arm and being, at least to some extent, financially independent; crucially, SEs seek to maximize social impact by reinvesting profits to fulfil a social and/or environmental mission rather than only distribute them among shareholders (Longhurst et al., 2016). SEs take various forms, sizes and organisational structures. In this study, SEs primarily concern *charities with on mission trading arm* and *commercial enterprises* (referred to as 'sole-traders') producing and selling items of social and/or environmental value (Bolton et al. 2007). By eliminating the use of toxic materials, or upcycling wasted materials, SEs tend to engage in CE practices whereby extraction of the highest possible value from resources is promoted through their recirculation and performance-oriented products and services. SEs are thus increasingly showing potential as important enablers of the CE (Social Circular Economy, 2017). By delivering social value as well as forming, capitalizing on, and acting as conduits for, social capital, SEs enrich the CE concept with the social dimension, which remains underrepresented in the existing CE literature (Murray et al., 2017; Lekan et al. 2020). Linked to this, this study uncovers a broad diversity of organizational forms, which, once provided with appropriate support, and hence more interconnected, may help to create a robust, SE-driven circular ecosystem in structurally disadvantaged cities.

2.2 Social Enterprises and Networks

This paper emphasizes the presently underexplored role and potential of SEs' networks in driving a transition toward a more socially inclusive CE. This is all the more important given that SEs form

networks spanning geographies and sectors, and which come into play as a modern organising principle that enables SEs to work at many integrated levels (Brudel and Preisendorfer, 1998; Hervieux and Turcotte, 2010). By establishing ties with other entities SEs can obtain not only (in)tnagible resources at a lower cost than they could be obtained on markets (e.g. production inputs and advice), but also those resources that are contingent upon social interactions such as reputation and referrals (Daniele et al., 2009). Given that many studies focus on individual entrepreneurs' networks rather than the broader ecosystem in which they are embedded (Witt, 2004), this study positions respective SEs within a broader network. This is in line with Salancik's (1995) call to acknowledge the way organizations' actions are organized: '*There is a danger in network analysis of not seeing the trees for the forest. Interactions, the building blocks of networks, are too easily taken as given*' (p.355). Such a broader perspective in turn allows to better explore the inter- and dis-connectedness of particular ties within the broader ecosystem at the city level, and which may result in, or hinder, the development of more circular practices. Demonstrating the collaborative efforts of those SEs that rely on financial grants is also increasingly appreciated among donors who become more specific in their funding conditions (Johnson et al., 2010).

The research on networks does not have a core theory that could result in a clear set of approaches to examine particular phenomena. It has been, instead, influenced by a range of disciplines and theories (Hoang and Anotoncic, 2003). Some of the commonly studied network constructs, or aspects of network analysis, which are usually studied in the context of entrepreneurship research and are explored in this study through the lens of the CE, refer to structural aspects such as network heterogeneity, centrality or positionality. All of these network characteristics are to some extent interlinked and mutually reinforcing, and can help to explain the power dynamics underpinning structural network configurations. We now briefly explain their significance for the entrepreneurial processes and, more specifically, their underinvestigated implications for the local CE development at the city scale.

Network heterogeneity, tie content and organizational attributes

Network heterogeneity broadly refers to networks where there is a diversity of nodes that differ in terms of their functions and utility (Hoang and Antoncic, 2003). This has implications for the diversity of behaviours and activities within a given entrepreneurial network. In this research we assume that high network heterogeneity can lead to more circularity, yet depending on the network content and the broader context in which it is embedded. While the content of ties (i.e. (in)tangible resources subject to flows between nodes) and the content of nodes (i.e. attributes of network actors, including their capabilities and key assets) are not structural network characteristics per se, they influence, and are influenced by, network heterogeneity. In other words, some of the endogenous variables that may determine, to varying degrees, network heterogeneity concern intra-organizational differences such as different size, antecedents, age, development stage (which is in turn often correlated to size),

demographics, capabilities, mission or motivations of organizations under scrutiny. These variables translate into differential organizational needs and forms, which determine and guide formation of particular ties and hence resource flows (e.g. financial capital, emotional support, reputation). They also help to challenge the assumption that organizations with larger and more diverse networks are not necessarily more successful than those with less diverse connections (Witt, 2004). This is because particular organizations may have different intentions, aspirations and capabilities, among other factors. At the same time, research shows that the more heterogeneous network structure is, the more heterogeneous knowledge it possesses. Heterogeneous network content may be thus associated with greater innovative potential (Rodan and Galunic, 2004), including capacity to implement CE practices.

An important attribute of ties that may have implications for the diffusion of CE thinking and practice concerns their strength. Drawing upon Granovetter (1973), Aldrich and Zimmer (1986) highlighted that ties can be either strong or weak ties depending on the *'level, frequency and reciprocity of relationships between persons*' (p.11) and, more broadly, social capital reflecting social proximity. Strong ties are characterized by high time and energy investments to build and maintain them. This is contrary to weak ties that may be the result of resource scarcity such as time to build profound connections and, more broadly, limited relational capabilities. Crucially, weak ties may be a valuable source of new and diverse (rather than in-depth) information (Granovetter, 1973), thus potentially stimulating diffusion of CE ideas.

Positionality

Positionality of actors in a given social network configuration is an important network characteristic that has an impact on resource flows, which, in turn, affect entrepreneurial outcomes and organizational performance (Hoang and Antonic, 2003; Burt, 2004). In other words, positionality can either facilitate or constrain access to necessary resources, hence influencing organizations' ability to generate social (circular) innovations. Linked to this, positionality is associated with particular levels of power. For example, there may be a correlation between the strongly central position of a given actor in a network and its level of power in that network (Galaskiewicz, 1985). Positionality is linked to network heterogeneity because having ties to, or the potential to establish ties with, a wide range of actors may facilitate access to vital resources, for example, those that are necessary for the local development of the CE. Crucially, positionality may be understood in terms of social and geographical proximity that tend to mutually reinforce one another.

Spatial proximity

Spatial location is rarely incorporated into the studies of networks (Sayles and Baggio, 2017). And yet, considerations of geographical proximity are important from the perspective of the CE. This is because circular activities are often deemed sustainable when they occur at the local level such that spatial

distances between economic spaces of procurement, production, exchange, and consumption are significantly reduced and hence negative environmental externalities lessened (Stahel, 2013). In addition to environmental advantages, co-location may facilitate information and knowledge spillovers (Breschi and Lissoni, 2001). Adopting such perspectives when analysing *social circular enterprise ecosystem* can enable to better evaluate the impact of spatial aspects on the performance of SEs and ultimately local development of the CE.

Network centrality and brokerage

Network centrality is defined as the total distance of a central actor to others in the network and the total number of other nodes a central individual can reach (Aldrich and Zimmer, 1986). It hence indicates the power to access (or control) vital resources through direct and indirect ties (Hoang and Antoncic, 2003). Degree centrality involves the ability of network actors to connect with others through intermediaries. Actors with high degree of centrality, and hence extensive links to other parts of a network, can be therefore vital communication channels between disconnected actors. In case particular network members can quickly and (in)directly reach one another without relying on intermediate people, social network analysts termed this as *centrality closeness*. In case central actors are located on the information paths between other network actors, this attribute is called *centrality betweenness*, and enables to detect bridging organizations that link, and could link, one part of the network with another, i.e. bridge structural holes (Witt, 2004). Positionality-related aspects of such brokers needs to be acknowledged as the ties they form/connect may enable to foster and/or diffuse innovations when brokers maintain ties to many diverse and sparsely linked actors (Alder and Kwon, 2002). It may be, however, costly to maintain bridging ties due to limited resources such as time, or lack of geographical proximity and external shocks. As brokers can control information flow, they need to be also regarded as trustworthy and impartial in order to be able to forge new connections and try to bring innovative (circular) ideas forward (Burt, 2004).

3. Methods

This research investigates the SE ecosystem in Hull – a port city in the East Riding of Yorkshire, England, with the population of 259.778 (Kingston Upon Hull Data Observatory, 2019). The city is defined as a 'structurally disadvantaged city' in that it has been ranked as the 3rd most deprived local authority (out of 326) in England (Kingston Upon Hull Data Observatory, 2015). High social deprivation is reflected in that the eastern part of the city hosts the UK's worst 'food desert', i.e. an area that lacks access to fresh and healthy food products (The Social Market Foundation, 2018). Linked to this, the city has a reputation for its home-grown unique voluntary and social enterprise sector that strives to improve the quality of life of its most deprived residents. Just as structurally disadvantaged cities can seek to run innovative carbon offset projects in order to attract more investment (Wurzel et

al. 2019), Hull City Council is in the process of formulating a strategy for the CE in the city. Exploring the *social enterprise ecosystem* in the city through the lens of the CE is thus highly relevant.

This research combines qualitative and quantitative research methods. It adopts Social Network Analysis (SNA) approach (Wasserman and Faust, 1994) enabling to analyse, both qualitatively and quantitatively, ego-networks of 31 selected enterprises (i.e. nodes)[1], which constitute *social circular enterprise ecosystem* in Hull, UK. Such data was obtained through 38 semi-structured interviews, which lasted approximately 60 minutes each and were thoroughly transcribed and coded. The interviews were complemented with secondary resources such as social media websites of respective enterprises that enabled to further identify ties. Identified ties were then transferred into a matrix in Excel spreadsheets and converted into a graph using online kumu.io software. Values such as degree centrality as well as centrality closeness and betweenness were calculated using kumu.io software. The SEs were categorized into the following clusters: 1) food, 2) textile & crafts, 3) wood & furniture, 4) electronics, 5) housing, 6) hygiene & cleaning, 7) elderly, 8) women and 9) ethnic minorities sectors.

4. Results and Discussion

This section is organized around some of the key themes emerging from the network theory and coding of the interviews, and which enabled to analyse relevant network characteristics that impact the actual and potential diffusion of CE thinking and practice across the ecosystem. A more extensive approach to research, which takes into account broader network characteristics, is followed by a more intensive approach that zooms in on a number of case study enterprises in order to explore cause and effect between emerging themes and factors for the CE development. Both approaches revolve around the Figure 1 below, which depicts ego-networks of 31 selected SEs - building blocks of the broader SE ecosystem in Hull (UK), and in a given temporal context (July 2020-April 2021).

[1] Out of 74 contacted SEs (that were identified using snowball sampling and online search), 38 agreed to participate in the study and 31 were mapped to the researcher's best capacity. Thus whilst the resulting map is not exhaustive, it is strongly indicative.
In using 'organization' as a unit of analysis, this research did not account for individuals that may be suppliers and/or recipients of particular (secondary) resources.

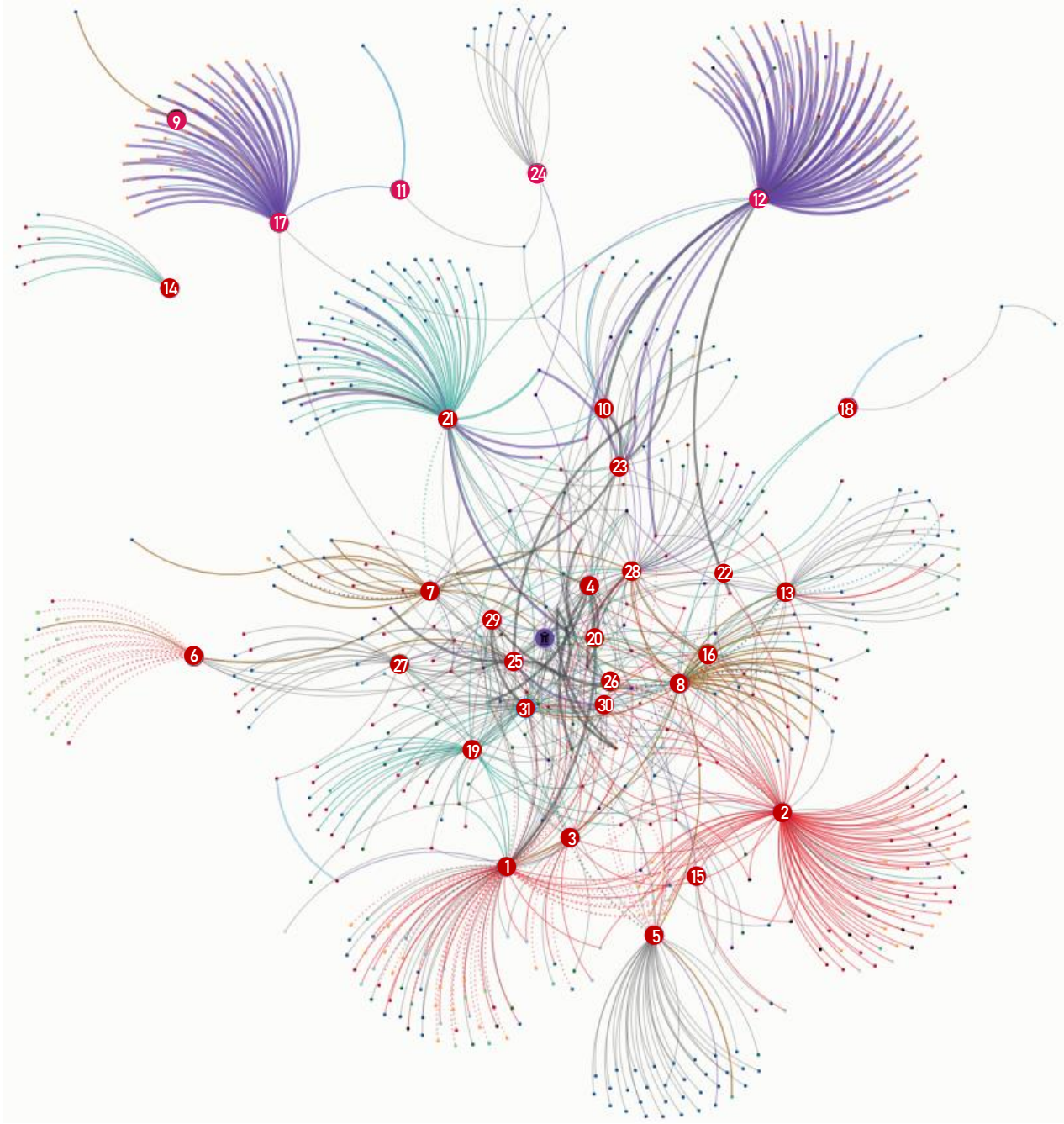
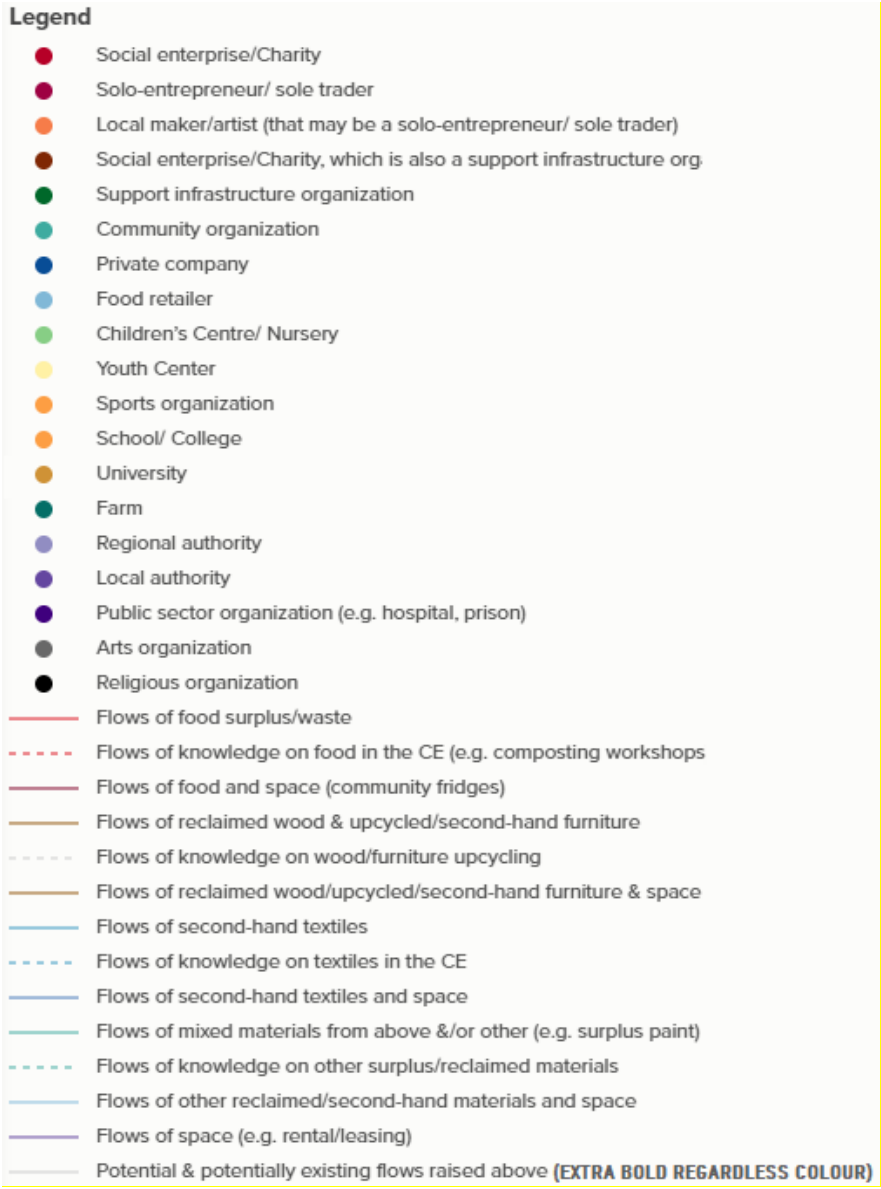


Figure 1. *Social circular enterprise ecosystem in Hull, UK (results from July 2020 – April 2021). The numbers indicate SEs participating in the study. Dots indicate other organisations ('nodes') that were not part of the study[2], and which are associated with ego-networks of SEs under study - illustrated as lines ('ties')[3]*

[2] Every node represents a different organization, yet not all the names of organizations were identified due to limited data or confidentiality issues. The nodes may be thus more interconnected.

[3] See legend for guide to the types of organisation and the type of secondary resource or knowledge in the CE being circulated.



Software for graph: kumu.io

An overview of key network characteristics

A total of 949 ties of SEs to social, private and public sector organizations (see Legend) have been identified and some of them span the city boundaries[4]. Given that many SEs adopted in the study are officially registered as charities, yet they have a trading arm and social and/or environmental mission, the 'SE/charity' sub-category was created (n=130). This sub-category also includes charities that do not have any trading arm and emerged during the mapping. Crucially, entities under the 'Solo-entrepreneur/ sole trader' category are referred to as SEs due to their social and/or environmental mission (e.g. 'SE 11' uses fabric scraps to make bags). Some of the identified SEs also intend to provide support

[4] The number of ties and interconnectedness of already mapped ties is likely to be significantly higher, yet not all information could be obtained due to limited data (partially caused by confidentiality issues)

infrastructure to other SEs alongside their individual mission to generate social and environmental benefits (see fourth category in legend)[5]. Figure 1 additionally highlights some of the cross-sectoral flows of secondary material resources (e.g. surplus wood/food/space) and knowledge associated with CE practices that may involve the use of secondary materials (e.g. planters made from reclaimed wood for composting workshops) (see Legend). Non-highlighted flows of other resources that indirectly stimulate resource recirculation concern financial flows (that underpin many highlighted material flows), referrals and reputation, or knowledge, which is vital to the functioning of a given SE. The summary of all these flows of tangible and intangible resources, which influence to varying degrees network structure, and hence opportunities for scaling of the CE across the city, are outlined in the Table 1 below.

Table 1. *Types of cross-sectoral collaborations versus resource flows: Hull, UK*

Sector	**Type of organization**	**Tie content: Type of resource/asset being transferred and/or exchanged**	**Nature of ties[6]**
Social	SEs and community organizations	Knowledge & advice (e.g. on how to set up a charity shop)	Non-market & (optionally) Relational
		Promotion/brand	Non-market & Reputational & (optionally) Relational
		Referrals (e.g. to mental health charities)	Informational & (optionally) Relational
		Secondary materials (e.g. furniture/textiles/ refurbished electronics)	Voluntary (exchange/donation)/transactional & (optionally) Relational
		Buildings	Transactional
		Pre-paid vouchers for community	Philanthropic
		Services	Transactional/ Philanthropic
		Finances	Funding
	Support infrastructure organizations	Knowledge & advice	Non-market
		Promotion/brand	Reputational
		Referrals	Reputational
		Financial resources	Funding
Private	Private company	New and secondary materials (construction materials, paint, woods/pellets)	Transactional (contractual and non-contractual)/ Philanthropic
		Knowledge & advice	Non-market
		Land and buildings	Philanthropic & Reputational/ Transactional (contractual)
		Sponsorship	Financial & Reputational

[5] Ego-networks of some of such SEs were not mapped due to lack of data (exception concerns 'SE 25' and 'SE 26').

[6] Given the multitude of different ties, the interviews did not always indicate to what extend resource exchanges were reciprocal or at least obliged receiving actors to reciprocate at some point in time.

		Labour (exchange) & corporate volunteers	Philanthropic & Reputational
		Promotion/brand	Reputational
	Food retailer	Food surplus	Philanthropic
		Promotion/brand	Reputational
	Farm	Food produce	Transactional
Public	Local authority	Land and buildings	Transactional
		Financial resources	Funding
		Knowledge & advice	Non-market
		Services	Transactional
	Regional authority	Financial resources	Financial
	Public sector organizations (e.g. prison)	Secondary materials (e.g. furniture, pellets, textiles)	Transactional
	University	Knowledge & advice	Non-market
Private/ Public	Schools and colleges	Knowledge-based service	Transactional/ Philanthropic
		Food surplus	Philanthropic / Transactional
	Children's centres and nurseries; Youth Centres	Knowledge-based service	Transactional/ Philanthropic
		Food surplus	Philanthropic / Transactional (service provision)
	Arts organization	Knowledge-based service	Transactional/ Philanthropic
		Secondary materials	Philanthropic
	Religious organization	Food surplus	Philanthropic / Transactional (service provision)

Apart from multiple interrelations among sub-sectors in the social economy sector (i.e., food, textile & crafts, wood & furniture, electronics, housing, hygiene & cleaning, elderly, women and ethnic minorities), there are several other emergent sectors that disclose the complexity of cross-sectoral interlinkages for the development of inclusive CE in the city. The most prominent ones concern links of SEs under study to mental health sector, prison and children's sector. For example, a charity providing support for disabled children welcomes workshops from SEs such as ScrapStore ('SE 21') that uses second-hand materials. KIDS also hosts workshops run by the charity for autistic people ('SE 29'). While SE 29's workshops do not necessarily involve circular practices such as upcycling, its CEO expressed interest in employing CE practices as part of its workshops across the city. Besides, some SEs engaged in wood upcycling (e.g. 'SE 7' and 'SE 8') provide mental health support through their inclusive projects and benefit from referrals of vulnerable individuals from charities such as MIND (and vice versa). Despite the relative lack of interest among doctors to prescribe activities such as community woodworking as part of the social prescribing schemes, such SEs tend to, however, struggle to cope with the rising demand for the mental health services, which is linked to COVID-19. This potentially opens up a window of opportunity to capitalize on existing community assets in order to run more of such 'healing' circular initiatives that could be organized in collaboration with local artists and nonconventional entrepreneurs (see extra bold ties in Figure 1). Nonetheless, the viability of such

initiatives is contingent on financial support from external institutions due to staff shortages and limited financial capacity of SEs. Another emerging theme concerns collaboration with the prison service. For example, Dove Hospice ('SE 13') together with Humber Wood Recycling ('SE 8') runs furniture upcycling activities in a local prison so that any profits from sales in shops run by 'SE 13' can be reinvested into SE 13's and SE 8's missions.

Zooming in: social positioning and organizational attributes vs. CE development

We argue that social positioning, understood as occupying an advantageous position in the network, which is linked to, and influenced by, organizational attributes such as organizational mission, age and (relational) capabilities, may impact adoption and diffusion of CE thinking and practice. Findings reveal that SEs' motivations behind partnerships and associated resource flows are rarely purely environmentally-driven and CE has not been, in fact, mentioned by any of the interviewees at all. Some SEs directly engaged in circular activities do not even strive to expose their environmental side. For example, the manager of 'SE 7' that upcycles reclaimed pallets stated that: '*We don't actively highlight environmental side. If it is noticed – fine. We are here to help people with mental health issues. I know we could do a lot, but we do struggle for time and volunteers to do work other than woodworking, for example, marketing*' (Interview in July, 2020). In contrast, a similar SE ('SE 8') provides its volunteers/trainees with the training course that includes environmental module on issues such as carbon based energy resources. The latter SE demonstrates how having ties to actors located in higher positions can provide access to valuable social resources. Stated differently, 'SE 8' is better socially positioned as it forms a merger with 'SE 13' that is a well-established charity in the city. As the manager of 'SE 13' noted: '*it* ['SE 8'] *has got to be self-sustaining but they do benefit from our HR, our finance, our support services, our brand and it has got its own brand which it trades under but it is connected to us*' (Interview in July, 2020). It can be, however, argued that 'SE 8' to some extent chose to trade its autonomy for improved financial sustainability, which is reflected in less external grant seeking. By specifically referring to applications for funds, this is one of the key reasons behind reluctance among SEs to collaborate with one another. The vast majority of the interviewees mentioned that there is a lot of competition for funding. For example, the CEO of 'SE 12' noted that: '*Locally, the infrastructure is very disjointed and I think they would rather have us competing for funding with each other than bringing us together to work together*' (Interview in September 2020). Such competitive behaviours have implications for lower trust among SEs/charities. Once again, some of the more established SEs/charities tend to be better in writing winning bids, thus contributing to power asymmetries within the network whereby smaller SEs facing liability of newness and smallness are placed at a disadvantage unless they receive support. Such circumstances are additionally exacerbated by the fact that, despite the diversity of funders at the national level, SEs that choose to rely on grants tend to apply for the same pots of money, often through not very heterogeneous SIOs at the local level.

Findings also reveal that in order to stimulate development of inclusive CE, SEs often need to have appropriate relational capabilities and put a lot of effort in forging and maintaining connections, yet less so in case they have a good reputation developed over time (e.g., 'SE 1') and through connections to well-known big brands. In line with Lekan et al. (2021), many private companies eagerly transfer their secondary materials such as food or wood surplus to SEs in order to lower their waste management fees and enhance their corporate image. SEs, in turn, receive secondary materials free of charge, and which can be sold at low price to local community members. The vast majority of such interactions is underpinned by informal agreements, which may be facilitated by strong ties that potentially impact the quality of procured resources and, consistent with Hoang and Antoncic (2003), exemplify how social capital may act as a governance mechanism that creates cost advantage. For example, the Manager of Recycling Unlimited noted that '*one of our volunteers is a director at a company that gives us pellets so they are quite useful. We sometimes get end of product stuff and things that we can sell*' (Interview in July 2020). From a dynamic perspective, the frequency of the content being transferred and/or exchanged is organization-specific (e.g. some organizations whose mission is to provide food aid to those in need are going to have frequent interactions with food retailers). Crucially, the high volume of surplus, or second-hand, materials from the private companies (e.g. textiles, wood/pellets, food) surpasses the capacity of SEs to reprocess it. This only highlights the scale of the waste problem in the economic system and limited capacity of SEs to expand in order to reutilize more resources.

Consistent with studies demonstrating that network diversity is shown to be negatively correlated with ventures under 3 years old as it takes a lot of time and energy to forge new links (Witt, 2004), many of the SEs under study that are less than 3 years old have less heterogeneous ties (see 'SE 11' and 'SE 14'). Nonetheless, young charity shops such as Sue Ryder ('SE 14'), which belongs to a larger national chain and hence are subordinated to higher management structures, display lower degrees of flexibility when it comes to decision making at the local level and, linked to this, rarely collaborate with other SEs in the city. Other SEs, such as 'SE 24' operating since 2011, simply do not have an interest in forging new collaborations out of personal reasons. Some representatives of SEs also complained about the lack of collaborative spirit in the city, which may be amplified in particular spatial locations.

Zooming in and out: spatial positioning vs. circular ties

Geographical proximity (or lack thereof) has implications on the collaborative relations across sectors, which may either enable or constrain local development of (inclusive) CE in the city. Crucially, spatial positioning may impact, and by impacted by, the SEs' social positioning. Interviewees clearly indicated that many SEs are less willing to collaborate with those SEs representing the same sector and mission (e.g. delivering educational workshops on food growing) that are located in a close geographical proximity due to competitive pressures and the risk of inadvertent knowledge spillovers. Such negative externality occurs regardless SEs' social positioning/development stage. Younger SEs facing liability

of newness and smallness are, however, all the more likely to experience such negative externalities as they try to establish themselves in the market. Many SEs are hence required to find strategic ways to act as satellites across the city, thus outside their catchment area. An exception here is charity shops, many of which are located in close proximity, yet do not tend to compete with one another over customers. As the manager of a large local charity retail ('SE 13') noted, customers, in fact, often '*do charity shop rounds* (…) *so some of our more successful shops are actually in a parade of shops where there are three different charity shops because generally shoppers are not shopping to support the hospice, they are shopping because there is a t-shirt that they like*' (Interview in July 2020). Findings reveal that the failure/closure of charity shops is, instead, largely attributed to their internal organization's difficulties that may be exacerbated by external factors such as COVID-19. Such difficulties usually concern financial issues, for example, when managing volunteers who wish to be remunerated ('SE 7'). There are also some spatially-contingent power imbalances whereby well-established and larger SE tend to dominate. For example, the manager of a 'SE 13' stated that: '*We can't keep opening shops anymore because we are running out of spaces where they are busy enough to have shops. We can't step outside of Hull and East Riding catchment area because there are other hospices and so you can only have kind of like one charity shop in that village or on that high street*' (Interview in July, 2020). Interestingly, the fact that it is becoming increasingly difficult to find a geographically attractive space for a charity retail shop has not had any significant impact on the performance of that particular SE. This is because it succeeded in forming a merger with 'SE 8' with which it shares revenues, and founded a lottery in order to source more financial capital from outside its catchment area.

Findings suggest that SEs are more likely going to form homophilic ties (i.e. collaborate with SEs that are more similar to themselves), including those in close proximity, in case they complement each other's activities. For instance, findings reveal EMS, Ltd. ('SE 1') works closely with a neighbouring SE that likewise provides food to the local community, yet offers EMS, Ltd. free space for cooking and food storage. While studies reveal that geographical proximity alongside long duration of relations can positively impact the quality of relationships due to the time required to foster trust (Lechner and Dowling, 2003), in this case such close geographical proximity coupled with frequent interactions does not indicate that there are high levels of trust and reciprocity between two organizations. For example, efforts of EMS, Ltd. to transform vacant urban land owned by the neighbouring SE ended up in failure after the latter SE decided to hand the land over to private companies for transformation into social housing infrastructure. This showcases how complex power relations underlie many ties.

By further referring to the food sector, there are also three SEs acting as 'food hubs', which form homophilic ties by mission attribute and coordinate efforts to provide food aid across the city. Facilitated by FareShare ('SE 2'), which redistributes food surplus from large retailers to social and

public sector organizations across the city, strategic spatial positioning of these food hubs (i.e. in the northern, central and eastern parts of the city) helps them to effectively realize their shared mission through coopetition. An alternative to such food aid initiatives constitute SEs such as Rooted in Hull ('SE 5') - an urban agriculture project in central Hull. 'SE 5' is co-located with Humber Galvanizing Ltd. after the SE became the tenant of the private company's vacant land. Such geographical proximity enabled to develop trust and reciprocity between the two partners. For example, in return for free rent, 'SE 5' not only enhances the private company's corporate image, but also offers an attractive outdoor space for corporate socially-distanced events in times of global pandemic caused by COVID-19. Such collaboration is in line with Witt (2004) who noted that '*In the long run, the ties need to be symmetrical and based on contributions of equal (subjective) value. Entrepreneurs trying to utilize their network ties opportunistically without reciprocal offerings are bound to fail*' (p. 408). 'SE 5' also hosts a variety of social events, welcomes volunteers from the adjacent prison, and provides a marketspace space for local artists and food growers. Despite having a number of strong ties to a number of organizations, the temporal nature of the tenancy agreement suggests that the longevity of this mini-SE-ecosystem is contingent upon the private company's future growth strategies. On the other hand, hubs such as 'SE 25' and 'SE 26' are autonomous and perhaps more resilient in that they own their properties. While those hubs tend to be more interested in providing symptomatic food aid, they have the potential to disseminate CE thinking and practice in their neighbourhoods. For example, 'SE 26' is in the process of developing a community hub, which will host an array of inclusive training schemes, and which is surrounded by entrepreneurs, some of whom could contribute to the CE in the city. By forging more links with community-based organizations and SEs that are, for example, engaged in activities such as tailoring ('SE 11' and 'SE 10'), it would be possible to expand the circular curriculum of such 'hubs'. Such agglomeration or clustering of diverse SEs in one place can generate a range of *untraded interdependencies*, i.e. intangible benefits that cannot be costed (Vicente, 2018). These may include enhanced community spirit and networking that may result in beneficial work partnerships. Overall, while co-location may enable information and knowledge spillovers (Breschi and Lissoni, 2001), gains from co-location may also come with costs (Bagley 2019). For example, entrepreneurs clustered around such hubs may need to travel across the city to reach their workplace. One could, however, argue that such costs may be offset by environmentally friendly activities within such hubs.

Core vs. Periphery

While findings suggest that there is a high network density, i.e. high concentration of actors, including large SEs, in central part of Hull, these actors are not necessarily more connected to others than SEs that are located in more Western, Northern or Eastern parts of the city such as 'SE 1', which is located in East Hull and has a large, well-established network with the highest degree centrality (n=95) and

centrality closeness in the whole network (n=0.481)[7]. Nonetheless, some SEs that are engaged in circular practices and are located on the periphery of the city tend to be, to a varying extent, negatively affected by their geographic location. An example concerns 'SE 7' located on the Western margins of the city that cannot be easily accessed by the public transport. Despite its peripheral location, the SE offers delivery of its goods (from upcycled pellets) and owns a mobile trailer shop for outdoor markets. It does, however, struggle with the low number of volunteers, which affects upscaling of SE's activities and could be attributed to the SE's remote location. Besides, while the SE offers services to private companies located in close proximity, the majority of the pallets is sourced from private companies located across the city. Coupled with private deliveries, these aspects have repercussions on the organisational carbon footprint.

Central location is not always beneficial for SEs either. For example, the CEO of 'SE 12' - an enterprise offering upcycling workshops with local artists on central High Street – is seeking new premises in order to collaborate with more actors. As the CEO of the SE said: '*there aren't many people down there (...) Equally everybody is trying to cover their rent and quite often people have got loads of ideas of doing things but getting people motivated was really difficult. I am just isolated down here*' (Interview in September 2020). This suggests that there is an interplay of factors inhibiting collaboration, including differential priorities among various organizations, which impact the overall network heterogeneity. Crucially, 'SE 12' is an example of an enterprise showcasing the negative correlation between its high degree centrality (n=78) and network heterogeneity as the majority of its ties (n=60) are weak ties with individual local makers/artists that are either given a space to sell their products or run workshops at the SE's premises. Some of these artists could, however, have useful connections to cultural organizations and are 'diverse' in terms of specializing in different forms of art and craft. All these aspects need to be taken into consideration when seeking new collaborations for a more creative CE in the city that could be promoted by organizations such as museums (e.g. through zero-waste exhibitions).

Circular brokerage

There is potential to foster more collaboration within and across sectors through brokers. While the highest betweenness centrality in the generated network (Figure 1) is represented by 'SE 1' (n=0.194), 'SE 12' (n=0.201)[8] or Hull City Council (0.136), empirical analysis suggests that it is SIOs and non-profit initiatives that could jointly facilitate CE-related flows of knowledge and information across the network due to their 'gatekeeping' behaviour, expansive contacts and reported interest in promoting CE. While some SEs such as 'SE 4' or 'SE 31' expressed interest in raising environmental awareness,

[7] Such values are only provisory as the data for each SE vary depending on the amount of information shared with the researcher.

[8] These numbers are not highly representative as it is very likely that other more established SEs have many more connections and high betweenness centrality.

their ties are less extensive than those of SEs and SIOs indicated above. Crucially, university can act as an important boundary-spanner that has the potential to incentivize and mediate interactions between relevant stakeholders, especially those on the social and spatial periphery. There is, however, a need for financial support, strong visionary leadership and a representative body for each 'cluster'. For example, Hull Food Partnership already acts as a 'representative broker' of the food sector by forging strategic partnerships and communicating information to relevant actors. As CE practices are increasingly being digitally-enabled (Lekan and Rogers 2020), it can be also expected that digital technologies and social media will play an important role in enabling *circular brokerage*, and thus fortifying circular SE ecosystem regardless social or geographic positioning of brokers.

6. Conclusions

This paper shed some light on the broader research project investigating the role of networks in stimulating SE-led local development of a socially inclusive CE that integrates vulnerable social groups (such as mentally unwell) and small (eco-) entrepreneurs across multiple sectors such as food, wood, textiles. While the generated SE ecosystem map only provides a snapshot of the social (circular) enterprise ecosystem in Hull (and in a given temporal context), some of the key network patterns that underlie formation of collaborative ties for the CE can be discerned. We contend that integrating considerations of SEs' organizational attributes, motivations behind partnerships and their social and spatial positioning, which, in turn, impact the content of SEs' ties and network heterogeneity, offers new insights into the underlying imbalances (such as those liked to competition over funds) and associated variegated levels of trust within the *social circular enterprise* ecosystem. All these aspects need to be scrutinized due to their impact on SEs' performance outcomes and, ultimately, on the development of a socially inclusive circular cities. Crucially, employment of CE practices will not increase attractiveness of the overall ecosystem to external and internal stakeholders unless relevant institutional support is in place. Adoption and diffusion of CE practices will take place provided that cross-sectoral collaborations enabling to 'plumb' the ecosystem are forged.

We propose a need for developing the chain of loosely interconnected 'entrepreneurial hubs' (mini-ecosystems) that emerge in different parts of the city, yet around well-established SEs that often act as SIOs for a diverse array of entrepreneurs, including those engaged in the CE that deserve much more attention to increase financial independency. Understood as '*inter-connected collections of actors, institutions, social structures, and cultural values*' (Roundy, 2017:1252), such entrepreneurial ecosystems could be infused with more circular practices, ultimately helping to regenerate areas of economic stagnation whilst strengthening communities and neighbourhoods across the city as a whole. It is also important to support SEs in acting as satellites across the city in order to facilitate recirculation of material and knowledge resources within the city boundaries. The subsequent part of this research, which is beyond the scope of this paper, investigates the impact of the broader institutional context in

both facilitating and impeding the development and diffusion of social circular innovations within the broader circular SE ecosystem under scrutiny.

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Assessing Circular Economy at the company level: proposal of an ex-ante evaluation framework

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Abstract

Companies require assistance in assessing the sustainability of circular solutions prior to strategic decisions on their introduction. This article proposes an ex-ante, holistic circular economy (CE) assessment framework SCEIA (Strategic Circular Economy Impact Assessment) at company level, using a mixed-methods approach. First, the framework's normative core and objectives are formulated. A critical literature review method is used to position this article's view that CE, as a concept, is valuable only when contributing positively to all three dimensions of SD. Secondly, a descriptive literature review of previously applied methods in CE assessment is used to design the framework's basic methodological structure, matching its previously defined normative core and objectives. The selected methods comprise a combination of the existing methods of Life Cycle Assessment (LCA), Life Cycle Costing (LCC), Social Life Cycle Assessment (S-LCA) and Material Flow Analysis (MFA), leading to a wide selection of to-be-applied indicators. These indicators can subsequently be tailored and simplified accordingly to the organization's goals at hand through a materiality assessment (MA). A Multi Criteria Decision Analysis (MCDA) TOPSIS approach is optional to assist in decision-making. Thirdly, the procedure of using the framework in a decision-making process at the strategic level is made explicit by connecting it to existing strategic decision-making frameworks and specifying its application routine. The CE assessment framework is designed to prevent trade-offs and burden shifting, and to deliver valuable insights in the impacts of company-level CE activities It will be validated in next research steps.

Keywords: Circular Economy, Sustainability, Corporate sustainability, Assessment methods

1. Introduction

The Circular Economy (CE) consists of an umbrella of ideas that are characterized by their aim to strive for increased resource efficiency through closing resource loops (Ghisellini et al., 2016; Blomsma & Brennan, 2017). While CE strategies can be implemented on different levels, private sector companies are particularly influential in the CE transition due to their intensive resource- and energy use (Blomsma et al., 2019; Pieroni et al., 2020). Still, the uptake of CE principles by companies is still limited (Pieroni et al., 2020; Howard et al., 2019).

The contribution of CE strategies to realizing sustainability goals is ambivalent; various examples in which higher resource efficiency does not lead to benefits in the environmental, economic or social domains of sustainability are available (Kravchenko et al., 2019; Blum et al., 2020). While the inclusion of positive social aspects from CE would be necessary to support Sustainable Development (SD), the social dimension is commonly overlooked in CE strategies (Kirchherr et al., 2017; Schöggl et al., 2020). In the context of the accelerated climate emergency and persisting global socioeconomic inequalities, the need for the assessment of the sustainability impacts of CE strategies before their introduction becomes pertinent (Corona et al. 2019).

A research field is dedicated to understanding how CE at the level of an organization could be assessed (Corona et al., 2019). Yet, no methodological consensus or standardized approach on how to assess an organization's degree of circularity exists (Kristensen & Alberg Mosgaard, 2020). CE assessment approaches are used relatively rarely by organizations (Stumpf et al., 2019) and reviews on current assessment methods indicate methodological shortcomings that might lead to undesirable burden shifting from reduced resource use to increased environmental, economic or social impacts (Corona et al., 2019).

With these issues in mind, the aim of this article is to design the foundations of a new ex-ante company-level CE assessment framework that prevents unwanted burden shifting. It is designed to assist in the strategic decision-making process of selecting a certain CE solution. Strategy is here interpreted as a way forward to achieving SD and its objectives (Waas et al., 2014). This level of decision-making is selected because of the apparent lack of including sustainability considerations in strategic decision making (Engert et al., 2016; Kravchenko et al., 2021).

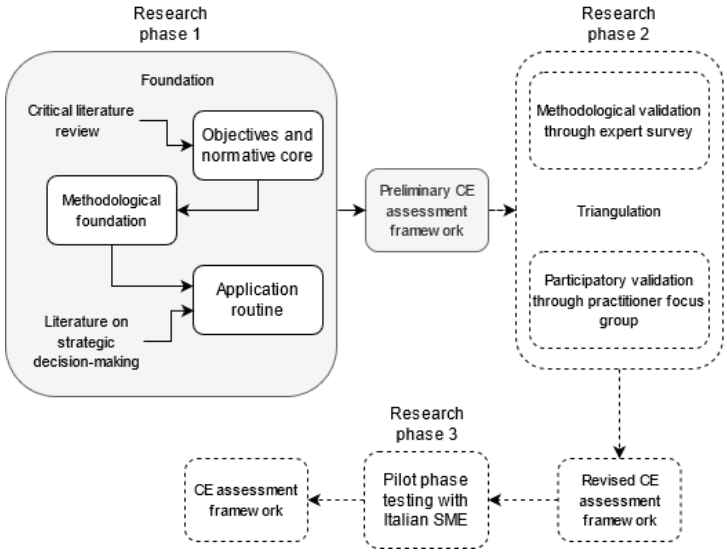
The proposed methodology consists of three phases, of which this paper focuses on the first phase. It comprises setting the objectives of the framework, determining its methodological content and its application routine. The second and third research phases, not reported in this article, consist of validating the framework using a triangulation approach: an expert panel survey and a series of focus group sessions with practitioners.

In the present paper first, the methods applied to construct the framework are presented. In chapter 3, the frameworks objectives, methodological content and application routine are presented. Then, in the conclusion, the research project's future research steps are detailed.

2. Methods

A mixed-method research design is used throughout this study, consisting of a literature-based approach in combination with the aforementioned validation steps (here not presented). A schematic presentation of the research design and the three consecutive research phases is visualized in figure 1. This paper describes research phase 1, leading to the preliminary CE assessment framework.

***Figure 1**. Schematic overview of full research design (research phases in dotted lines are not described in this article).*



The foundation of the framework consists of three elements: its objectives and normative core, its methodological foundation, and the application routine of the framework. Formulating the normative core is based on positioning the framework in the context of the connections between CE and Sustainable Development (SD). To synthesize the primary characteristics of this debate and substantiate our view on the links between CE & SD, a critical literature review approach is applied. The goal of this approach has been described to "assess, critique, and synthesize the literature on a research topic in a way that enables new theoretical frameworks and perspectives to emerge" (Snyder, 2019).

After developing an understanding of the objectives and desired eventual outcome of CE and the framework, fitting methodological properties of the framework are formulated. They are discussed through the application of a descriptive literature review, using CE assessment framework that are already applied by practitioners (Paré et al., 2015). A descriptive review seeks out to find patterns among literature on a certain topic with respect to pre-existing propositions, theories, methodologies and has the aim to ensure generalizability of the results. First, existing frameworks are reviewed based on whether they (1) are applied in practice or (2) show to have an approach that responds to at least one of the objectives as formulated previously. From these frameworks, methodologies are extracted that are matching the previously formulated objectives. Next, strategic decision-making literature is consulted to further structure the framework and provide its application routine. In following research steps, to be conducted in future research, the resulting preliminary framework is then revised based on the outputs of the triangulation step.

3

3. Results and Discussion

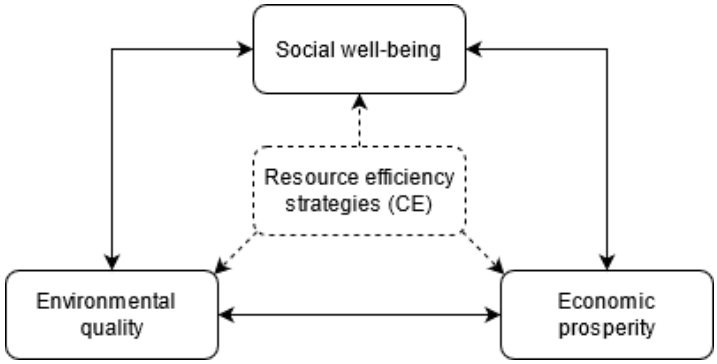
3.1 Framework objectives and normative core

The overall goal of the framework is to assist strategic decision-making processes that involve the consideration of whether to implement CE solutions. From the critical literature review, the framework will follow the subsequent five objectives.

A. Enable holistic (multi-dimensional) assessment.

Firstly, a conceptual understanding of the relation between CE and SD is formulated. This is referred to as the framework's normative core. The current debate about this relation is complex and the relation has yet to be thoroughly defined (Calisto Friant et al., 2020; Geissdoerfer et al., 2017). Several studies recommend to consider all three dimensions of SD as the desired end goal of CE strategies (Vermeulen et al., 2018; Kravchenko et al., 2019). Current resource-focused metrics might lead undesirable burden shifting from reduced resource use to increased environmental, economic or social impacts. The foundation of the framework aims to avoid this by inclusion of all three interrelated SD dimensions. CE is thus interpreted as a toolbox of resource-efficiency strategies to achieve positive impacts on these three SD dimensions (see figure 2).

Figure 2. *Proposed normative core of the CE assessment framework.*



B. Prevent burden shifting to other parts of supply chain or life-cycle (life-cycle perspective).

To avoid burden shifting to other parts of the supply chain, a holistic, life-cycle perspective on corporate sustainability is promoted. Today, the impacts of an organization's operations occur in different stages of the production process, which are often undertaken by different companies (Bianchini et al., 2018). The framework adheres to the established concept of Life Cycle Thinking (LCT), which considers the whole product system life cycle from the "cradle to the grave", hereby preventing environmental burden shifting to different parts of the life cycle (Finkbeiner et al., 2010).

C. Provide flexibility in terms of (1) scale and (2) sustainability maturity.

The scale on which the framework can be applied is flexible. The SCEIA framework adopts the view that the scale of assessment depends on an organization's goal of evaluation and decision-making context (Ávila-Gutiérrez et al., 2019). Product, product-line, plant, division, or entire organization could

be units of analysis within the framework, depending on the end user's goals (Ceschin & Gaziulusoy, 2019). Next, the complexity of sustainability assessment methods has been described as a barrier to their application, especially for companies with lower sustainability maturity or less available resources (Álvarez Jaramillo et al., 2019; Johnson & Schaltegger, 2016). The SCEIA framework intends overcome this through being adjustable to the sustainability maturity of the applying firm, by limiting the number of indicators when necessary.

D. Build on existing assessment tools.

The SCEIA framework emphasizes the use of existing sustainability impact assessment methods. They are able to avoid burden-shifting and trade-offs and provide a holistic representation of the real-world impacts (Pauliuk, 2018). Using methods such as LCA to assess CE has been explored and recommended (ISO/TC 323, 2021; Niero & Rivera, 2018; Walker et al. 2018). While some methodological adaptations are still necessary, existing methodologies, such as LCA, but also Material Flow Analysis (MFA), Life Cycle Costing (LCC) and Social Life Cycle Assessment (S-LCA) provide an appropriate starting point for assessing CE activities (Kristensen & Mosgaard, 2020; Niero & Rivera, 2018b).

E. Assist strategic decision-making processes.

The integration of sustainability into company strategy levels is still a challenge for firms of various sizes (Kravchenko et al., 2021). Strategy has been described as the creation of a unique and valuable position, involving a different set of activities (Porter, 1996). Strategic decisions in firms are characterized by high stakes and long-term repercussions (Bushan & Rai, 2004). Strategic decision-making is a process that involves the selection of a preferred action among alternatives (Waas et al., 2014; Kahneman et al., 2019). The choice for the this level follows from the standpoint that marginal impact improvements are not enough and can even be counterproductive (Holmberg & Robert, 2000). The strategic level of decision-making is considered to more likely result in high-impact changes.

3.2 Methodological foundation

The methodological basis of the framework consists of a combination of existing methods that contribute to the previously formulated objectives. This basic methodological structure draws inspiration from previously applied CE assessment approaches, which are (1) applied in practice or (2) show to have an approach that responds to at least one of the objectives as formulated previously. These are: Ecotest (FFACT), Optimal Scan (Optimal Planet), Circular Transition Indicators (CTI), UL3600 (UL), and ISO 323 (ISO, currently under development). From this selection of CE assessment approaches, the following methods have been extracted:

Environmental quality – LCA.

The intention of LCA is to quantify the potential environmental impacts of a product system throughout its life cycle (Dieterle et al., 2018). It is the most widely used environmental impact assessment method

available, and companies are already using the methodology to reduce the environmental impact of their products and operations (Kjaer et al., 2019).

Economic prosperity – LCC.

LCC is a technique to assess the total costs associated with the life cycle of a product system, or over a selected period of time, that supports decision making processes during the development stage of products (Wouterszoon Jansen et al., 2020). The SCEIA framework incorporates LCC to provide insights into the changes in life cycle costs through the introduction of CE activities.

Social well-being – S-LCA.

Methodologies that enable the assessment of the social impacts of organizations are still under development, and their use is not widespread (OECD, 2015). The methodology that is selected to assess the social dimension of SD is Social Life Cycle Assessment (S-LCA) (UNEP, 2020). It facilitates companies to operate in a socially responsible manner by providing data about the potential social impacts on people caused by the activities in the life cycle of their product (Dreyer et al., 2006). S-LCA carries several methodological- and practical challenges, but is considered the most advanced method to obtain insights into social impacts while accounting for trade-offs.

Resource efficiency strategies (CE) – MFA and CE strategy inventories.

No standardized methodology to assess the resource-oriented or 'circular' dimension exists (Kristensen & Alberg Mosgaard, 2020; Roos Lindgreen et al., 2020). While there is a lack of scientific consensus on the nature of CE assessment, research agrees that a core principle of CE consists of striving for resource efficiency. With respect to CE, a well-used existing methodology to obtain insights into resource and energy flows of products and processes is Material Flow Analysis (MFA). It does not provide information on how a certain system could become more resource-efficient. However, several authors have designed frameworks that enable identifying circular material strategies (e.g. Blomsma et al., 2019; Reike et al., 2018a).

Providing flexibility in terms of sustainability maturity – Materiality Assessment (MA).

The previously selected methodologies will result in a large number of indicators. To make its use more attractive and accessible, the SCEIA framework aims to enable the selection of indicators that are most 'material' (important) to an organization and its stakeholders through a Materiality Assessment (MA) (Johnson & Schaltegger, 2016; Whitehead, 2017). MAs involve a materiality matrix, with the company and its stakeholder placing issues on a spectrum from less to more important. Previous experience with sustainability impact assessment is likely to allow for a higher number of indicators to be included (UNEP Setac Life Cycle Initiative, 2020).

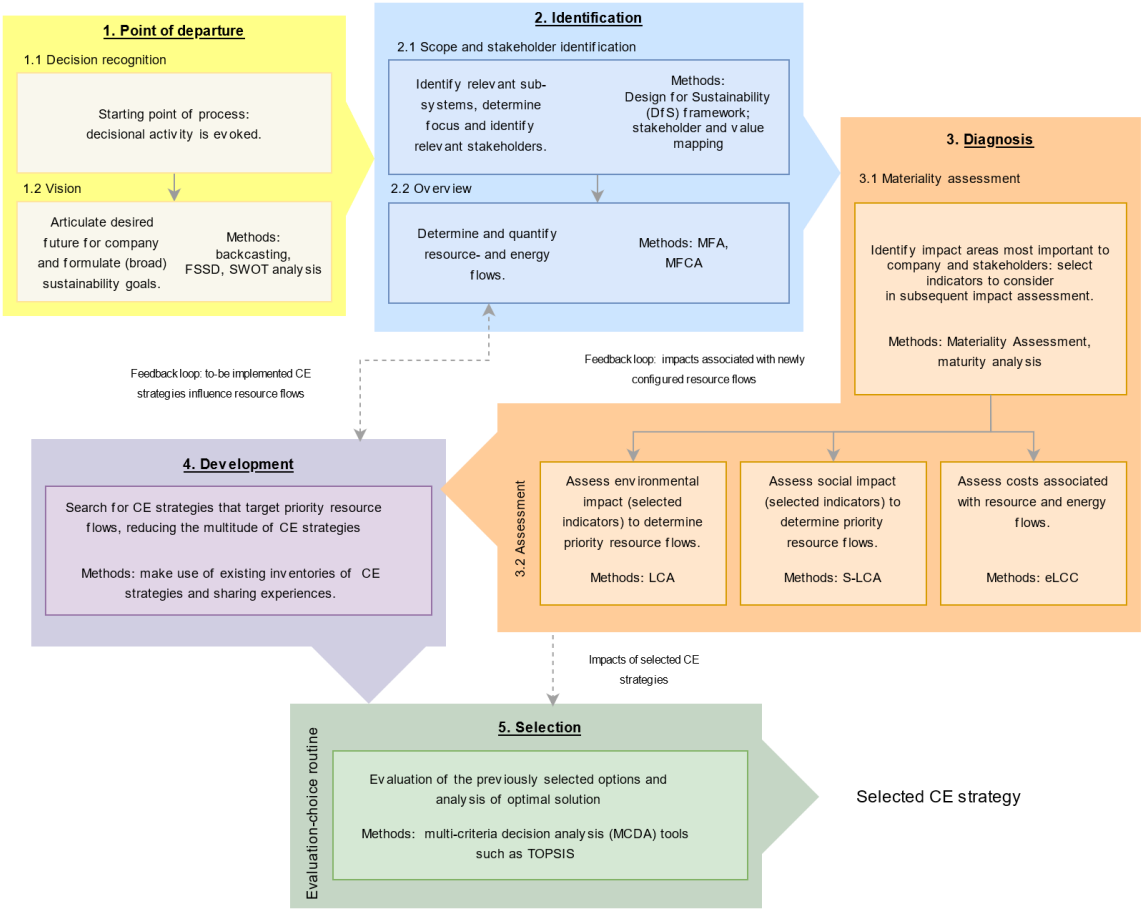
Multiple criteria analysis methods.

Applying Multi Criteria Decision Analysis (MCDA) is a well-described strategy for addressing multiple conflicting objectives in sustainability assessment to facilitate decision-making processes (Cinelli et al., 2014; Buchert et al., 2015). While various types of MCDA exist, in the SCEIA framework, the use of the so-called Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS) is recommended. This technique has been described as simple, rational and comprehensible, and has been applied to sustainability decision-making in CE before (Roszkowska, 2011; Niero & Kalbar, 2019).

3.3 Structure of the CE assessment framework

After describing the framework's normative core and methodological setup, its step-by-step application routine is described. The SCEIA framework is intended to assist strategic-level decision-making with respect to the introduction of circular strategies. This purpose requires connecting it to management literature, particularly from Mintzberg et al. (1976), Azapagic (2003) and Porter (1996). The framework is structured accordingly to the proposed structure of decision processes by Mintzberg et al. (1976), after which it has been modified accordingly to the context of CE decision-making. The structure is also in line with the 4-step (ABCD) operational procedure of the framework for strategic sustainable development as proposed in Broman & Robèrt (2017), the three consecutive phases of sustainability decision planning along supply chains by Stindt (2017), and Azapagic's systems approach to corporate sustainability (2003). The framework's structure consists of five phases as shown in table 5, of which some are iterative. A visual representation of the application routine of the framework is provided in figure 2. Each of these steps contains sub-steps that comprise the methodological elements as described in chapter 3.2. In the next subsections, each step is briefly explained.

Figure 2. *Visualization of application routine of SCEIA framework.*



Phase 1. Point of departure

Step 1.1 - Decision recognition.

The first phase of the strategic decision-making process is the decision recognition phase, in which strategic opportunities, problems and crises which evoke decisional activity are recognized (Mintzberg et al., 1976). Various drivers (legislation, customer demand) that evoke such a decision can be envisioned. The external drivers and actors involved are therefore highly diverse; internally, the decisional activity will likely be driven by management level employees.

Step 1.2 – Vision.

Then, the development of a sustainability vision by the company's management follows. Participation of a diverse range of both internal as well as external stakeholders has been described as a success factor for vision development (Mirvis, Googins, & Kinnicutt, 2010). This vision is then translated into general sustainability objectives on a strategic level; for more operational decisions, more specific targets are recommended (Kravchenko et al., 2021). Backcasting and the FSSD are recommended as appropriate approaches to move from a sustainability vision to arriving at a strategic plan (Broman & Robèrt, 2017; Mendoza et al., 2017). A sustainability SWOT analysis could be carried out to obtain a more formalized

picture of the company's strategic fit through identification of its strengths, weaknesses, threats and opportunities (Azapagic, 2003).

Phase 2. Identification

Step 2.1 - Scope and stakeholder identification.

Next, the scope of the assessment is identified (Broman & Robèrt, 2017). It could still be adjusted after continuing with the following steps, as most parts of the framework are intended to be applied iteratively (ISO, 2006). The scope is determined by the nature of the decision at hand, providing flexibility to zoom in on a certain product, product category, business division, geographic location, or process most relevant to the company (Ceschin & Gaziulusoy, 2019). Also, internal- and external stakeholders are identified, since early and constructive stakeholder engagement is described as a prerequisite for a sustainable corporation (Azapagic, 2003; Shrivastava & Hart, 1995).

Step 2.2 – Overview.

In the overview step of the decision-making process, the system at hand is clarified and formalized. It is the first step in which the CE assessment framework explicitly offers quantification of inputs- and outputs of the system. To quantify these resource flows along value chain processes within the previously set scope, the framework recommends the use of MFA (Stindt, 2017). It will provide the blueprint for any next steps, indicating where in the system which types and quantities of energy and resources are used. This is a technical and data-intensive exercise, for which external expertise is likely needed.

Phase 3. Diagnosis

The diagnosis phase entails comprehending the cause-and-effect relationship between the "evoking stimuli" relevant to the decision context (Mintzberg et al. 1976). In the current context of understanding the sustainability impacts of introducing CE solutions, this would mean to understand the relations between resource- and energy use and their respective sustainability impacts, allowing to prioritize areas for change; i.e. determining which resource flows to target with the implementation of CE strategies. It provides the baseline environmental, economic, and social performance of the system, signalling impact hotspots (Azapagic, 2003).

Step 3.1 - Materiality assessment.

Before determining these baseline impacts, it is recommended to determine priority impact areas through a materiality assessment (MA). The primary reason for this is the need for simplification, driven by the large number of possible impact indicators from the impact assessment methods LCA, LCC and S-LCA. The MA will reveal the aspects of each sustainability domain that are most important to both the company and its stakeholders (Whitehead, 2017).

Step 3.2 - Impact assessment.

Then, the sustainability impacts associated with the resource- and energy flows of the system are quantified. This is done using methods as proposed in Life Cycle Sustainability Assessment: LCA, S-

LCA and LCC (ISO 14040-44; 2006). They will be tailored accordingly to the input from the previous MA (i.e. the number of indicators is reduced).

Phase 4. Development: search and screen

Following the realization of the baseline impact of the system, this phase includes 'browsing' existing ready-made solutions and designing new solutions (Mintzberg et al. 1976). This process of 'search and screen' will be centred around browsing available CE strategies (see table 2), and choosing which CE strategy is (1) most suitable to the system at hand, (2) most effectively targets the previously determined priority impact domains. The CE strategy that is most useful to the company is to a large extent determined by the decision-making context (i.e. sector, internal culture, market conditions, logistics, available human resources, etc.). It goes beyond the scope of this framework to formulate business model innovation pathways for manufacturing companies. Still, when selecting a CE strategy, the focus should be on eliminating – or minimizing - resource flows that are associated with high environmental and social impacts.

Phase 5. Selection - evaluation-choice routine

The evaluation-choice routine is considered to be the evaluation of the previously collected options (Mintzberg et al. 1976). When a small number of CE strategies is selected, and an equally small number of SD indicators, the evaluation-choice routine (i.e. selecting the preferred CE strategy) might be straightforward. However, it is highly likely that trade-offs emerge that are not resolved easily without additional decision support. This additional support is offered in the forms of the MCDA approach, and, more specifically, by recommending TOPSIS. This relatively simple technique offers to select the alternative (i.e. CE strategy) with the shortest Eucledian distance to an ideal solution. Software to aid the TOPSIS process is readily available, increasing its applicability.

4. Conclusions

This paper presents a preliminary draft of the CE assessment framework SCEIA, designed to be used in strategic decision-making processes with respect to the implementation of CE strategies. Following a critical literature reviews, the framework's objectives were formulated as follows: (1) enable holistic (multi-dimensional) assessment, (2) burden shifting to other parts of supply chain (life-cycle perspective), (3) provide flexibility in terms of scale and sustainability maturity, (4) build on existing assessment tools, (5) assist strategic decision-making processes. Next, appropriate methods matching these objectives were selected from a number of existing frameworks, and the application routine of the methods was constructed based on literature on strategic decision-making. In the next phases of the research project, the framework will be validated using a dual triangulation approach: an expert panel survey with CE assessment experts and a series of focus group sessions with practitioners in order to gather their inputs. It is expected that, in this validation process, some tension between completeness (robustness) and applicability (ease of implementation) will be revealed. While these questions have currently not yet been addressed extensively in literature, the presented preliminary

framework will offer the opportunity to thoroughly reflect on sustainability assessment in the context of CE strategies, eventually aiming to move forward the transition to a more sustainable mode of business.

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Circular economy implementation strategies towards circular economy operationalization: transition perspectives from the meso-level in Spain.

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Abstract

The circular economy (CE) is still struggling to move away from the current linear system and shift towards a factual sustainable development that brings economic prosperity, social justice, and environmental protection. Thus, an acceleration of the transition through different stakeholders supporting the shift away from a linear system could bring the CE considerably closer. Thus, this study carried out multiple semi-structured interviews among CE stakeholders to explore what implementation activities might transform strategies into practice in a particular circular transition scenario (i.e., industrial symbiosis). Multiple stakeholders were interviewed regarding the implementation activities that must be either practiced, tried out, or showcased based on a set of strategies for this transition scenario previously prioritised for this study. The results were analysed through MAXQDA software to seek new insights on how specific experiments and actions towards the CE can be upscaled to established practices. Therefore, the transitions might be fully deployed from both the bottom-up and top-down.

Keywords: circular economy, transition management, experiments, stakeholders, industrial symbiosis.

1. Introduction

Despite the practical benefits that the CE might deliver to society, the endless pursuit of continue economic growth is challenging the materialization of closed-loop systems of resources and energy with lower carbon emissions (Figge & Thorpe, 2019). As material extraction, processing and handling are accountable for a large chunk of emissions, CE strategies are even more necessary for emissions reduction through a systemic transformation of the current consumption and production pattern (Prieto-Sandoval, Jaca, Santos, Baumgartner, & Ormazabal, 2019). Since the term CE was coined and

popularized, the progress accomplished is more closely tied to a niche issue, such as in Europe, where the European Commission has established an action plan to enhance circularity at the supranational level (European Commission, 2015). Despite top-down efforts to promote the CE, the circular model is still advancing slowly in the EU, with most of the reasons for this being attributed to a lack of consumer interest and an industry environment reluctant to accept this change of paradigm (Kirchherr et al., 2018).

This slow transition calls for solutions with a systemic approach involving a plurality of actors, namely policymakers and businesses, in coordinated strategies that transform narrative into practice (Kern, Sharp, & Hachmann, 2020). To do so, an approach that brings initiatives aimed to foster systemic action in collaboration with multiple stakeholders across and within value chains will be critical for a circular transition to materialise (Figge, Thorpe, & Good, 2021). In that sense, Loorbach, Frantzeskaki, and Avelino (2017) propose transition management theory as a reference for a deliberative process to speed up change towards a CE. Furthermore, transitions management theory provides information on mobilising transformative skills from the existing system to more sustainable production and consumption, such as the CE (Geels & Schot, 2010). Furthermore, this theory could be used by stakeholders (i.e., policymakers and businesses) to coordinate and mobilize capabilities to solve problems by emphasizing specific initiatives wherein all the stakeholders within it may execute such CE implementation activities (Hofmann & Jaeger-Erben, 2020).

So that, transition research offers an excellent basis to design and adopt policies and strategic frameworks in which stakeholders explore novel possibilities to a more sustainable mode of production and consumption that goes from narrative into practice (Cramer, 2020). However, few experimental scenarios demonstrate CE implementation (Kalmykova, Sadagopan, & Rosado, 2018). Thus, this research aims to analyse activities deployed in the short term to mobilize results towards a CE model by applying transition management theory by answering the research question: How can different CE strategies be deployed to ensure a transition?

The paper is structured as follows: Section 1.1 discusses how the transition management theory has been studied in this paradigm change. Section 2 explains the methodology used to carry out the transition management process activities with the stakeholders to create circular systems. Section 3 discusses the results obtained from semi-structured interviews. Finally, section 4 delivers some conclusions concerning the activities in the short-term to mobilize results towards a CE through a transition management perspective.

1.1 Literature review

In the CE field, some studies have suggested that a better understanding of collaborative value creation networks within market-based ecosystems, which initiate circular business model innovation and associated stakeholder groups under an organizational transition management approach, would be beneficial (Hofmann & Jaeger-Erben, 2020). Some authors proposed that this may be accomplished by reorganising their organisations and stakeholder networks to help accelerate the transition to CE, starting at the strategic level and working down to the operational level (Kalmykova et al., 2018).

On the route to attaining a revolutionary and systemic CE transformation, some drivers and barriers such as interactions, transactions, and discrepancies between technology and socio-technical systems have also been identified (de Jesus & Mendonça, 2018). Moreover, because the CE is not limited to a single socio-technical structure but rather entails changing both output and consuming behaviours, it has a long way to go before it becomes the dominant system promoted by leading countries (Schot & Kanger, 2018). As a result, Kern et al. (2020) advocated for a more thorough examination of the involvement of various types of organisations and networks, as much of the present research on transitions focuses on the function of national policy or local actors. To that purpose, transition management theory provides a mechanism for more accurately selecting collaborators, tools, and activities appropriate to stakeholders' interests and objectives.

Transition management is defined as "the process of facilitating changes by bringing together actors from academics, government, civil society, and industry to build a cooperative rather than competing relationship" (Köhler et al., 2019). The process of transition management is an ongoing process of finding, learning, and experimenting within societies. Furthermore, transition studies call for more research to produce additional observations about attaining acceleration (Gorissen, Spira, Meynaerts, Valkering, & Frantzeskaki, 2018). Some authors recommend research focused on accelerating transitions to the next stage of development by experimenting with projects to stimulate such transition (Gorissen et al., 2018).

In transition research, experiments are characterized as an innovation initiative that aims to explore fundamentally new approaches to fulfilling sustainable transitions proactively. The purpose of transition experiments is to inspire transitions with more widely defined social goals in mind through activities. Transition experiments focus their analysis on three processes: deepening, broadening, and scaling up. Learning about the experiment and its (restricting) parameters is referred to as deepening. Learning from comparable or similar experiments in new environments is referred to as broadening. Finally, learning about regime transition and (making use of) broader advancements are two aspects of scaling up.

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2. Methods

This paper aimed to analyse how different strategies can be deployed to ensure a transition to a CE system through an explanatory study as it is the purpose of this study due to its focus on studying a situation or a problem to explain the relationships between CE activities and the stakeholders involved (Saunders, Lewis, & Thornhill, 2009). Thus, semi-structured interviews were used as a qualitative data collection technique because of their nature for acquiring and analysing data concerning the research topic (Charmaz & Liska, 2013). Then, explanation building was used as a deductively based analytical procedure to analyse the data.

2.1 Data collection

Semi-structured interviews were performed with 19 stakeholders in Spain grouped in six categories to gather insights into how different stakeholders are deploying CE strategies in collaboration. Following Ghinoi, Silvestri, & Steiner's (2020) six categories of stakeholders for supporting the CE according to their primary organisational activities, including business (5), business associations (3), foundations (3), local and regional administrations and agencies (3), research institutions (3), and social organisations (2) as detailed in Table 1.

Table 1 Overview interviewees

#	**Stakeholder category**	**Role**	**Organisation**
1	Business	Manager innovation	Machinery manufacturer
2	Business	Co-founder	Circular start-up
3	Business	Advisor CE innovation	Holding company
4	Business	Manager environmental affairs	Bus and coach manufacturer
5	Business	Managing director	Waste management
6	Business association	Program senior manager	Corporate social responsibility cluster
7	Business association	Managing director	Circular economy cluster

8	Business association	Managing director	Environmental cluster
9	Foundation	Managing director	Environment
10	Foundation	Managing director	Waste management
11	Foundation	Manager	Climate change
12	Local and regional administration and agencies	Advisor Business Development	City government
13	Local and regional administration and agencies	Policymaker	Provincial government
14	Local and regional administration and agencies	Advisor Business Development	City government
15	Research institutions	Scholar	Research institution
16	Research institutions	Scholar	University
17	Research institutions	Scholar	University
18	Social organisations	Project leader	Social enterprise
19	Social organisations	Project Manager	Student Union

The goal of this type of interview is to learn about interviewees' experiences in organisations in a focused and detailed manner, revealing perspectives, feelings, intentions, and actions, as well as the context and organization of their activities, in order to understand better the reality within organisations (Saunders et al., 2009). Specifically, the stakeholders were asked about the activities centred on sharing infrastructures and by-products to increase resource efficiency and value creation from waste.

2.2 Data analysis

To ensure the accuracy of the data in this study, two researchers conducted the interviews, audio-recorded and then transcribed. The transcripts of the interviews were checked and categorized independently. An explanation building was used as a deductively based analytical approach to testing a theoretical proposition, albeit in an iterative manner (Yin, 2003). An attempt to build an explanation while collecting data and analysing them was made by initially matching some categories derived from previous studies and from literature to build a transition towards CE (de Souza et al., 2020).

The coding process yielded helped to compare initial categories and further iterate this process until a satisfactory explanation is derived for relationships between CE activities and stakeholders (Yin, 2003). The created codes were then analysed through the software MAXQDA which is widely used in qualitative research to investigate the relationships between multiple responses (Saunders et al., 2009)

and in this research to seek new insights on how specific experiments and actions towards the CE can be deepened, broaden or upscaled to a cleaner mode of production

3. Results and Discussion

This section describes different CE activities the different stakeholders carry out, whether in isolation or collaboration with other stakeholders. Five main categories were used to analyse practices involving incentives, collaboration, characterization, collaboration, recirculation, and R&D and innovation that influence the CE business network opportunities (de Souza et al., 2020). The activities were coded according to the activities from diverse industrial sectors and the value creation that may arise when the idea of waste is eliminated (Baldassarre et al., 2019). Twenty-four codes were grouped in the five categories proposed for this study, as observed in Figure 1.

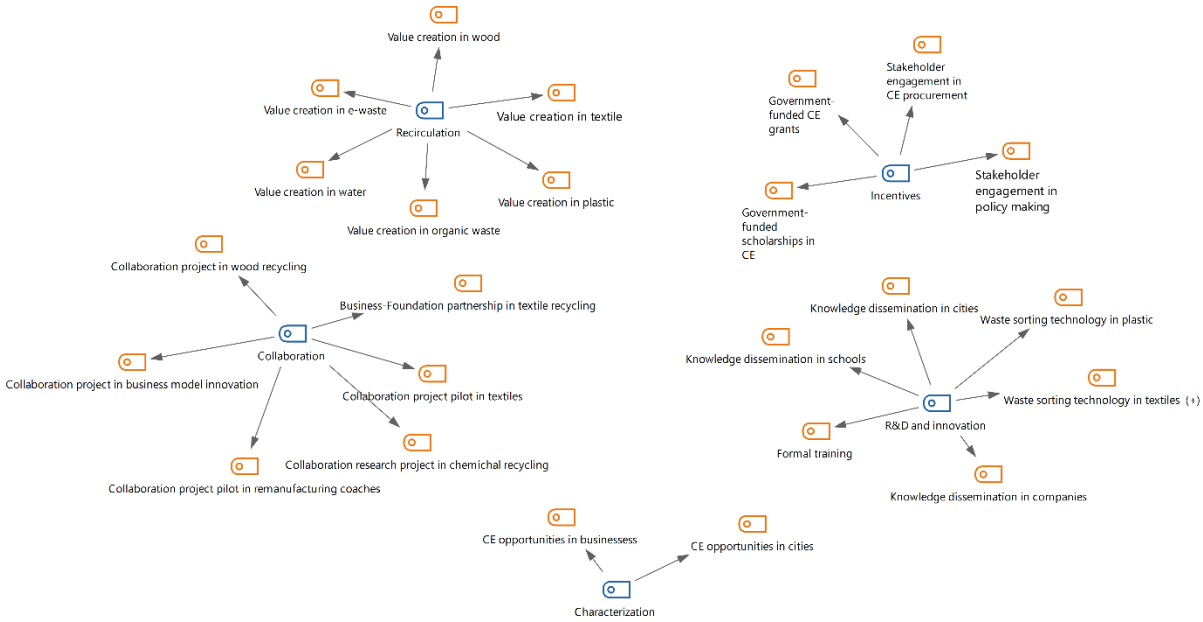

Figure 1 CE transition activities described by stakeholders

It was observed that most of the activities carried out by the stakeholders had some collaboration, whether this partnership comes from the public or the private sector. Moreover, most CE activities aim to eliminate waste and thus, promote a waste-to-resource exchange. These activities were born as projects that evolved into more robust partnerships but are often delivered as projects rather than a change in their business model. This slow progress in developing CE business models might cause some problems in accelerating the transition since to achieve waste-free production, innovative product design, material reuse, and remanufacturing, the transition necessitates innovation and new business models incorporating CE (Veleva & Bodkin, 2018). However, few projects have turned into successful

new business opportunities as they include secondary materials into their value chain, thereby changing or adding suppliers to their supply chain but exhibit potential to be scaled up. Table 2 indicates the activities developed more extensively by several stakeholders based on the number of applications of these activities.

Table 2 Most activities carried out by stakeholders

Recirculation	**Collaboration**	**Incentives**	**Characterization**	**R&D+i**
Value creation in organic waste	Collaboration project in business model innovation	Government-funded CE grants	CE opportunities in businesses	Knowledge dissemination in companies
Value creation in plastic	Collaboration project pilot in textiles	Stakeholder engagement in policymaking		Waste sorting technology in textiles
Value creation in textile				

In the recirculation category, the activities centred around downstream solutions concerning the textile sector, such as recycling hospitality fabrics, household clothes, buses cloth, or sheep wool. The stakeholders participating in this solution have not created a new supply chain, but they take advantage of the municipal waste management collection to recycle the fabrics. The value creation in plastic aims to recover this material sourced from the ocean, coffee cups, and industrial waste to be converted as yarn for the fashion industry. The value creation in organic waste is broader in terms of solutions. Whereas some solutions are based on composting or energy recovery, others focus on adding value to waste, such as organic dyes resulting from nuts used in garments or keratin recovery from slaughterhouses to be sold in the pharmaceutical sector.

In the collaboration category, it was observed that companies manage most projects with the support of the public administration to create spinoffs such as new products out coffee pods. The creation of spinoffs results from advising companies to use the waste from coffee and plastic as a resource for new products. Similarly, public-private partnerships were developed to introduce secondary cloth material in a company's value chain by ensuring that the supply can meet the demand. On the other hand, the incentives category is strongly influenced by the funding of public administration, though most of the grants are directed to pilot experiences. It may seem that the release of the CE action plan by the European Commission has resulted in money flowing to these experiences, with different targets in projects and more focused on deepening the CE across different sectors before scaling up some solutions. Furthermore, the public administration at this stage of the transition seems to be deeply

concerned with engaging different stakeholders through meetings, business fairs, and workshops to stimulate collaboration networks and have a voice in the drafting of public policies.

Regarding the characterization category, most initiatives are related to discovering new business opportunities by assessing capabilities, essential resources, and strategies via digital platforms, toolkits, or methodologies. Finally, the R&D+I category involves knowledge dissemination in companies such as newsletters, networking, events that may serve as a bridge to develop innovative capabilities. Moreover, better technologies to sort out textiles or plastics have been used to increase the recyclability of products and, therefore, their profitability.

Based on the findings of this study, most of the solutions are closely related to a downstream solution rather than upstream; this might be explained by the fact that most of the initiatives have at least the public administration involved in some way. The public administration has to meet some targets set by the European Commission set in their CE action plan (European Commission, 2020). So that, the public administration is funding more recycling targets to stimulate the collaboration between different stakeholders and meet the goals set in the European Union.

4. Conclusions

The transition to a CE necessitates the aggregation of multiple circular efforts moving at varying rates as every step toward an entirely CE is a building block to achieve this new paradigm. Eliminating the concept of waste play a critical role as a waste-to-resource exchange may help speed up this transition. This study found some activities to implement circular initiatives that focus on plastics and textiles, indicating that this set of activities could be scaled up. However, some activities are left out, which might be problematic when a downstream focus is more relevant than an upstream approach. Nevertheless, completing as many building blocks as possible, whether they come from different approaches, is necessary to stimulate an industry environment reluctant to accept this paradigm change.

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Size matters in a Circular Economy

An introduction to the Circular Futures Approach to support Small and Medium-sized Enterprises (SMEs) transitioning to Circularity and to a Futures-oriented organisation

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Abstract

The Circular Economy (CE) is conceived by many as paramount to decouple economic growth from environmental impacts and resource depletion. Implementing this economic paradigm in the private sector is challenging, as it requires substantial changes at the strategic level. However, while SMEs represent 99% of all businesses and 67% of employment in Europe, the available support for a CE transition has been mainly focused on large corporations. Therefore, the backbone of the European economy might be left out by the CE if tailored solutions are not implemented for SMEs. Furthermore, most strategic decision-making activities lack Futures Literacy (FL): the capability to understand the role that the future plays in influencing the present and the skills to generate the imaginary futures to catalyse change today.

Through a literature review, complemented by a snowballing technique, we reviewed the available CE and FL approaches and analysed further the most prominent of these frameworks. As the available frameworks lack guidance for their implementation, we developed an integrated and systematic process to make it more practical and applicable, especially for those SMEs to which the FL concepts are novel.

The combination of Futures Studies (FS) methods and a Futures mindset could contribute to a successful transition towards sustainable futures by (i) understanding the different concept and meanings of the term future(s); (ii) exploring possible future pathways for better decision-making in the present, and (iii) building resilience for unexpected events to survive and stay future-relevant in

uncertain times. The developed process provides a customisable approach to SMEs, contributing to both disciplines' literature. This paper attempts to discuss the relation between FS, CE and how SMEs can thrive with the support and input of both disciplines.

We expect this research will influence the interface between top-down policy-making and bottom-up business decision-making as a valuable hands-on guideline. By that, the approach could enhance the policy developments that focus on supporting the vast number of existing and future SMEs in Europe and around the globe.

Keywords: Circular Economy; Future Studies; Small and Medium-sized Enterprises; Futures Literacy, Futures Thinking

1. Introduction

The world has been in pandemic mode for almost two years due to the spread of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), leading to the coronavirus disease (COVID-19), the fastest-growing global pandemic in human history (Our World In Data, 2021). This resulted in higher uncertainty and uncovered a series of global vulnerabilities Going beyond its terrible human toll (this pandemic has caused more than three million deaths at the time of writing), the impact of COVID-19 on the economy has severely affected the business environment. The most acknowledged effects of the virus outburst on enterprises have been supply chain and transportation disruptions, raw material shortage, cancellation of orders, and decreased market demand (Shafi et al., 2020).

If present pressures continue, these could result in an unprecedented and significant group of organisations left behind in the markets of the future (World Economic Forum, 2021). Among all, Small and Medium-sized Enterprises (SMEs) have been impacted the most (Shafi et al., 2020). We addressed a series of primary causes: more economic vulnerability of SMEs than large multinationals because of reduced financial and managerial resources, more dependency on routinary business transactions, and more limited customer volume than large enterprises.

Acting upon this crisis, in addition to more silent but systemic and pressing worldwide issues, such as global rising temperatures, ocean pollution, loss of biodiversity and food, as well as water security (United Nations, 2021; IPCC, 2014) demands immediate and efficient decision-making to navigate current and future challenges (Foer, 2019).

To navigate and address these 21st-century challenges, it has been argued that the CE has the potential to increase resilience in organisations whilst bringing about positive impacts in several other spheres related to society and planet Earth compared to the current linear model of production and consumption (Prieto-Sandoval, 2021; Wuyts et al., 2020). At the organisation level, this change of paradigm could be a catalyst for improving, sustaining or keeping their enterprises alive. However, in the absence of solid evidence on the promises that it holds, the CE requires more in-depth scrutiny (Lazerevic and Valve, 2017). Other studies demand a greater focus to reflect and explore how the

different potential, possible, plausible and preferred futures look like under a CE paradigm (Voros, 2003). However, the current body of literature pays little attention to how SMEs could benefit from combining CE principles and FS methods to explore and seek preferred futures (Weigend Rodríguez et al., 2019).

Given the above, this manuscript introduces a novel concept, which we call "Circular Futures" (CF). To make this concept actionable, we have turned it into a methodological approach for SMEs, which we define as the "Circular Futures approach" (CFA).

The following research questions are stated, and this article will discuss and attempt to answer them:

1. How does the CFA contribute to SMEs for a successful transition to circularity?
2. What steps and activities should SMEs follow for a successful transition to CE and Futures Thinking implementation?

The remainder of the paper is structured as follows. Section 2 explains the methodology applied for the literature review. In Section 3, we summarise and discuss the fundamental concepts of CE, FS, and SMEs. Section 4 analyses the existing approaches on CE and FS and introduces the methodological advancements of our designed Circular Futures Approach. It then outlines its required implementation steps. Section 5 discusses the main contributions of the approach. Section 6 highlights its current limitations and concludes the paper.

2. Methods

A systematic literature review was carried out to understand the level of interdisciplinary research between CE and FS in the SME context. The first approach used to gather information was a bibliometric review. Data was sourced from Dimensions, an inter-linked research information system provided by Digital Science (Dimensions, 2021). We used this software due to its dynamic research data platform to explore connections and develop meaningful data. However, to corroborate our findings, we also searched four additional academic search engines: Google Scholar, Microsoft Academic, Research Gate, and Connected Papers. Data collected for this study was last updated in May 2021. The keywords used were "Circular Economy", "Futures Studies" and "Small and Medium-sized Enterprises (SMEs)". When these keywords were used together to search for titles and abstracts, we found no publication containing these keywords.

A snowballing technique (Jalali and Wohin, 2012) was adopted to build up our bibliometric analysis. To start using the snowballing procedure, we identified a set of papers that focus on CE, FS and/or SMEs that were either high on the number of citations or deemed highly relevant by the authors for the topic explored in this paper. Mainly articles written in English were reviewed with some exceptions of papers written in Italian or Spanish. The snowballing procedure was stopped when no

new publications relevant for this research were found. A total of 126 publications including books, journals and consultancy publications were analysed using this approach. In the next section we discuss the findings from our snowballing technique.

Mainly, in sections 4 and 5, we also combined our literature review with a narrative technique (Caprotti, 2014) as two of the co-authors are professionally engaged with FS and three of the co-authors are professionally engaged with CE and exploring it also on an academic level.

3. Theoretical background

This section is allocated to a concise overview of the literature review. The initial notion is the one of CE, whilst considering the context of SMEs. Subsequently, the focus is on FS, and the relevance of FS in circularity applied to SMEs.

3.1 Circular Economy

Based on the Ellen McArthur Foundation (EMF) definition (EMF, 2021), a CE is regarded as a new economic paradigm applied via-à-vis the linear take-make-waste extractive industrial model. A CE aims to redefine growth, decoupling it from excessive resource extraction and exploitation while focusing on positive society-wide benefits. Underpinned by a transition to renewable energy sources, the circular model builds economic, natural, and social capital. It is based on three principles: 1) design out waste and pollution, 2) keep products and materials in use, and 3) regenerate natural systems by returning and retaining the biological and technical nutrients into the system (EMF, 2021). One of the fundamental tools outlining the three basic principles of CE and how they could be applied into practice, in this particular case by SMEs, is the Butterfly Diagram (EMF, 2013). The diagram illustrates the many possibilities to avoid resource leakage by slowing, narrowing and closing both biological and technical loops. The former refers to the management of biological resources, renewables and stocks, whilst the latter focuses on solutions to retain components, materials and products in technical loops. Notably, the Butterfly Diagram is intertwined with the ReSOLVE Framework, which has been designed by the EMF to support businesses in identifying six core actions areas that can be taken to apply the CE principles: regenerate, share, optimise, loop, virtualise, and exchange (EMF, 2013).

The CE concept is debated mainly by academics, policy-makers, practitioners and professionals as a branch of sustainability science. Mainly entrenched in principles of industrial ecology (Erkman, 1997), Cradle-to-Cradle products and systems design approach (Braungart et al., 2007) and cleaner production (Fresner, 1998). Recent literature has focused on addressing the need for increased resource efficiency at the core of organisations' action plans, exploring more sustainable ways of conducting business (Garcés-Ayerbe et al., 2019; Salvador et al., 2020). Although CE embeds multiple disciplines, methodologies, approaches, and tools to support the transition towards a more sustainable and resilient society, the available support to the private sector falls short in providing a structured methodology to guide SMEs in the transition towards an alternative course of action to the linear model (Prieto-

Sandoval et al., 2021). Instead, the majority of studies have been mainly focused on large corporations. According to Ahola and Tolonen (2021), SMEs and any other size of organisations should begin their journey to circularity to ensure the long-term viability of their business, either financially, from a resource dependency point of view or from a licence to operate point of view.

3.2 Futures Studies

Futures Studies (FS) apply a holistic approach in organisations. By creating visions, aligning the strategy with them, having the courage to change actively and looking at all processes, communication channels, organisational structures, employee recruitment and promotion, product and portfolio management and finally, the technological components of the organisation as a whole, the challenge to remain future-relevant can succeed. Organisations are not likely to survive by only passively observing competitors or the industrial environment. They must therefore start thinking about the future and align their strategy to these long-term goals. These organisations will have a greater chance of surviving the emerging economic depression and other future challenges by showing the courage to change and tread new paths (Rohrbeck and Kum, 2018).

In addition to the courage to have visions, organisations need resilience, which can be achieved by applying a Futures mindset. Organisations need to learn how to think about alternatives to expand their potential space for manoeuvre and apply their strategies in an agile manner. When the realisation is reached that it is not essential (or possible) to predict the future but to deal with a certain degree of uncertainty and increased complexity, organisations remain actionable at any time and in any situation. This can be achieved through the appropriate application of FS methods. However, this way of thinking must be applied throughout the entire organisation and requires managers to better assess the consequences and implications of their actions and make decisions based on the explored alternative futures and a previously agreed vision. Agile methods and strategies can then compensate for the given uncertainties of the changing future. Instead of falling into a state of shock, entrepreneurship and opportunity optimisation are created. Combining human-centricity, long-term vision, agility, and resilience aligns organisations with the future and enables them to survive even in times of high uncertainty, such as global pandemics like the COVID-19.

3.3 SMEs

SMEs have been hit the hardest by COVID-19 (World Economic Forum, 2021). The World Economic Forum (2021) estimated that SMEs generate around 80% of employment, while Garcés-Ayerbe et al. (2019) reported that nearly 95% of organisations in OECD countries are SMEs. In contrast, in Europe, the percentage increases up to 99% (Ormazabal et al., 2016). Considering their prevalence in the European and international landscapes, SMEs play a critical role in the diffusion of CE corporate practices. However, barriers such as limited resources hamper their potential to reach high economic and environmental performance at the root of fully nature-inspired and regenerative solutions (Mura et

al., 2020). Ormazabal et al. (2016) conducted a survey study focused on SMEs in northern Spain, which identified several barriers including lack of capital as well as government support, scarce financial resources and customers' uninterest in environmental issues. Another analysis by Rizos et al. (2016) was conducted on a selected sample of SMEs, from solutions providers to distributors, to end-users, and pointed at similar barriers when implementing circular business models. The study revealed that 54% of the sampled SMEs suffered from the lack of support from both the supply and demand networks, followed by a lack of public (funding) support. Alongside limited resources, other SMEs experienced hindering company environmental cultures that would prevent investments in methods and tools to explore possible futures for the company or specific innovations, mostly because the corporate horizon planning is short-sighted (Rinkinen and Mäkimattila, 2015).

Despite studies proving that the CE adoption into business model innovations can help organisations achieve competitive advantages in challenging contexts (Mendoza et al., 2017), practical implementation of CE practices is scarce in the literature (Urbinati et al., 2017). The available support for a CE transition is mainly focused on large corporations. In this regard, the benefits that a guided and structured approach entails for SMEs are numerous, starting from a better understanding of the key elements to implement and the specific CE principles that apply to the organisation and which different aspects of the business can be the focus on the intervention (Järvenpää et al., 2020). Such an approach should also develop the necessary capabilities in their employees involved in this transition, especially to generate the organisation's preferred future collaboratively. Furthermore, for SMEs operating in the CE, their need for futures approaches linked to strategy and their business development is crucial (Järvenpää et al., 2020; Rohrbeck and Kum, 2018).

4. Circular Futures Approach

There are major shared characteristics between CE and FS and a common objective. Both disciplines aim to maintain or improve the welfare and freedom of humans, as well as the welfare of all living beings, plants, and earth's biosphere for their own sake (Bell, 2009). However, whilst both disciplines are working towards the same goals, until now, they show little interaction (Weigend Rodríguez et al., 2020). As the available frameworks from CE and FS lack guidance for their implementation, we developed an integrated and systematic process to make both concepts more practical and applicable, especially for those SMEs in which the Futures' concepts are new. Therefore this paper represents the first methodological effort that integrates both disciplines' contributions into a unifying approach. We named the proposed approach "Circular Futures" as it combines key CE and FS principles, and FS methods. We define this approach as a systematic process that enables organisations to explore alternative futures while acting in the present to create a preferred sustainable future that gravitates around essential CE and FS principles. As French novelist Antoine de Saint-Exupéry most eloquently wrote in 1948, the future ought not to be foreseen but enabled (de Saint-Exupéry, 1948).

As defined by Webster (2017, p.22), the fundamental CE principles are 1) "to become an economy built on the endless flow of energy from the sun, which transforms materials into valuable goods and services endlessly"; 2) "to build capital and maintain it, where money is seen as information that stimulates and coordinates the exchange of all things and where prices act as messages and reflect the total cost of things just as materials need to flow cleanly and without contamination for new cycles"; 3) "like all living systems, CE is dynamic but adaptative and, if it endures, it will be effective"; 4) "to thrive by celebrating diversity as a fount of creative adaptation, a means of resilience, a source of redundancy or back-up, and lastly"; 5) "CE is led by business for a profit within the rules of the game, decided by active citizenship in a flourishing democracy".

Regarding FS, there are five main principles: 1) the future exists in multiples, as it is not written yet. Instead, it exists in parallel futures; 2) the future is a space and not a time destination; 3) the pathway into the future is spiral, not linear; 4) how we think about the future influences our current decisions in the present; 5) most changes start with a disruption coming from outside the usual business or industry. However, they have the power to transform the field entirely.

We have combined all of these principles from both fields and have created an integrated approach. As inspiration for our new process, we first reviewed existing FS frameworks to build on a structure that has already been used and approved by the FS field. Therefore, we analysed the following frameworks.

1) 'Generic Foresight Framework' by Voros (2007)
2) 'Six Pillar Approach' by Inayatullah (2008)
3) 'Natural Foresight Process' by Salvatico and Spencer (2019)
4) 'APF's Competency Model' by Hines et al., (2017)
5) 'FTI Forecasting Model' by Webb (2020)

We decided to use the Six Pillars approach as our guiding structure as it offered us the most flexibility to adapt the process. Then, we enhanced the approach and built it around the theme of exploring outer space. Metaphorically speaking, exploring space denotes exploring the possible futures for the organisations, and the orbit that the organisation must gravitate around are the CE and FS principles. The Circular Futures Approach (CFA) is made of seven phases: 1) Surveying, 2) Mapping, 3) Exploring, 4) Cruising, 5) Encountering, 6) Landing and Probing, and 7) Transforming, as shown in Figure 1.

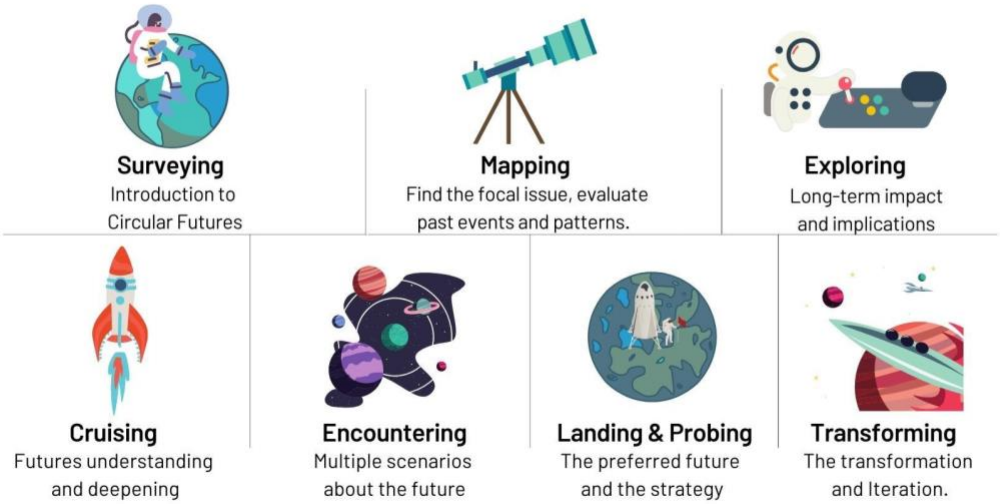

Figure 1. *Circular Futures Approach.*

The seven phases and the activities within each stage are explained below:

4.1 Surveying

This phase of the approach introduces the definitions of both disciplines (FS and CE), key concepts, characteristics, and shared goals. The activities that take place in this stage are:

1) The Masterclass. A visual presentation with the most relevant concepts and examples of organisations implementing FS and CE.

2) The Polak game. It is a popular exercise within the Futures community, named after Frederik Polak, considered one of the fathers of the FS discipline. In this game, the objective is for participants to map themselves in a 2 x 2 matrix. Firstly, participants allocate themselves on the matrix by how they perceive the change in the world: either towards an optimistic or pessimistic future. Secondly, the participants are asked whether they consider having influence or not in the state of the future. This activity helps organisations consider the different viewpoints that each individual has about the future. It also opens up a rich discussion in which the participants share the nature of their answers, their moral basis, and culture (Hayward and Candy, 2017).

3) The Readings. Selected readings and case studies as complementary material for those participants who would like to expand their knowledge to prepare for the subsequent phases.

4) Six basic futures questions. This activity requires answering six basic questions of Futures Thinking related to the concepts of the used future, the disowned future, alternative futures, alignment, models of social change, and uses of the future (Inayatullah 2008). These questions are to be answered by the SME managing director(s). The reason for just involving this role in the activity is to engage with the prominent leader(s) of the organisation to understand better the process of change and the importance of working towards a preferred future so that the leader can be the first catalyst of change within the organisation.

5) The State of Play. Lastly, the participants asked to answer a set of questions called the "State of Play" (Rao, 2020). These are 20 questions that help organisations to uncover the state of play (current situation) in their business. Specifically to turn an unconscious sense of the business into a conscious one.

4.2 Mapping

This phase focuses on finding the focal issue or most crucial challenge that the organisation faces to survive and evaluate past events and patterns to establish narratives about the future. The tools that enable to achieve these outputs are five:

1) The Circular Thing from the Future. 'The Thing from the Future' is originally an existing downloadable open-source card game. Our approach adapted it by adding the principles of CE and making it playable as a virtual online game. The game's object has initially been to use a set of cards, divided into four groups, to generate new artefacts or "things" from the future. The four sets of cards are: a) arc, which outlines the type of future world that the "thing" comes from and how far away it is from today; b) terrain, which is the thematic location where the object is to be found in the future; c) object, a specific cultural element that reveals something about how the state of the future is different from the present; and d) mood, which express how it might feel to experience this object from the future (Hayward and Candy, 2017). The way the players create the artefacts from the future is by producing their brief description and sketch or collaging images of the object they have developed by combining the cards. We modified this game for our approach by aligning it with the CE principles. Therefore, we included two additional groups or cards, circular business models, and circular design strategies. A second modification of the game is to have two rounds with different objectives. The first round is to develop a (circular) artefact about the future (as in the original game). In the second round, the goal is to develop a circular product for the organisation where the participants are working.

2) Futures Triangle. In this method, the future is mapped by understanding three dimensions (future, present and past), the image of the future (a preferred vision of the organisation for the future), the existing and observable pushes of the present (such as trends that lead towards the preferred futures), and the weight of the past (such as systems, structures and barriers that hold the organization back to reach their preferred future). First, the group is asked, "what is your preferred future?". The second dimension, the present, answers the question, "what are the trends and drivers pushing towards the image of the future previously identified?". The last step is to move to the third dimension and answer the question, "what are the weights from the past that keep us from reaching that image of the future?". By answering those three questions in each angle of the triangle, the organisation gained first insights on their relation to the future and indicators how to reach it.

3) The Futures Landscape. This concept from Tibbs (2000) introduces Futures Thinking in the organisational concept by imagining it as a landscape. Using the metaphor of a star, the mountains, a chessboard, and the self, explain the interconnections between vision, goals, strategy, and personal

biases within an organisation. The star in the horizon describes an organisation's vision, providing guidance even in uncertain times when we cannot see what is coming next. In order to fulfil this vision, an organisation needs to climb certain mountains which represent the strategic goals. On the other end of the landscape is the organisation and its employees, representing their values on how to perceive the world. Those biases and assumptions are represented to reach the goals. The chessboard also represents the environment in which the organisation needs to navigate to reach its goals. To make this concept practical, the organisation gets together to map the landscape. They begin with a shared vision, the star; the vision must be shared amongst all stakeholders. The same goes with the mountains, the goals. Following this, they map their individual and organisational values at the bottom of the landscape; this is the lens through which they see the world. For the chessboard they write down their current strategy on how to reach their goals and map their current environment (stakeholders, customers, competitors, regulations). The chessboard is also directly connected to the scanning activities, which are explained later in section 4.3.

4) Past Janus Cone. The Janus Cone looks backwards and forwards in time to see the chronological sequence of historical events and also how the passage of time may affect possible future events (Carleton et al., 2013). It is an adaptation of the Futures Cone from Voros (2007) that looks mainly forward in time. At this state, we only look into past events and, hence, only run through the first part of this method. By looking backwards, we can identify patterns that may implicate some future developments, and are used for the following scanning activities.

5) Butterfly Diagram [present]. This diagram was adapted from the CE model developed by the EMF (2013). When visually dividing it into three horizontal sections for analytical purposes, the upper section illustrates the first principle: preserving, regenerating and restoring natural capital by managing finite resources and renewables. The central part of the diagram has two sides: the left side illustrates the loops and cascades of the biological cycle, in which biological resources, renewables and stocks are managed. The right side displays the technical cycle and the circularity loops to keep materials in use. The centre after that illustrates the second CE principle: enhancing the usefulness of products, components and materials throughout both biological and technical loops. Finally, the lower part of the diagram focuses on the third principle: developing effective systems that design waste and negative externalities. In the exercise we have developed, the group is asked to fill in text boxes and indicate the company's status in each loop and/or cross-section of the Butterfly Diagram by considering all principles mentioned above in their rationale. This exercise entails a single yet comprehensive snapshot of the organisation's current status in the CE biological and technical loops.

4.3 Exploration/Launch

In this phase, the purpose is to anticipate future issues and explore countless possibilities for new products and innovation within the complex connected global arena. During such interaction, participants are confronted with the reason (the 'why') they should actively participate in implementing

the CFA by realising the long-term impacts and implications of moving towards a CE and Futures-oriented organisation.

1) Scanning. As explained in the Futures Landscape in section 4.2, it is vital to be constantly and intensely aware of what is going on around us in the environment, both immediate and external, as this affects our daily actions. Therefore, the members of the organisation need to be looking out for signals and patterns of change. Scanning is then how organisations explore their ever-changing surroundings to identify changes in the future, present, and past. Several frameworks are utilised to conduct scanning activities; the most popular one is around the STEEP categories (Social, Technological, Environmental, Economic, and Political). In this phase, the focal issue or the main research question explored in the Mapping phase is taken forward, followed by the actual collection of weak signals. Looking out for signals in non-mainstream places, wearing different hats and different lenses besides challenging one's own biases is critical for this stage. These collected signals need to be stored, organised and analysed; this stage is called Sensemaking and is further explained in section 4.4.

2) Emerging Issues Analysis. Figure 2. shows the life cycle of a trend and highlights that all trends arise from emerging issues, whereas emerging issues can evolve from weak signals, which are to be found in the very left corner of the graph (Conway, 2015). Weak signals give a glimpse into the future but are hard to find. They are signals that mostly only appear in a geographically limited region and, therefore, are only noticed by a small number of people but may become a driving force in the future (Miles et al., 2016). The case with megatrends is that these do not happen linearly; megatrends develop over a long period, have global effects and tend to stay long-term. After scanning, the collected signals should be clustered using this framework.

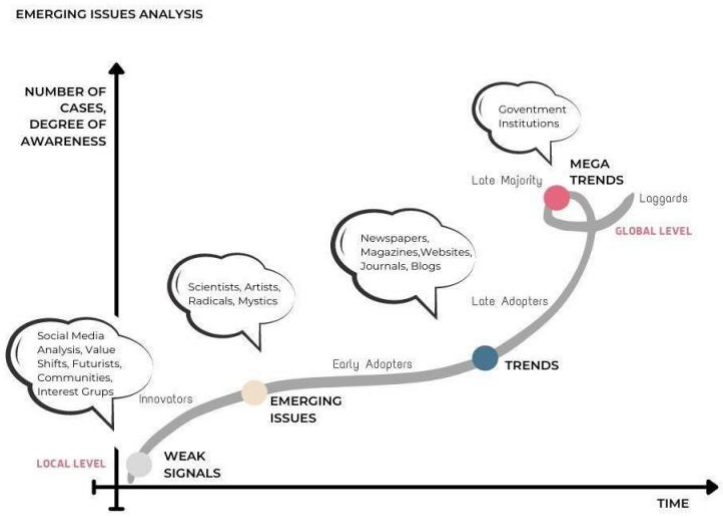

Figure 2. *Emerging Issue Analysis in comparison to other phenomena adapted from Molitor, Rogers and Schultz (Schultz, 2006).*

3) Futures Janus Cone. After looking backwards in time with the Past Janus Cone exercise, we continue looking forward and mapping the collected trends into the future. This identifies patterns and makes sense of future uncertainties by comparing past patterns with patterns emerging in the future. The participants of the organisations are asked to map the identified patterns alongside their relevance for their business, level of impact and approx. appearance in time.
4) Butterfly Diagram [future]. As previously explained in the Mapping phase, the group is asked to fill in the text boxes for each of the loops and cross-sections displayed on the Butterfly Diagram [future]. Compared to the first Butterfly Diagram [present], the group is asked to indicate what they envision for the company in each section, with a timeframe to reach such a vision in the future, they then express the rationale behind their choices. The direct results from the scanning activities can be used as input to enhance the diagram and to identify new opportunities.

4.4 Cruising

This phase aims to obtain deeper insights into the why; look at ingrained behaviours, society's drives and systems. Here we navigate the future and the present by gaining a better understanding of who we are.
1) Sensemaking. This activity is where the collected signals start making sense for the participants. As a very natural process, once a series of signals of change are collected, patterns emerge; some patterns emerge organically when signals are grouped into commonalities. Other patterns need to be further analysed by the team to find potential implications of these changes in the organisation's surroundings. Signals in isolation may seem relatively unimportant, but these, when identified early and linked to a particular issue, can be of great benefit to the design of strategic pathways. A series of frameworks are used; causal loop diagramming, Impact/Uncertainty matrix, among others.
2) Futures Wheel. This method looks like a three-ringed wheel, hence its name. As with emerging issues analysis in the previous phase, this method facilitates anticipating the future by deliberating on how today's emerging issues can develop and, most importantly, which consequences could create in the longer-term future. The trend, innovation, or event is written in the centre of the wheel (depending on which of them is most uncertain for the organisation and needs to be further explored). From there, trim rings are drawn from the centre to a second area, and these rings are filled in with the primary consequences; a ripple effect continues to a second and third set of consequences or until the implications of the event are clear. This method does not stop at first-order consequences; it helps explore and deduce the unthinkable consequences (Inayatullah, 2008).
3) Sarkar Game. This role-playing game was invented by academics and futurists Voros and Hayward (Inayatullah et al., 2006) to obtain a more personal and deeper understanding of alternative futures (Inayatullah, 2008). The game has four types of roles, which represent four powers: the worker, the warrior, the intellectual, and the capitalist, and each of these archetypes has a positive and a negative aspect. We also adapted this game by adding another role called the activist, to represent the current

development of political movements. By playing this game, the individuals can learn their social constructions and how each role limits or not the effectiveness of their professional activities within an organisation (Inayatullah, 2008). The aim of the game is to identify that in order to provoke change we need to step outside of our roles and empower collaboration amongst those systems. A new role created by the participants may be introduced as a consequence.

4) Causal Layered Analysis (CLA) - part 1. The CLA is a method that helps organisations to articulate core metaphors, develop new strategies and measures of success. The contribution of CLA is to be alert to litanies, worldviews, systems and metaphors within the organisation. CLA has these four layers deep and two parts wide: the present (part 1) and the future (part 2). According to Inayatullah (2008), CLA is promoting critical futures discourses of the future where it decisively moved from ontological concerns about the nature of the predictability of the universe to epistemological concerns about the knowledge interests in varied truth claims about the future (Kuusi., et al., 2016). The CLA (part 1) helps to unveil the current status of the company and supports the mapping of present needs. This method helps organisations first by enhancing their ability to be alert to new possibilities before deciding how to address a problem or challenge. The result of this method is also a deep revealing experience of the power of worldview and metaphors that dominate the decision making within the organisation.

4.5 Encountering

The Encountering phase is dedicated to imagining and visualising alternatives to uncover multiple scenarios, to show that there are options and alternatives, possible futures. It also touches on the different layers towards a preferred future.

1) The Space Mission. This is a new method loosely based on CLA, created to imagine visions and build scenarios. It describes an alternative future on four levels: litany, systems, worldview and metaphor. Like pieces of the puzzle, this method is designed to help participants create the building blocks of a story with five possible scenarios by using the following structure:

1. Time frame -- the when (minimum of 10 years into the future)
2. Metaphor - planets and their framing - the where (meta)
3. Litany (individual) - a message from the future - the what
4. Worldview with weak signals - the where (macro)
5. Systems with STEEP+H +V+CE[1] analysis - the how
6. Litany (collective) by describing the planet - the why
7. Characters (customers, competitors) with future personas - the who
8. Storylines with empathy maps - the where (micro)

[1] STEEP (Social, technological, economic, environmental, political) + H (Habitat) + V (Values) + CE (Circular Economy principles).

The method starts with a visioning exercise where the participants are asked to close their eyes and imagine a space mission in time selected where they have to find new planets because planet Earth has become uninhabitable. Each of these planets is ruled by a new theme and has different properties (challenges and opportunities) depending on the organisation's goals defined in the earlier process. Further, each planet has different CE principles and tools available to overcome those challenges and seize the opportunities. In the end, each planet functions as the terrain in which a new scenario will come to life. By moving through the different building blocks described above, participants are asked to imagine the new worlds, their worldview, systems, characters and their storylines resulting in a 'Day in a Life' story of one character on the new planet. By using this metaphorical approach the organisation learns to think about the current world from an angle of new possibilities, removing the barriers of the present. In the end of the process, they have a set of scenarios that offer new challenges and opportunities for their business. The input gained from this exercise can then be used as an inspiration to define the transformed metaphor of the preferred future in the next activity (CLA - part 2). This method has been created by two of the co-authors of this paper (Schindler and Guadarrama). A complete publication of this method will be available by the end of 2021.

2) Causal Layered Analysis (CLA) - part 2. As explained by the CLA in section 4.4, this method is tailored to foster people's imagination and think metaphorically to facilitate the transformation process by better understanding the deeper levels of the change processes. The CLA (future) helps create alternative futures by bringing different worldviews and stakeholders into the futures process. By being inclusive, the resultant strategy is often more resilient and robust. After a shift in the metaphor of the organisation, this method lines out the necessary changes in the organization's culture and processes to enable their preferred vision.

4.6 Landing and Probing

A preferred future has been described in the previous activities; this phase is the next step after knowing where the organisation wants to go. This phase is concerned about the how, the strategies, the steps and milestones one needs to make to achieve that future. Moreover, it looks at making the future image more tangible by introducing storytelling in future artefacts.

1) Strategy Diamond, by Hambrick and Fredrickson (2005), provides a framework to create a solid strategy based on the assumption that by answering the following questions of the following domains to define a profound strategy: Arena - where will the organisation be active?; Vehicles - how does the organisation get there?; Differentiators - how does the organisation win in the marketplace?; Economic logic - how will returns be obtained; and Staging - what will be the speed and sequence of moves. Thereby, all five fields are interrelated and only when the organisation is able to align them to create a mutual reinforcement, it will outperform the competition.

2) Windtunneling. This exercise assesses strategies that are discussed in the previous section. It is the process by which strategic options are evaluated in terms of cultural fit, financial performance, and risk. This is done by drawing out the strategies versus the scenarios created in section 4.5 into a matrix. The purpose here is to define the better strategies to go forward within any of the scenarios. This is a multi-coverage strategy and is meant to be a good fit for any possible outcome. Other strategies are avoiding strategies; these are meant to prevent the future that is not desired. Shape strategies are designed to push for and create a preferred future, and there are also strategies to adapt to the possible futures.
3) Experiential Futures - Artefacts. The goal of this Experiential Futures' immersive experience is to create impact by bringing one or more of the five scenarios from the Encountering phase to life in the form of an artefact and get participants to live it. These artefacts make the possible futures more tangible, and bridge the gap from the future into the present. This activity seeks to create empathy and understanding towards an environment, an industry, and ourselves as humanity. Creating an artefact that lives in that vision of the future helps one grasp what is possible and how one would feel and act if that were to happen.

4.7 Transforming

After all of the previous work from the six phases this is the point where all of the insights gathered are applied to set concrete and actionable steps in the present to reach organisational transformation towards the preferred future.
1) Reflection Exercise. Considered a bridging activity between phase 6 and phase 7, the main goal of the reflection exercise is to draw closing remarks on the activities, emotions, considerations, and changes experienced by the participants in the previous exercises. This is to prepare them to reach and hold onto the final stage of transformation whilst laying the path ahead for continuous iterative improvement. There are several ways to engage the team in such a discussion, and they revolve around asking questions, to oneself, to each other, and the team which are strongly linked to the "State of Play" questions in section 4.1. These reflective questions should be asked and answered amongst all participants in an open discussion format.
2) Backcasting. This is a FS method that focuses on what needs to be done to shape the preferred future. In the end, it provides a clear pathway from the present into the future. To get there, the method puts into place the preferred future that wants to be reached (Dreborg, 1996). Then, it goes backwards in 3-5 year steps from the year of the preferred future towards the present. With every step backwards, the main obstacles, next steps, and milestones to reach this future are clarified. What seemed to be impossible to reach from the present, has now a clear pathway with milestones.
3) Transformed Futures Landscape. This method is based on the concept explained earlier by Tibbs (2000). This time we use it to map the emerging future of the organisation and its updated vision, goals, strategy and personal exploration within the organisation. The insights from the scanning activities are mapped on the chessboard. The complete map helps to visualise and reflect on the preferred future

without neglecting the different pathways explored during the scenario exercise. It is a visual that shows where the organisation comes from, wants to go, the obstacles and future challenges and a possible pathway to reach its goals and vision in the end.

Phases	Purpose	Activity	Name	Approximate time required (min)
1. Surveying	Introduction to Circular Economy and Futures	1	Masterclass	90
		2	Polak game	30
		3	The readings	120
		4	The six basic questions	90
		5	The State of play	120
2. Mapping	To evaluate past events and patterns. To find the focal issue	6	Current Butterfly diagram [present]	60
		7	The Circular thing from the future	60
		8	Futures Triangle	60
		9	Futures Landscape	60
		10	Past Janus cone and scan	60
3. Exploration/Launch	Assess long-term impacts and implications	11	Scanning	60
		12	Emerging issue analysis	60
		13	Futures Janus cone.	60
		14	Futures Butterfly diagram [future]	60
4. Cruise/Journey	To deconstruct and reconstruct futures through a deeper understanding	15	Pattern and sense making	120
		16	Futures Wheel	90
		17	Sarkar game	90
		18	CLA part 1	60
5.Encounter	To create multiple scenarios about the future	19	Space Mission method	90
		20	CLA part 2	60
6. Landing & Probing	To choose the preferred future and the sequence to achive it	21	Strategy diamond	90
		22	Windtunneling	90
		23	Experiential futures artefacts	90
7.Transformation & Re-entry	To reach organisational transformation and continously improve	24	Reflection excercise	90
		25	Backcasting	60
		26	Transformed Futures Landscape	60
				33 Hours

***Figure 3**. Circular Futures Approach outline*

5. Results and Discussion

As seen in the structure and the methods that we have described in the previous section, the Circular Futures Approach has three main unique characteristics compared to the other existing approaches:

We have developed an interdisciplinary approach with CE principles and FS methods by including a balanced set of activities originating from both disciples (e.g. Butterfly diagram from CE and Futures Triangle from FS). We have also synthesised, where possible, the elements of both disciplines in specific methods or activities. An example is a 'Circular Thing from the Future', where we have adapted the game to revolve around CE principles. Participants design an object by including certain boundaries to their design aligned to CE business models and design strategies. A slightly different example but with the same purpose in mind was to adapt the Butterfly Diagram by splitting the exercise into two different stages, analysing the organisation in the present state on phase 2, and analysing the futures state on phase 3. We have also done this for the other two activities, CLA, Futures Landscape, and the Space Mission (scenario building).

This approach was inspired by our experience using other frameworks (as analysed in Section 4). Usually, these frameworks do not offer a defined structure: where to start, where to finish, or which activities to do next. This has its reasoning in that a FS process is rather fluid. However, having no structure seems to increase the barrier for SMEs to implement CE and FS after all. Hence, we decided

to provide a clear structure that can be adapted by cutting down specific elements without reordering the existing structure. This is particularly important for us since we have noted that especially for practitioners that are new to the field or those where the concepts of FS and CE are new, it is hard to frame a holistic process.

The other main contribution of the approach is that we draw a unifying orbit where the participants are to be exploring the future, the CE principles. Participants are enabled to scan the CE principles for their organisation and frame them around the desired pathway of transformation (the orbit). Additionally, this approach captures the momentum for tackling climate change and other world problems in the present. It is designed to guide SMEs to navigate their end goal(s) and strategies applying CE elements and tools under extreme environmental and social pressure and resource scarcity. We believe this offers a tangible vehicle to start taking action today towards a more sustainable future.

6. Conclusions

Both disciplines, CE and FS, challenge old paradigms. On the one hand, CE defies the unsustainability of the current linear economic model. On the other hand, FS inquiries about social norms, social systems, and the existence of biases and assumptions that influence the data collection and decision-making of organisations. As we cannot fully overcome those biases and assumptions, it is critical to be aware and include diverse perspectives and lenses, multicultural backgrounds, and disciplines. For these reasons, the CFA approach can prove to be very challenging to organisations. In parallel to writing this manuscript, we have started the approach implementation and testing with a Dutch Circular SME. We have also tested our approach by participating as guest speakers in a series of masterclasses. We were thus able to strengthen our approach, learn from practice, and gain valuable feedback from peers and participants regarding the organisations' culture at the implementation phase and the biases that may hinder its application.

Based on our implementation and the existing literature, in the business context of SMEs, we need to consider two factors that will be highly influenced by Circular Futures thinking; speed in decision-making and emotion in information perceiving. Especially in the context of SMEs, the decision-making on all matters should not be centralised to a few or even one individual. SMEs' day-to-day operations bring about stressful circumstances, challenges the workload, (internal and external) priorities and team coordination, and cohesion and relationships. Here, emotions play a significant role in perceiving what team members communicate and influence how we communicate to others.

The rollout strategy is a joint effort requiring high coordination that should not only be on the shoulders of a few business leaders. Instead, it immensely helps to have a mutual alignment on where the team stands and which directions the team is going, with possible scenarios that do not divert from the shared vision and ambition. The CFA can help organisations overcome such uncertainty and ambiguity of the organisation undergoing a CE transformation, allocating each member to its role into the organisation that will maximise their skills and benefits to the organisation overall. The CFA aims

to support organisations in those challenges, as it contributes explicitly to 1) identify drivers that could have an impact in the future of the firm, 2) this set of drivers could then be turned into future visions that, through the approach, the participants would consider coherent and justifiable, 3) select the most preferred and the most probable future visions, 4) provide a structured approach that helps organisations to identify the key actions and crucial steps to change trajectories, from the most probable to the most desired circular futures vision and to create a path to progress in this direction, and 5) enhances the organisational decision-making processes. In sum, the approach seeks to equip SMEs with strategic options rather than being led or dragged by one strategy or one future.

We hope that SMEs find the approach beneficial and that it is comprehensive enough for organisations to assimilate and apply the insights gathered during its implementation. We also hope that our approach is analysed, implemented and tested by other scholars and professionals within CE and FS. Also that the CFA will be improved upon further, and new methods and activities will be included.

A possible exploration on how to improve the approach is by adding quantitative tools that measure the organisations' present state as well as the preferred future; e.g. a scoreboard that numerically shows the financial situation, the social activities and impact that are taking place and the involvement of the organisation towards a more sustainable future. From the perspective of the SMEs, we hope that the CFA will give positive tangible results in the short, medium, and long-horizon.

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"Prato Circular City": an integrated strategy to accelerate the circular urban transition through innovation, regeneration, cohesion

Case study of the City of Prato, Tuscany (Italy)

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Abstract

Accelerating the transition towards a circular economy is an important challenge for institutions, cities, production clusters, organizations and citizens. Alongside the many virtuous initiatives that exist at a micro level, it is essential to encourage the development and affirmation of increasingly systemic and integrated circular models aimed at sustainability on a larger scale. Cities are the main drivers of economic development and the production districts introduce a bio-uniqueness principle among the urban and industrial dimension at a territorial level. The circular economy offers great opportunities for innovation and sustainability of cities and their production systems. Enabling organizations to identify these opportunities can help the transition acceleration. This also means enhancing all the initiatives developed by virtuous organizations at micro level translating them into a wider system, where that symbiotic phenomena are favoured. The development of more sustainable consumption patterns among citizens is an additional opportunity to move the economy to a circular direction. Cities are able to motivate and push their citizens in this direction.

At urban level, circular economy principles need to be managed in an integrated manner by policy makers and relevant stakeholders. In order to overcome barriers, our proposal to local policy makers is to approach to the circular economy taking into account innovation, regeneration, cohesion.

Innovation means rethinking production processes in a circular way considering the product's life cycle. A better legislation can facilitate the recovery and reuse of waste and by-products, better funding can help to adopt less impactful technologies, better knowledge can affect organizations on the one hand and citizens on the other to drive more informed consumption.

Regeneration means unused or underused spaces and buildings must be rethought and destined for new productive, recreational and social functions. Better legislation can help in temporary or permanent change of destination, better funding can contribute to the necessary adjustments, and better knowledge can push more aware citizens to reclaim "forgotten" spaces.

Cohesion, by promoting participatory processes and active citizenship within the cities, may contribute to improving the quality of life and collaboration at all levels.

This paper presents the integrated strategy promoted by the Municipality of Prato in order to accelerate the city's transition towards a circular economy. The so-called “Prato Circular City” is a local public strategy, supported by scientific supervision, able to involve public and private local stakeholders, also favouring connection with upper level of decision makers. The territory of Prato is strongly characterized by a homogeneous production district (e.g. textile and clothes production) which is a fertile ground for this transition. Prato Circular City explores four relevant vertical themes, and it defines an innovative model of governance of the circular economy transition at local level

This paper relates mainly to SDG 11, target 11.a. The health emergency due to Covid-19 forces the reconsideration of lifestyles and coexistence, the training system, the ways of using spaces, and our production processes. Pushing the transition to circular economy at urban level could contribute in accelerating progress towards SDGs.

Keywords: Circular economy, Urban policies, Innovation, Regeneration, Cohesion

1. Introduction

A sustainable vision of the city gives rise to reflections on the need for a paradigm shift, involving the gradual abandonment of the linear use of resources in favour of one based on a circular logic, through innovative economies. In fact, in the so-called technosphere, what is processed, exchanged and consumed in production chains leaves waste and residues (Nebbia, 2002). The adoption of a circular approach in production process, as well as in the governance of a territory can offer opportunities for innovation within the local context and the sustainability of existing economic systems. This also means enhancing virtuous initiatives by transferring them into a wider system, capable of fostering symbiosis phenomena. In other words, it means for a municipality to incorporate the principles of a circular economy in all its functions, with local policies designed to be regenerative, accessible and with a sustainable use of resources (Ellen MacArthur Foundation, 2015). From the point of view of awareness, it is also necessary to direct citizens towards more sustainable consumption models. In addition, the concept of the circular city, as mentioned above, is linked to that of urban metabolism, in which the resources flowing within the city define complex networks of interconnected social and physical infrastructures (Ghisellini et al., 2016). Moreover, the urban dimension is one within which specific

policies and initiatives can influence both consumers and businesses (Kirchherr, 2017). Consequently, the adoption of a circular approach in cities should necessarily involve from administrators to productive activities, from associations to citizens (Borsacchi and Pinelli, 2019). It is desirable that this sharing of intentions translates into concrete actions to promote innovation, regeneration and cohesion as the accelerating factors of the transition into a circular city model.

The ecological transition and the circular economy are at the centre of recent European policies. Some European cities are experimenting model of urban governance of circular economy. Among them, in Berlin, the "Circular Berlin" program promotes the development of knowledges, strategies and projects to understand material flow, exploring their linkages and imagining innovative modalities of eco-design. The Berlin metabolism analysis aims to develop a local circular economy agenda and its implementation through research, community building and a participatory approach for the co-creation of urban strategies. More emphasis on organisations is given by the Brussels-Capital initiative "Be Circular Be.Brussels", with the aim of providing support in the development of circular economy activities. A further dimension of the initiative is the promotion of a local economy to improve the quality of life. The "Circular Glasglow" project, promoted by the local Chamber of commerce, is focalized on organizations by accompanying programmes for the adoption of sustainable and circular practices, also encouraged by dedicated funds. Instead, the policy of Milan, called "Food Policy", aims to orientate the food policies, in order to make the food system of Milano city more equitable and sustainable. Indeed, five priorities have been identified by participative processes, including the access to health food for all, the sustainability of the food system, the reduction of waste.

Since 2006, as part of the European Urban Agenda, cities, regions and Member States, together with European institutions, have started to discuss about regulatory issues, funding opportunities and increased awareness. Among the various partnerships is the one on Circular Economy, which started its activities in February 2017. The participating municipalities are Oslo (coordinating the work), The Hague, Prato, Porto, Kaunas, as well as the region of Flanders. Also involved are ministries (from Finland, Poland, Slovenia and Greece), representatives of Directorates-General of the European Commission and other European institutions (Borsacchi et al, 2020). The methodology used by the Partnership to enhance sharing and converge on shared proposals for the circular economy included the identification of a number of priority themes. The result was the definition of an action plan based on concrete actions for the acceleration of the transition towards the circular economy at urban level. This methodology provided the Partnership with the opportunity to enter into direct dialogue with the European Commission and the Parliament on relevant urban issues. The experience gained within the partnership, together with the building of a consolidated network of relations at European level, allowed all the parties involved to increase their awareness that is carried over into their strategies at local level. Based on this experience, some members of the Partnership have started to define and launch their own local circular economy strategies.

The Municipality of Prato, with its almost 200,000 inhabitants, is the second largest city in Tuscany and the third largest in central Italy by residents. Famous worldwide for its textile district, it has over 3,500 enterprises. Alongside the textile district, since the 1990s the fast fashion district has grown, with a sector of over 4,000 enterprises. In the last decades, Prato has been affected by strong migration processes of foreign citizens that have ended up characterising its social and productive structure in an important way. The coexistence of numerous cultures, including one of the largest Chinese communities in Europe, has led to the experimentation of coexistence and multicultural solutions. Over the years, it has become necessary to launch projects to promote a culture of integration and legality, as well as to raise awareness, disseminate knowledge and provide training. From the economic point, textile production in Prato has historically based its fortunes on the reuse of textile waste from manufacturing, and used clothing from all over the world. This activity was made possible in the past thanks to the support of the district's mechanical textile industry, which was able to design machinery to recycle the fractions that would otherwise have been considered waste. The application of circular economy principles to the textile chain has also created over the years virtuous symbiosis phenomena. A significant example in strategic and infrastructural terms was the construction in the early 1980s of a centralised treatment plant for industrial and urban wastewater. This is still the most important industrial plant in Europe, and it allows the reuse of treated water back to textile production, in a closed loop. More, the availability of empty industrial buildings no longer in use due to the relocation of business activities to more accessible locations, together with the progressive closure of enterprises, has led to public and private initiatives to recover and regenerate buildings and spaces.

The Municipality of Prato's approach to sustainability issues and the application of circular economy concepts goes beyond efficient waste management. In fact, circularity also includes issues such as building design; renewable energy systems; sustainable urban mobility; a balanced urban bio-economy; and production systems that minimise the use of new resources and are based on the recovery, recycling and reuse of materials and energy. Thus, the administration has made the strategic choice to place the circular economy at the centre of the city's innovation and development policies. This decision is part of an integrated short- to medium-term plan based on digital transition, ecological transition, local economic development and social policies. These conditions, together with Prato's experience in the above-mentioned European Partnership, the existence of policies at metropolitan level (Florence-Prato-Pistoia area), the administration's ability to involve the various local stakeholders, and the scientific-technical support provided on these issues by the local university research centre, led to the definition of the “Prato Circular City” (PCC) strategy and related methodology.

2. Methods

Structured as a Living Lab, PCC operates to overcome the barriers that slow down the transition to the circular economy. For this reason, PCC focuses on better regulation, better funding and better

knowledge. Within the discussion on circular economy, actions of better regulation aim at the improvement of existing laws by comparing them with the regional, national and European level, especially in order to affect and address legislative review processes that are already underway. Better funding is geared towards tapping appropriate funding, including European structural and investment funds, as well as creating partnerships at city and district level. Better knowledge actions aim at increase awareness at all levels, including the creation of a sense of belonging to the systemic mechanism of the circular city.

The living labs work as follow: 1) Identification of relevant stakeholders, according the topics, and willingness to participate in meetings. 2) Organisation of thematic working tables in the identified areas and for specific topics. 3) Focusing on specific topics, chosen and validated by the participants. Discussion of the specific topics in working groups. 4) Presentation of the proposals for action to others outside the working group and collection of feedbacks. These defined actions are compiled in an operational plan containing implementation modalities and timing. However, not all actions are intended to be finalised. In order to limit failures around a specific topic, the first meetings are devoted to systematising useful information for the continuation of the activity. Group participants are invited to identify and share initiatives; good practices and existing networks (knowledge); relevant legislation (regulation); relevant funding calls (funding). This is an initial survey that highlights existing barriers. Based on the information gathered, a hypothesis of action is formulated, which is then evaluated through criteria and by decision tree. Only relevant and feasible ideas can continue in the process of defining the action, until to subsequent implementation. Working groups are set up and operate in three different ways. Based on the state of the art and existing initiatives at local and supra-local level, Operational working group (OWG) formulates a hypothesis of action to overcome at least one barrier. Thanks to the support of the action co-ordinator, OWG works on concrete and feasible proposals, with relevant impact on the transition whenever implemented. Cross-cutting working groups (CWG) are groups already operating prior to the launch of PCC. CWGs use the PCC platform to operate in an integrated manner on their interest topics but including in their discussion circular economy principals and approach. An Observatory (OSS) is a forum for discussion and the conduction of in-depth analysis of economic and social phenomena.

3. Results and Discussion

Officially launched in July 2020, “Prato Circular City” (PCC), aims to promote and accelerate the transition of the city towards the circular economy. In fact, the strategy, willing to strength the image of Prato as «circular city» and promote shared, integrated and participatory actions. The result is the creation of a permanent forum that involve all local stakeholders to co-create and implement shared circular economy actions and act as the governance of circular city.

The promotion of innovation in production dynamics and citizens' behaviour, together with the adoption of urban regeneration policies, can make the urban system more sustainable and resilient. Likewise, by means of strengthening social cohesion, it contributes to the creation of an inclusive and solidarity-based community, based on the principle of sharing and creative reuse as a means of stimulating innovative driving forces for business activities, also with social purposes, within collaborative economy initiatives (Borsacchi et al., 2018). Thus, the approach followed by the Municipality of Prato in the adoption of circular economy principles within local policies and strategies takes into account innovation, regeneration, cohesion.

Innovation: For the textile district, the challenge of global markets requires a change in production processes towards more sustainable and innovative models, aimed at strengthening inter-district relations and increasing competitiveness, and considering the product's life cycle. A better legislation can facilitate the recovery and reuse of waste and by-products, better funding can help to adopt less impactful technologies, better knowledge can affect organizations on the one hand and citizens on the other to drive more informed consumption. The district must be able to benefit from adequate investment, both public and private, especially related to the processes of digital and ecological transition. This translates into focusing resources on supporting the diffusion of technologies and digital skills at companies, green transition, circular economy, energy transition. In addition, it will be necessary to define funding lines for supply chain projects aimed at the reorganization of relations between production activities, using technological solutions (i.e. blockchain). At the logistics level, the development of integrated strategies at the regional level is expected. More, the application of digital information technologies to cultural assets and activities must result in a more widespread knowledge of heritage and can, if extended to the tourism sector, further translate into increased attractiveness.

Regeneration: Increasing the competitiveness of businesses activities in the textile district also involves organizational reorganization in production chains. The development of circular economy projects will have to go hand in hand with the digitalization of enterprises. At city level, phenomena of uncontrolled urbanization in the past have caused fragmentation and unjustified land use, intensifying in marginalized areas the risk of exclusion. On this issue, also thanks to the participation in the European Partnership on Circular Economy, the Municipality of Prato has understood that circular reuse of unused buildings and spaces is an opportunity to re-think and change critical areas of the city, assigning them new functions and services (i.e. productive, recreational and social functions). Better legislation can help in temporary or permanent change of destination, better funding can contribute to the necessary adjustments, and better knowledge can push more aware citizens to reclaim "forgotten" spaces. Participatory processes and co-design with residents can increase the positive impact of the interventions. The social dimension of urban regeneration also includes the promotion of health and citizens wellbeing.

Cohesion: Strengthen responsible production chains, encouraging virtuous initiatives and symbiosis phenomena. The textile waste can be directed, for example, towards other production sectors such as construction, furniture and automotive thanks to dedicated funds for research on materials and certification of the obtained products. At city level, it is possible to motivate or push citizens towards more sustainable consumption patterns. In addition, the development of the territory passes through the creation of integrated paths of enhancement of agribusiness and tourism offer of the area. At the same time, the Public Administration intends to promote collaboration with neighbouring municipalities, by extending the sharing of data with other public and private entities. Finally, by promoting participatory processes and active citizenship, it is possible to obtain positive results in terms of quality of life and increase collaboration at all levels. The application of a circular approach in the urban area must translate into a commitment to promoting innovation, regeneration and cohesion as factors accelerating the transition process, which also provides for systematic governance. The actions developed by PCC intend to contribute to Sustainable Development Goals (SDGs) 3, 8, 9, 11, 12, 13 and 17. The approach of PCC strategy for accelerating the circular transition at the urban level is represented in Fig 1.

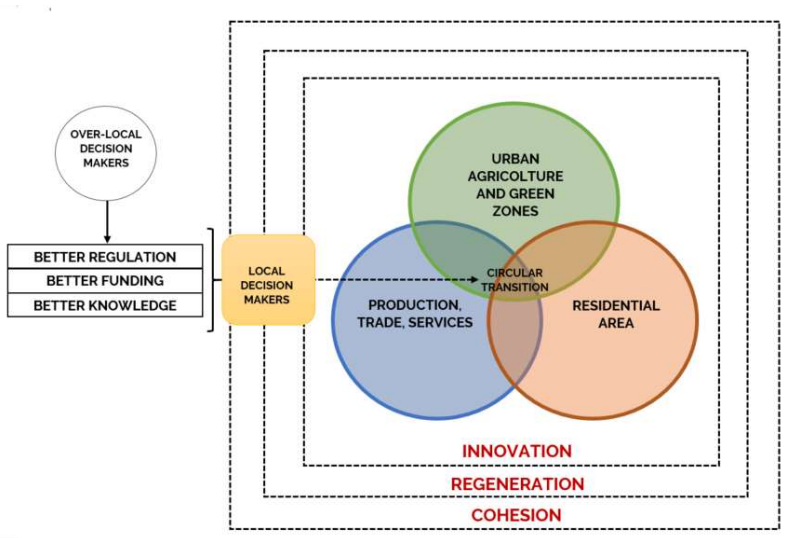

Figure 1*. The Prato Circular City strategy, by integration of innovation, regeneration and cohesion (source: Borsacchi et al, 2020)*

The governance model of PCC depicts the relations between governance, priority areas and interactions between the specific topics and takes into account the digital transition. The groups of stakeholders work on priority areas on specific topics as shown in the table 1. The complex system of interactions between priority areas and specific topics is depicted in Figure 2. It should be noted the dynamism of PCC. In fact, with the progress of the meetings, some working groups will progressively close (with the production or not of an output). At the same time the opening of new working groups, based on emerging needs, is expected. PCC will remain active through the three-year period 2020-2023.

Table 1. *Prato Circular City, areas of discussion*

Priority areas	Specific topics and related working groups
AREA 1 - TEXTILE / CLOTHING DISTRICT AND INDUSTRIAL SYMBIOSIS	OBS End of waste legislation OWG New business models for textile waste OWG EU funding OWG Promotion of the district OBS Labour and training needs CWG Digital transition CWG Life Cycle Assessment and decarbonisation
AREA 2 - MANAGEMENT OF URBAN RESOURCES	OWG on waste management OWG on waste water management OWG on circular public procurements CWG on municipal regulations
AREA 3 - CIRCULAR CONSUMPTION	OWG Eco-design OWG Responsible consumption OWG Repair and reuse OWG Collaborative economy
AREA 4 - SUSTAINABLE URBAN AGRICULTURE	OWG Integrated water system OWG Short supply chains OWG Urban gardens and common goods OWG Vertical farming

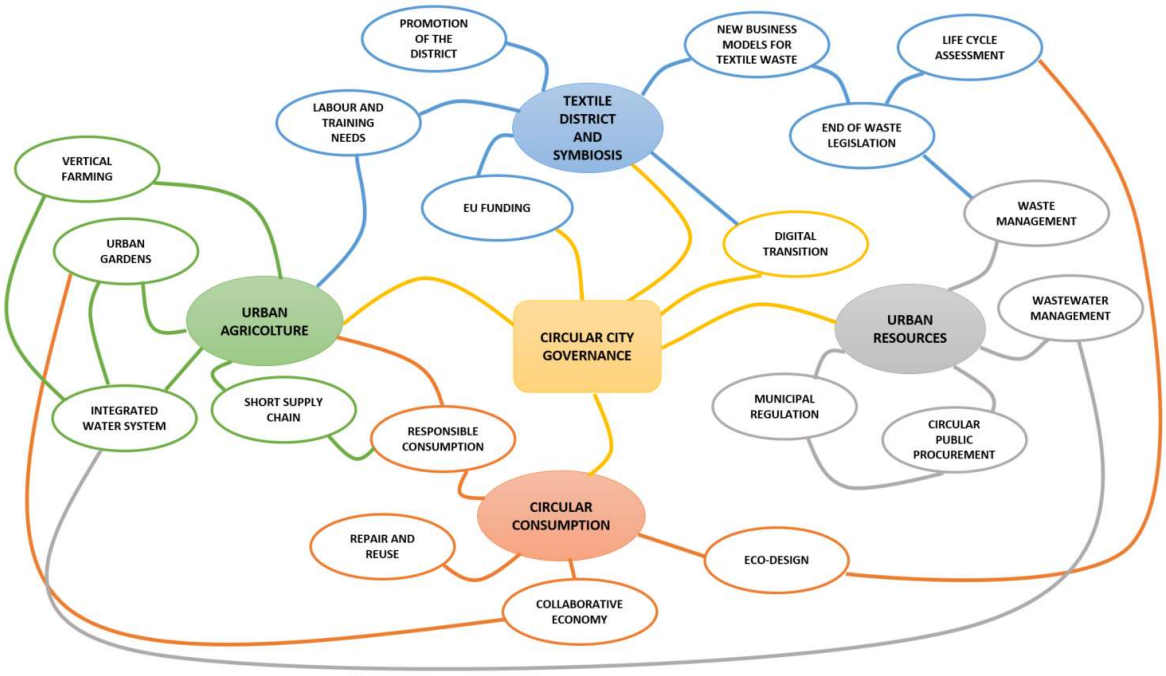

Figure 2*. Prato Circular City, interactions between priority areas and specific topics (source: Authors)*

In the first six months of Prato Circular City (September 2020 - February 2021) 14 working group meetings were organised. The working groups operated on six specific topics and have defined five actions that will continue in the subsequent implementation phases. Policymakers participated in all working groups, emphasizing strong commitment to the overall PCC strategy.

The evidence gathered during the first months allows us to highlight some positive and negative elements of the methodology used. Among the positive elements, there is the direct involvement of qualified stakeholders from the textile district and civil society thanks to the aforementioned attitude of the local administration to listening to the needs of the various local actors. Having the discussion converged on a single platform avoids duplicating meetings. While on the one hand this facilitates the possibility of creating synergies and partnerships for participation in funding calls, it also underlines the possibility of relating to supra-local levels with a single and shared position on certain priority issues. However, it should be noted the lack of involvement of citizens in the meetings in this first phase of the strategy (they will be involved in a later phase). These considerations are outlined in the following SWOT table 2:

Table 2. *Prato Circular City, positive and negative elements about the used methodology*

STRENGTHS	WEAKNESSES
Involvement of qualified stakeholders, both of the textile district and civil society Attitude of the local administration to listen to the needs of stakeholders Single discussion platform that avoids replicating meetings Integrated discussion between different project and policies Possible creation of synergies and partnerships for participation in calls for funding	Lack of citizen involvement at this stage of the strategy Possibility of overlaps among specific topics and working groups Different timing of working groups in defining actions
OPPORTUNITIES	THREATS
Development of a single and shared position on some priority issues facilitate the discussion with supra-local levels Improvement of the perception of Prato as circular city Circular economy as a pillar in the Recovery Plan	Widespread increase in awareness among cities about circular economy and consequent competitiveness in fundraising

The overall result is an improvement in the perception at local level of Prato as circular and sustainable city as well as an increase in awareness among stakeholders of circular economy as pillar in the green revolution and ecological transition indicated as missions of the National Recovery Plan. It should be noted that, meanwhile, other Italian cities are starting to launch strategies similar to PCC. This will competitiveness in fundraising among cities in the short-medium period.

4. Conclusions

Cities need courageous urban agendas based on a renewed alliance between economic, social and cultural policies in which the issues of digital and circular transition, the social impact of economic systems, a return to short supply chains, and environmental transition, which in cities are translated into resilience strategies, urban forestation and sustainable mobility, are seen as major opportunities for generating sustainable local development. To these must be added the centrality of human health, through the adoption of new socio-economic models that look to the well-being of citizens, while respecting the planet we live on.

The capacity for integrated vision on circular economy policies on the part of the municipality of Prato is due to a number of factors concerning the history and evolution of the textile district. First, the presence of a homogeneous production district in which common interests and knowledge converge. This allows policies to be targeted. The textile sector is also a sector where innovative and sustainable production solutions can be introduced, some of which are already in place (*innovation*). Secondly, the relocation of numerous production activities from the previous dedicated area (close to the city centre). This emptied numerous buildings. By urban regeneration practices, the disused buildings can nowadays to be rethought in terms of their functions and destinations (*regeneration*). Finally, the presence of a multicultural society on the territory represents a fertile ground for innovative solutions to strengthen social *cohesion*.

The methodological approach used by Prato Circular City is replicable in other urban contexts, regardless of size, with the appropriate adaptations related to the presence of prevalent productive sectors and previous initiatives and policies already in place. A 'circular city' strategy can act effectively on urban areas by contributing to and implementing effects of ecological transition, increased resilience and social sustainability of local economies, digitalisation, and innovation, and by contributing to placing territories and their specificities in the more general debate that promotes the centrality of urban policies in national ones.

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Disclaimer

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Circular Economy in the Event Sector

A Framework for Circular Festivals

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Abstract

The events industry is a very competitive and continuously growing sector, capable of playing a fundamental role in the transformation and development of the territories. At the same time, the sector contributes considerably to the environmental problem, mainly in terms of the use of energy, waste produced, emissions, water usage, food waste, and noise. For these reasons, many players in the sector have therefore decided to start adopting tools to measure their environmental impact and to reduce it. One of the strategies that companies are evaluating to deal with the adverse effects caused by the event industry is circular economy (CE). CE is an alternative model regenerative by design, based on renewable sources, and where the concept of waste is replaced by that of the resource. In light of the above, this paper investigates the possibility of applying the principles of the circular economy to the event sector. Particularly, this paper deals with a specific type of events that are very widespread and therefore cause significant environmental consequences: festivals. As a matter of fact, festivals to continue to thrive over time should adopt a circular approach, trying to minimize the use of resources and preserving the value produced for as long as possible. The aim of this work is therefore to propose a model for the development of a circular events industry. Particularly, for the organization and management of a circular festival throughout its entire life cycle. Firstly, the paper reviews significant circular economy initiatives for the festivals industry. Then, a framework to systematize circular economy practices applicable in the sector has been proposed. The methodology adopted is based on the construction of a matrix built on three variables: Rs of CE, festivals' phases, and environmental aspects. In particular, as regards the chosen Rs, a study of the existing literature was first carried out, considering that several authors have adopted and defined different R frameworks. As for events' phases, an attempt was made to reproduce the life cycle of an event. Finally, the selection of the environmental aspects was based in part on data regarding the major environmental impacts of festivals and in part on the indications provided the most significant standards of the sector. Once the framework

is developed it should be possible to have some insights on the impact of CE principles on festivals management and organization and on which are the areas that require greater attention in terms of research and investments to enhance a more sustainable festival sector.

SDG12 - Target 12.2: Sustainable management and use of natural resources - In 2020, the events sector was hit by an unprecedented crisis following the COVID-19 pandemic. The events sector to restart post-COVID is becoming more aware of the fact that it contributes considerably to the environmental problem, in particular through travels to events' venues, the use of energy, and the production of waste. Many players in the sector have therefore decided to start adopting tools to measure their environmental impact and to reduce it.

Keywords: circular economy, circular festivals, sustainable events, events industry, circular festivals framework

1. Introduction

Events have always been essential parts of the history of human civilization. Their primary function has always been that of providing the possibility of living memorable and unique experiences while reinforcing cultural values and beliefs (Ferdinand and Shaw, 2019). Since the 1980s, the increase in leisure time and the availability of income destined for unnecessary expenses has led to a proliferation of events in all countries of the world (Mayr and Whitford, 2013), and in the 2000s, the spread of the Experience Economy as an evolution of the service economy has led to a dramatic growth of the events sector (Getz and Page, 2016).

Donald Getz (2007) defines an event as "*an occurrence at a given place and time; a special set of circumstances; a noteworthy occurrence*". All events, therefore, are phenomena confined in space and time, having a beginning and an end and taking place in defined and delineated spaces. Fundamental elements of event planning are design, location, facilities, a detailed program, and advertising. Furthermore, planned events present several stakeholders, such as paying customers, organizers, staff, suppliers, regulators, producers, workers, participants (in sporting events mainly), volunteers, and many others (Getz, 2007). Events are typically classified by size and form. As regards the size, events can be divided into mega-events, regional events, major events, and minor events (Der Wagen and Carlos, 2006). Considering the events form it is possible to identify several typologies such as festivals, sporting events, religious events, political and state events, entertainment arts and cultural events, business and trade events, scientific events and private events (Der Wagen and Carlos, 2006; Donald Getz, 2007).

There is no doubt that the organization of events has numerous economic advantages. Events have the power to attract new resources to a specific area (Krajnović and Gortan-Carlin, 2018). A study from OECD (2017) based on 30 countries demonstrates that hosting an event can lead to economic growth,

job creation, new infrastructures, destination branding, and urban regeneration. For most events, spending by visitors in the local area and in particular on accommodation ticket sales, other purchases, taxes, and tips is the most significant factor in generating economic impact. Events have also significant social impacts on the communities in which they take place. Events can strengthen community pride, improve the relationship between community members, increase community cohesiveness, enrich recreational activities offer and shopping opportunities. At the same time events can also lead to an increase in crime rate, enhance traffic, and intensify pressure on local services and infrastructures (Kim and Muzaffer, 2003). Together with economic and social impacts, events are also associated with a series of negative consequences on the environment. Events by nature are activities that draw a lot of people and services into a specific place, inevitably causing environmental damages that can arise from the transport of people and goods, waste, energy, and water use by venues and accommodations (OECD, 2017). Generally, the environmental impacts resulting from the organization of an event concern five main areas: air quality, waste, water management, noise pollution, flora, and fauna together with geological conditions. It goes without saying that as the number of facilities, staff required, and participants raise, the effects on those areas increase (Raj and Musgrave, 2009). In 2020, the events sector was hit by an unprecedented crisis following the COVID-19 pandemic that generated a total paralysis of the events and live communication sector throughout its supply chain. The health emergency has had a destructive effect on economies and communities, at the same time the stop of all activities, including events, has produced temporary environmental benefits such as the reduction of polluting emissions and air quality improvements. Those economic losses and environmental improvements generated from the pandemic stressed the trade-off between the Economy and the Environment highlighting the matter of sustainable consumption (Jones and Comfort, 2020). Inevitably, in this situation, some mainstream business models will decline while others will arise and that is true also in the case of the event industry. Covid-19 can be seen as a starting point to plan the transition towards a greener and more sustainable event sector (Ioannides and Gyimóthy, 2020). In this transition, the leading players of the events industry will necessarily have to change and revolutionize their business models to build them more sustainable and resilient (Jones and Comfort, 2020). In conclusion, it is possible to claim that the Pandemic has negatively impacted the event sector, but at the same time it offered an occasion to reinvent the industry adopting a stronger commitment to sustainability and circular economy principles (Ioannides and Gyimóthy, 2020; Jones and Comfort, 2020). Even before the COVID-19 outbreak, many realities within the event industry, from large sporting events and Olympics Games to small corporate events, assured their commitment to the United Nations Sustainable Development Goals (SDGs) and started to implement solutions aimed at reducing the impact of their events on the environment and communities. Sustainability in the events sector represents a growing trend, and it is changing the culture and business models of the event industry. Also, during the last decade, there has been an increase in modules and dissertations dedicated to events sustainability in universities all over the world together with an increase in chapters dedicated to sustainability within

events management books and the existence of dedicated journals (Pelham, 2011). Further evidence of the growing relevance of sustainable events is that many national and international organizations have worked to develop specific certifications for the sector. Standards are developed only when there is a clear market need (ISO, 2012a), consequently, the development of two globally accepted frameworks ISO 20121 and the Global Reporting Event Organizer Sector Supplement are confirmation of the significant nature of the event industry and its potential in contributing to the goal of sustainable development. As said, the pandemic revealed the vulnerability of the current economic and production system based on a linear supply chain and excessive use of virgin raw materials. Economic actors should focus on the circular economy as an instrument to decouple economic growth from resource use and to build an economic system more resilient against global risks (Ellen MacArthur Foundation, 2020). The European Union was already committed to promoting CE principles, but the Covid-19 outbreak made it further necessary (Ellen MacArthur Foundation, 2020). Next Generation Eu, the tool aimed at mitigating the economic and social impact of Covid-19, is based on the transition to a green and digital Europe and therefore on investments in renewable energy, clean transport, sustainable food, and circular economy. The European Union is fully aware that the transition to a circular, resource-efficient, and climate-neutral economy is the key to success for the recovery. In particular, the European Commission has proposed to allocate an additional € 30 billion to the Just Transition Fund, bringing it to € 40 billion. The JTF money will support countries and SMEs to create new economic opportunities and investing in energy transition and circular economy (European Commission, 2020). Given the growing importance that circular economy will assume in the future, it is likely to hypothesize that CE related projects will increasingly involve the events sector. Circular events are the maximum expression of events that are sustainable over time both from an economic and environmental point of view. Specifically, A circular event is an event regenerative by design in which every single aspect of the organization is based on the principles of the circular economy. There is one particular type of event that is extremely widespread and therefore causes significant environmental consequences: festivals. To date, festivals, especially music festivals, play an important role in tourism and they represent, tourism assets and are treated as touristic products (Quinn, 2006). Festivals can create great pressure on local resources as a consequence of tourist trips described as tourist traffic. Festivals also impose a high cost in terms of greenhouse gas emissions and quantity of waste produced as well as noise. That's the reason why many organizations are starting to adopt policies to address the environmental and social impact of festivals. While sustainable festivals and events are already studied and discussed, there is relatively scarce literature published on circular festivals and the implementation of CE principles in the event sector. This paper could be said to be filling this gap in the literature. The ultimate goal of this work is to analyse the integration of CE in the event sector and to develop a framework to manage a circular festival throughout its entire life cycle. The framework will be based on three variables: the R-strategies of the Circular Economy, environmental aspects, and festival phases.

2. Methods

A type of event that has been gaining more and more importance in the last two years is the circular event based on the principles of the circular economy. The objective of this paper is to develop a framework to manage sustainable festivals. For the construction of the framework, it is necessary to pay attention to what the circular economy is and what are the advantages of abandoning the traditional linear (take-make-dispose) model, even more so in light of the events of 2020. In fact, the importance of the circular economy has now been strengthened, because of its potential to build resilient communities through a tech-driven growth. In essence, the circular economy represents an exceptional opportunity to rebuild the world economies stronger, greener and better (Forslund, 2020). As mentioned, this paper's objective is to develop a toolkit aimed at managing circular festivals, given the strategic importance of this type of event, and given the environmental impacts that it can generate. This paper spotlights on the events sector, first retrieving the best practices promoted by events organizers analysing three different case studies of circular events implementation (Green Europe Experience (GEX), Green Deal "Circular Festivals" (GDCF) and DGTL festival). Then the paper tries to classify and categorize circular events best practices. To do so a Circular Festival framework has been proposed. The methodology used for the construction of the toolkit is based on all the literature analysis carried out, afterwards integrated with a collection of case studies and best practices collected through the consultation of festivals and event organizers websites and, a series of guidelines developed by local authorities and associations that are dealing with sustainable events. The form designated for developing the toolkit is that of a matrix built on three variables: Rs of CE, Event phases, and environmental aspects. The practices collected and identified in the previous phases of the work are then organized on the basis of those variables

3. Results and Discussion

The main goal of the present work is to assess the implementation of circular economy principles on the event sector. It has been decided to focus on a specific type of events: festivals. Festivals are periodic social celebrations to which all members of a community are invited to participate and to share experiences. The main objective of Festivals is to deliver an experience that is different from everyday life, involving a large number of people. There are several typologies of festivals such as music, dance, art theatre, film, literature, comedy, food, and beverages (Arcodia and Whitford, 2006; Der Wagen and Carlos, 2006; Getz and Page, 2016). In recent years, some organizers and institutions are starting to realize that the linear take-make-dispose model that relies on large quantities of cheap and easily accessible resources is not viable any longer and it is necessary to adopt a circular approach trying to minimize the use of resources and preserving the value produced for as long as possible (Geissdoerfer et al., 2017). In particular CE principles will be applied to festival industry through the development of a framework designed for the organization and management of circular festivals. The starting point for

the construction of the toolkit is the work of some European organizations working in the area and that in recent years have begun to deal with circular festivals.

The first of those realities is Green Europe Experience (GEX), a network of 6 European partners, four festivals and two NGOs that decided to collaborate to co-create a new future for music and arts festivals, and events in general. The objective of GEX is that of rethinking how festivals are organized focusing mainly on two topics: scenography and Food e relying on the 7R model: rethink, reduce, re-use, repair, refurbish, recover, recycle. GEX project will take place for three years, from Sept 2019 – Sept 2023 (originally it was September 2022, but it was postponed due to Coronavirus). Year one is dedicated to Scenography, while year two will be dedicated to Food. In the end, GEX will write two specifics charters based on the 7R for the two main topics, and it will create some develop analysis tools such as evaluation grids, survey dedicated to the project (GEX, 2020).

Another significant initiative was the Green Deal "Circular Festivals" (GDCF), launched in 2019, it is one of the numerous Green Deal initiatives supported by the Dutch Government (Green Deal, 2019). This initiative is directed by the Dutch Ministry of Infrastructure and Water Management and it aims at reducing the environmental impact of European festivals. GDCF's principal goals are designing and realizing a model for circular festivals, encouraging the sharing of knowledge, experience and best practices, and communicating to inspire other parties and visitors to more circular practices. The ambition of the initiative is to set the standard for circularity the event industry by 2025, by developing solutions that can be put into practice by other festivals worldwide (Circular Festival, 2021).

Exceptionally relevant is also the DGTL festival, an electronic music festival which takes place in Amsterdam. DGTL festival is a pioneer in the field of sustainability and circularity. DGTL festival has set itself the goal of organizing the world's first circular festival for 2021. To reach its purpose, the festival profoundly redesigns the entire event. During the whole year, DGTL organizers examine the latest technological breakthroughs to close material loops, eliminate CO2 emissions and increase environmental awareness. The final objective of DGTL is that of becoming a living-lab for future city innovations (DGTL, 2021). In particular, in 2018 DGTL introduced the world's first circular food court within the festival. In the circular food court, local vendors will serve tasty vegetarian and vegan meals to festival attendees, using compostable plates and cutlery. Once they have finished eating, guests can bring the leftover food and dishes to the collection area where a composting machine is installed. Within 24 hours, the machine converts leftovers and dishes into compost which will then be brought to local farmers and used to produce vegetables and other ingredients for next year's festival menu closing the loop. Additionally, the festival collaborates with local associations such as The Food Line Up and Instock to present festival attendees with original menus based on existing local food surplus and flawed food from local traders to prevent this food from going to waste (DGTL, 2021).

Starting from the main elements of the case studies described above a toolkit was developed using three main variables described below.

The first variable taken into consideration is that of the Rs of circular economy. The R framework is frequently used as a guide for the implementation of the circular economy. In the literature there are several R frameworks that differ both in terms of R used and in terms of the meaning of the single R. However, all those frameworks have in common a hierarchy of the Rs based on the principle of preferability for the circular economy. In fact, the different Rs are always introduced in an order that reflects the degree of circularity, so the Rs that are at the beginning represent a high circularity value and those towards the end represent a low circularity value (Kirchherr et al., 2017). The Rs framework used for the construction of this toolkit is an 11 R framework developed by Acampora et al. (2020) for circular tourism and therefore easily adaptable to the festival sector valued from the perspective of a sub-category or branch of the wider tourism sector (Table 1).

Table 1. *11Rs framework adapted from Acampora et al. (2020)*

Rs	Description
Refuse	- Delivering the same task and offering the same function with a radically different product - Refusing to use raw materials and natural resources - Rejecting in first place to purchase to prevent the production of waste - Reflection on the need to hold the event.
Re-servitization	- Deliver a service virtually instead of employing a physical product - Smarter and more intensive use of products
Reduce	- Reducing the use of primary energy, raw materials and natural resources - Minimizing waste production
Regenerate	- Restoring and protecting ecosystems - Returning biological resources to nature
Re-use	- Reusing products in good condition by transferring them in their original form to another user
Repair	- Repairing defective products to maintain their original function - Maintenance of components and parts so that products can be used longer by one and the same user.
Refurbish	- Renovating products by replacing malfunctioning components and parts by new ones
Remanufacture	- Re-processing of already used product - Creating new products with functioning parts of old products
Re-purpose	- Re-using a product or its part for a different purpose
Recycle	- Reprocessing waste materials into new products
Recover	- Recovering embedded energy from non-recyclable waste material where feasible

The phases for the implementation of a festival are the second element considered for the construction of the matrix. In particular, it was decided to use the phases in reference to the fact that almost all the events related standards and certifications require to evaluate the environmental impact during all the phases of the event and all the activities associated with it. Specifically, the phases chosen are planning, setting-up, day of the event, and strip down/clear up (Table 2).

Table 2. *Event' phases*

Phases	Description
Planning	Initial phase of the organization of a festival in which fundamental decisions are made such as location, date, times, capacity and also the aim of the festival. During this phase, the organizer will need to contact local authorities, to confirm requirements, permissions and licensing for the event. Besides, the organizer in the planning phase will take care of hiring the staff, contacting the suppliers and artists who will perform. If the organizer opts for a circular festival, he must start from the planning stage to adopt the principles of circularity.
Setting-up	Site preparation phase for the festival. In this phase, the stage, the signage, the decorations will be assembled, and the power generation devices are installed.
Day of the event	The main phase of the festival in which the most significant environmental impacts are produced, that because of the arrival of an impressive flow of festival tourists at the same time. To make the tool easier to use and to try to include the various activities related to the festival, the central phase (day of the event) has been divided into four sub-phases, namely, transport, event site, toilets, and food court.
Strip down	Closing phase in which the structures, the camping area and the food stalls are dismantled. Furthermore, in this phase, the signs are removed, the site is cleaned, and the procedures for the collection and differentiation of waste for recycling begin. The ultimate goal of a circular festival should be to leave no trace after the clear-up stage.

The third element that has been considered is that of environmental aspects which will be indicated for each practice classified in the matrix at the meeting point between the single R and the phase of the event. The aspects identified are those that are assumed to be particularly relevant for the festival sector and those envisaged by the standards and certifications of the event sector, such as Green Globe (Green Globe, 2021) or ISO 20121 and ISO 14001 (ISO, 2015, 2012b) namely resource utilization, emissions, biodiversity preservation, waste production, energy management and water use. It goes without saying that those impact can be interlinked, and each practice can act on more than one aspect. In the matrix the environmental impacts will be indicated with colored dots as described in the following legend (Figure 1).

Figure 1*. Legend of environmental aspects.*

Resource utilization	Emissions	Biodiversity preservation	Waste production	Energy management	Water use
●	●	●	●	●	●

Table 3 presents the Circular Festival Framework showing the combination of these variables. In the intersection between the areas and the Rs the best circular practices will be described. The collection and systematization of these best practices will be founded on a deep study of the literature, international reports and specifically circular events case studies. However, this paper presents just the results of a preliminary study on circular practices implementation in events proving a theoretical tool to systematize these practices. Further efforts will be dedicated to fill in the table presented in Table 3. Just as an example we tried to fill in the REFUSE row of the table.

Table 3. *Circular Festival Framework*

			DAY OF THE EVENT				
	PLANNING	**SETTING UP**	***Transport***	***Food Court***	***Toilets/Showers***	***Festival site***	**STRIP DOWN**
REFUSE	• "Fallow year" every four years of festival to give the land a rest •Reducing festival capacity to reduce the natural area • when choosing artists and workers/security involve locals as much as possible to avoid travel related emission	• Avoiding printing and when it is unavoidable it is done using solar-powered printer and sustainably sourced paper • Paint or projections instead of flags and banners • Choose wood instead of PVC whenever is possible	• Incentives on choosing train over plane (slow travel) • Special voucher to buy food or merchandise handled to those arriving by public transport or Bicycle • Combine amount of festival tickets with coach bus or public transport ticket • Train instead of flights for artists that live reasonably closely	• Choose food suppliers certified • vegan or vegetarian menu • Ban on unnecessary packaging • Ban on plastic straws • Ban on single portions for condiments and sauces, replacement with dispenser	• Banning chemicals on site • Charging a price to use showers as a deterrent	• Ban on samples from promoters (chewing gums, candies etc.), encourage companies to involve audience with activities instead of disposable giveaways	n.a.
RE-SERVITIZATION							
REDUCE							
REGENERATE							
RE-USE							
REPAIR							
REFURBISH							
REMANUFACTURE							
RE-PURPOSE							
RECYCLE							
RECOVER							

4. Conclusions

The transition from the current economic system based on linear production processes towards a circular system based on closed loops is one of the fundamental challenges that the European Union will face in building a sustainable, resilient and internationally competitive Europe. That is true especially when considering the effects of Covid-19 pandemic which has shown how much the current production system and the different economic sectors were unprepared to react to global risks. Covid-19 has, in fact, massively hit the world economy, however, it has also been recognized as a potential green stimulus, forcing companies to rethink their business model to shape a better tomorrow. The events sector is no exception, it has been one of the sectors that most of all suffered the consequences of the pandemic and now, it can be among the protagonists of the paradigm shift by implementing circular economy's principles in events' management strategies. Therefore, the present work aims at investigating the impact of the circular economy on the events sector, in particular with regard to festivals which are exceptionally popular events, especially among millennials. Festivals are also capable of producing important environmental impacts, especially considering that these usually take place near or in protected natural areas. This is just a preliminary phase of the research; at this stage the focus is that of examining the festival sector to identify the key elements for the construction of a framework to organize and manage festivals according to the principles of circular economy on the base of the best practices available at European level. Future steps will see the classification of all the practices collected in this first phase of investigation. Once the different practices are correctly organized within the matrix, it will be possible to have further insights on which are the areas that require greater attention in terms of research and investments in order to deliver a circular festival.

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Posters

The 27th International Sustainable Development Research Society Conference
13–15 July 2021
Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis
Mid Sweden University
Virtual Conference, Sweden

MSc Eng. Natalia Generowicz[1] **PhD Fernando Tornos**[2]

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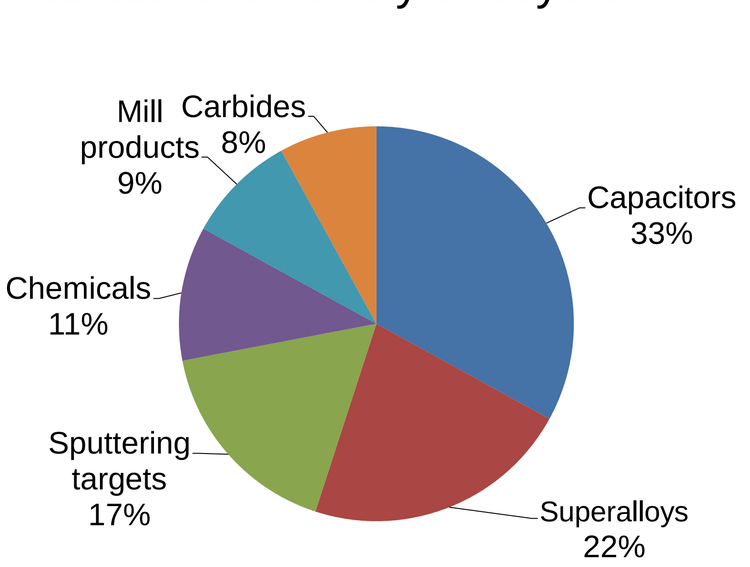
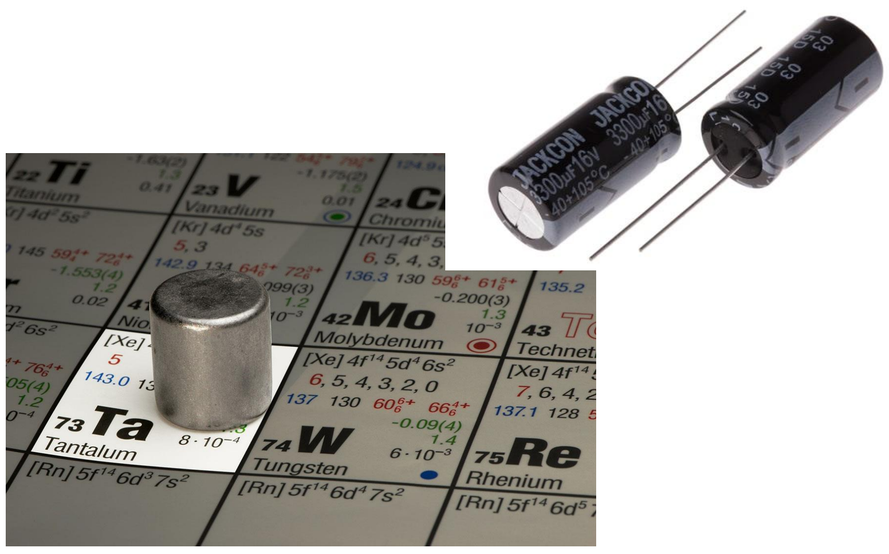
Recovery of Sn, W, Ta and Li from tailings as an example of sustainable mining

Tantalum is used in the electronics industry to produce electrolytic capacitors, which are found in every electronic device, defence and space equipment. It is used in the production of chemical equipment due to its resistance to most acids and bases. As a result, this metal to become an object of interest for a variety of buyers.



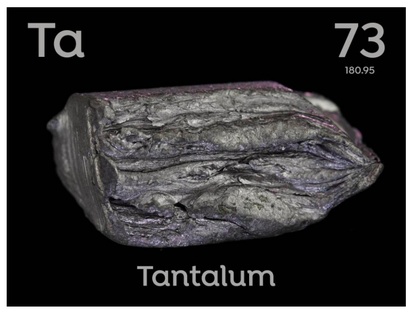
Main applications of Ta



Tantalum can be recovered from more than **16 different sources** such as:

- end-of-life waste (e.g. capacitors),
- municipal solid waste,
- landfills containing electrical waste and electronic equipment,
- **tailings**.

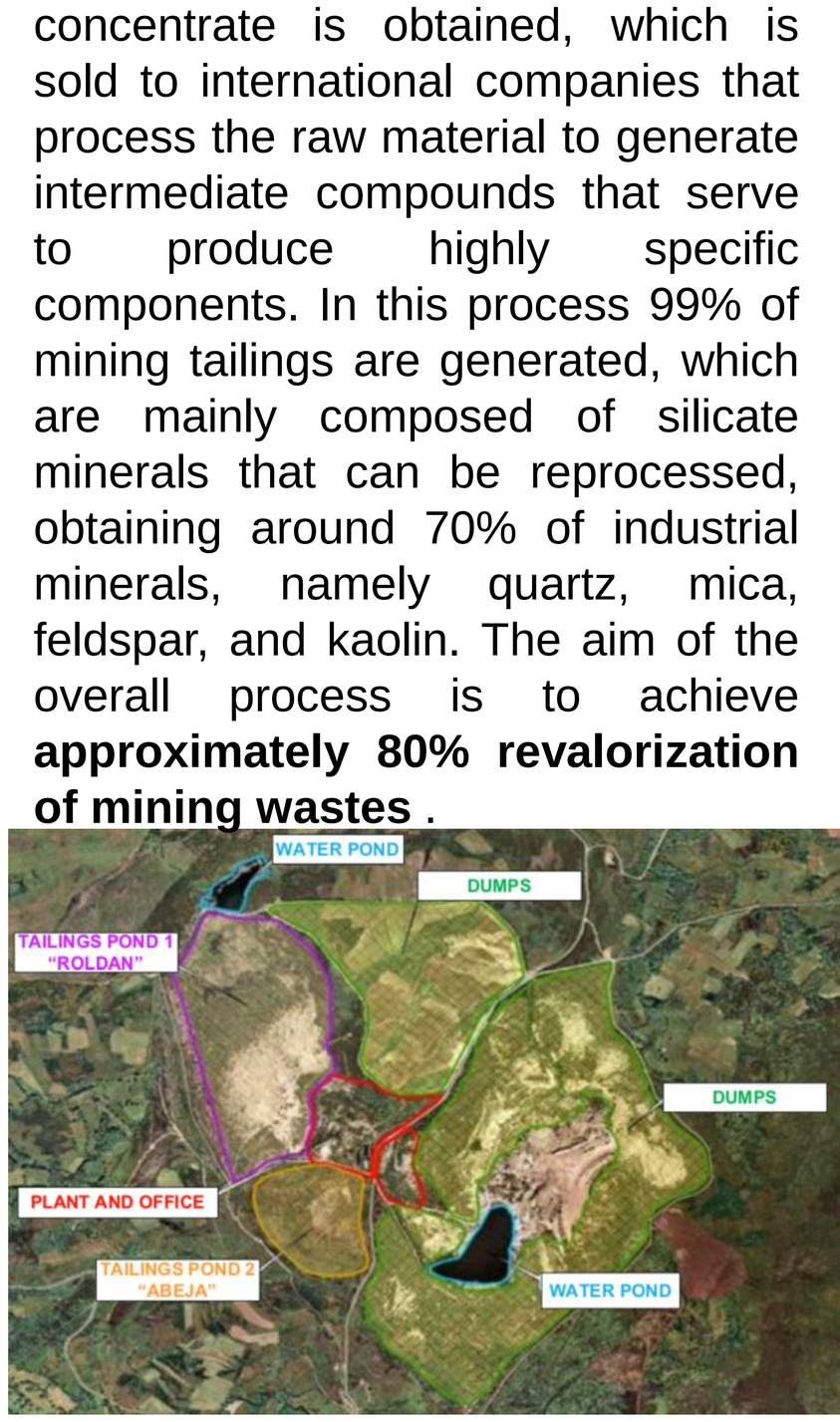
The biggest tantalum reserves in the world are located in South America (40%) and also in Australia (21%), but only **1%** being found **in Europe**.



With the exception of small quantities of tantalite that are obtained as a by-product from the exploitation of kaolin in France, **there is no production of primary origin in the EU**.

The Penouta Sn-Ta-Nb deposit is located in **the Central Iberian Zone**. Thanks to the development of new technologies and the evolution of old mineral separation techniques, it is possible to recover the metals of interest contained in these tailings and waste-rock heaps of the former **Penouta mine**.

During the processing of **tailings from waste-rock heaps and ponds** of the old Penouta mine, around 1% of tin, tantalum, and niobium concentrate is obtained, which is sold to international companies that process the raw material to generate intermediate compounds that serve to produce highly specific components. In this process 99% of mining tailings are generated, which are mainly composed of silicate minerals that can be reprocessed, obtaining around 70% of industrial minerals, namely quartz, mica, feldspar, and kaolin. The aim of the overall process is to achieve **approximately 80% revalorization of mining wastes** .



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Mineral and Energy Economy Research Institute Polish Academy of Sciences

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Scenarios of the energy transition in Poland towards circular economy – case of the photovoltaic sector

The key assumptions of the "Poland's Energy Policy until 2040" are the development of renewable energy sources, improvement of energy efficiency and air quality in Poland. By 2040, half of the installed capacity will come from zero-emission sources.

In 2030, the installed capacity may reach approx. 5–7 GW in total in micro-installations and large installations, and 10–16 GW in 2040.

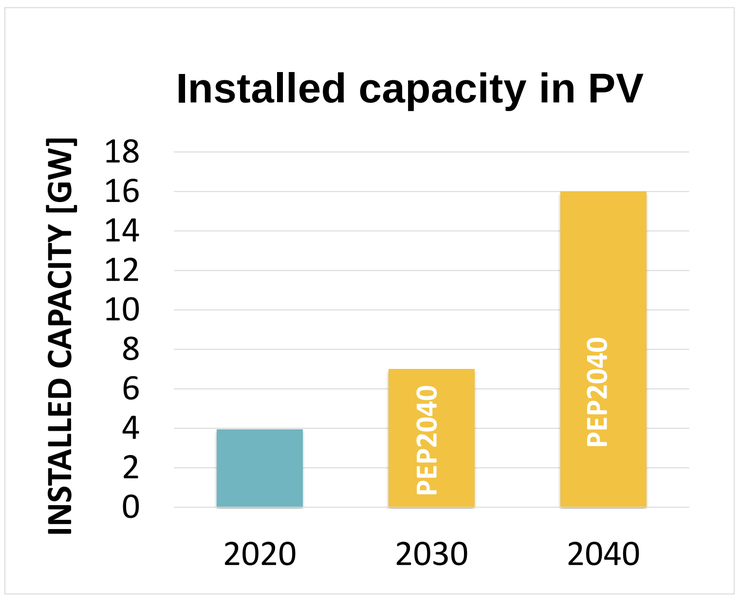


Figure 1. Installed capacity in PV

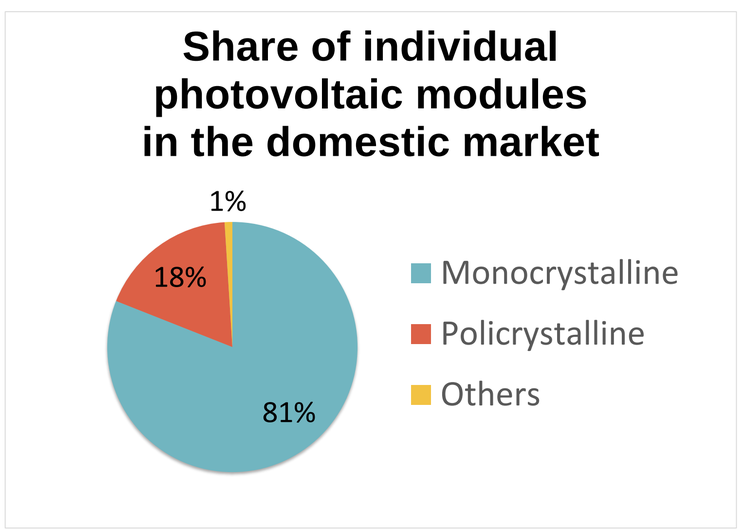


Figure 2. PV market in Poland by technology
Based on IEO

Material intensities

$$\textit{Material intensity}\ \left[\frac{kg}{MW}\right] = \frac{weight\ [kg]}{max.power\ [MW]}$$

c-Si 60,500 [kg/MW]
Cd-Te 106,209 [kg/MW]
CIGS 117,438 [kg/MW]

Table 1. PV composition by technology

Fraction	Fraction	Fraction
Glass (74%)	Cadmium (0.08%)	Copper (0.68%)
Polymer (10%)	Plastic (3.5%)	Gallium (0.01%)
Aluminium (11.08%)	Copper (0.04%)	Indium (0.03%)
Silicon (4%)	Tin (0.05%)	Molybdenum (0.12%)
Copper (0.6%)	Tellurium(0.07%)	Selenium (0.04%)
Silver (0.1%)	Glass (96.6%)	Zinc (0.12%)
Zinc (0.12%)	Zinc(0.05%)	Lead (0.001%)
Lead (0.1%)	Lead (0.05%)	Aluminium (7%)
	Nickel (0.1%)	Glass (88%)
		Plastic (4%)

Using the shares of the fractions in PV module (table 1) and mean material intensities, the demand for each material was calculated required to cover the demand for energy from photovoltaics until 2100, then it was compared with the reserves, and using lifetime of PV, the depletion year was calculated (table 2). In the end, the impact of recycling was checked (figure 3).

Results: Critical metals

Table 2. Depletion year

Metal	Depletion year
Cadmium	2050.05
Indium	2050.08
Lead	2052.65
Selenium	2054.30
Silver	2020.27
Tellurium	2065.92
Tin	2030.07

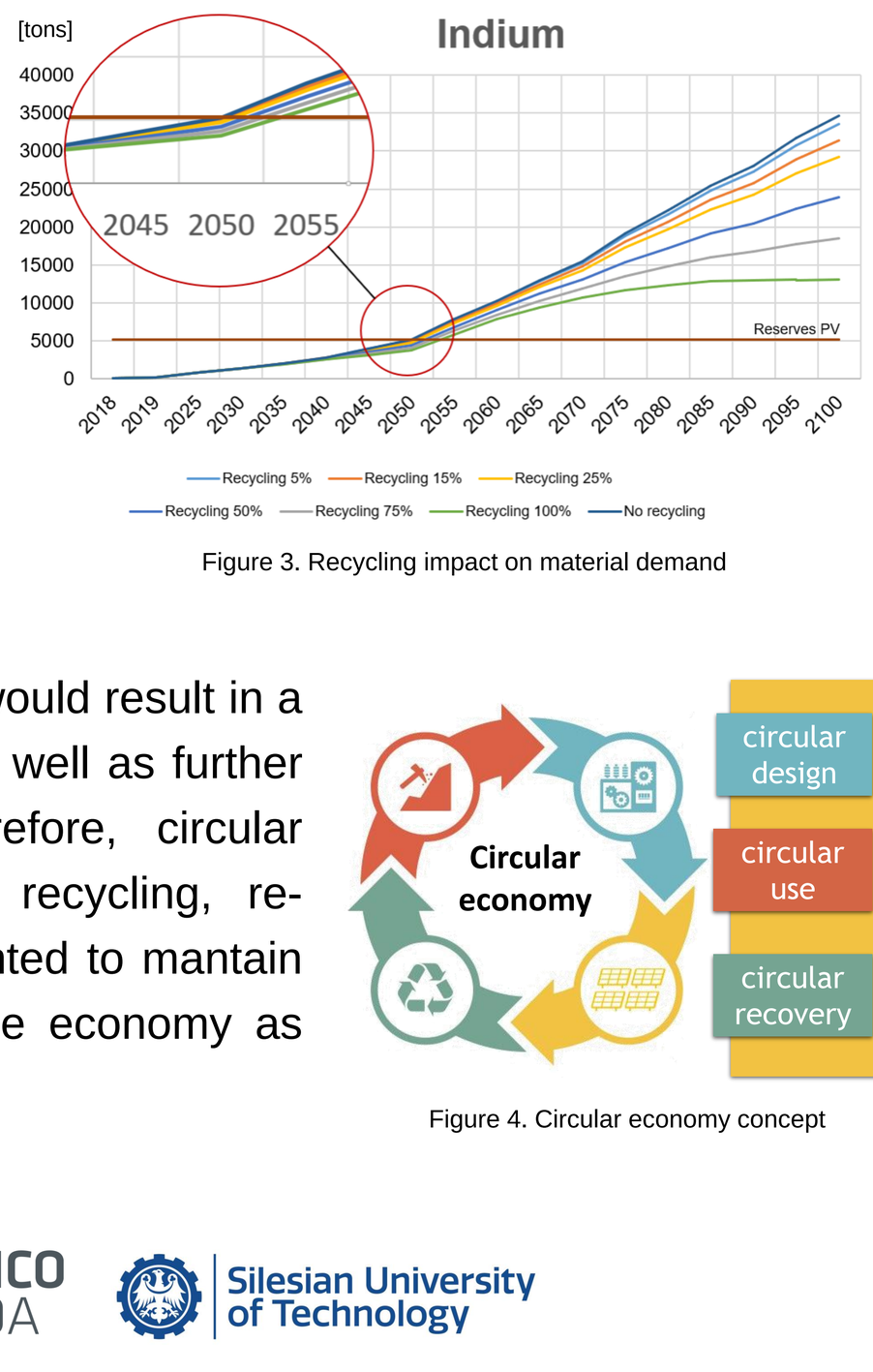


Figure 3. Recycling impact on material demand

Conclusions

The energy transformation would result in a great demand for metals as well as further development of PV. Therefore, circular practices (e.g. ecodesign, recycling, recovery) should be implemented to mantain valuable materials within the economy as long as possible.

Figure 4. Circular economy concept

SYNERGIES AND TRADE-OFFS BETWEEN EUROPEAN BIOECONOMY STRATEGIES AND SUSTAINABLE DEVELOPMENT GOALS (SDGs): A MULTI-CRITERIA ANAYLSIS FRAMEWORK

Anne Warchold, Prajal Pradhan, & Jürgen P. Kropp

PIK RD II Climate Resilience

INTRODUCTION

An increasing amount of countries in the European Union (EU) have now commenced the implementation of bioeconomy strategies and documented these efforts in their national strategy papers. The bioeconomy is at the center of European sustainable development strategies and contributes to many Sustainable Development Goals (SDGs). Due to the integrated nature of SDGs and the associated targets, progress towards one target is also linked through complex feedback loops to other targets [1]. We plan to outline which SDGs and targets need to be prioritized when implementing a bioeconomy according to EU policy concepts and vice versa.

DATA & METHODOLOGY

We apply a multi-criteria analysis (MCA) decision framework (Fig. 1), which is based on the introduced MCA by ALLEN et al. (2018) [2], to assess interlinkages between SDGs and bioeconomy indicators. The methodological approach is a combination of recent publications and guidelines on SDG and bioeconomy implementations. We apply a range of complementary qualitative and quantitative methods within the assessment framework (Fig. 1).

1. Setting Scope

- Initial screening of SDGs and BE-indicators
- Data preparation
- Initial set of SDG targets and indicators for the EU-BE

1.1 Unified SDG Framework [3]

UN | WBG | BE-SDSN

→ Unified SDG Database

1.2 FAO Bioeconomy Indicator Framework [4]

Unified SDG Database | EUROSTAT | FAOSTAT | Global Footprint Network | …

→ Bioeconomy Database

2. Multi-Criteria Analysis

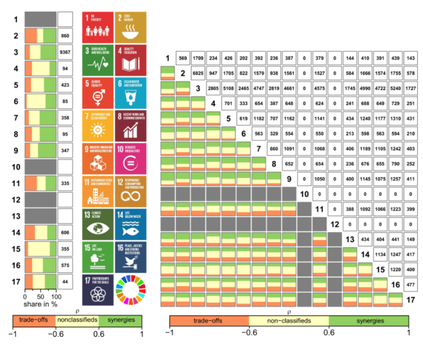
2.1 Assess baseline [2] — Urgency assessment of SDG indicators – trends and benchmarking of progress

Category and score	Rule Applied
5 Most urgent	Baseline worse than benchmark *and* unfavourable trend ○ + (↗,↘)
4	Baseline worse than benchmark but no trend available ○
3	Mixed assessment: favourable (benchmark or trend) + unfavourable (benchmark or trend) ● + (↗,↘) or ○ + (↗,↘)
2	Baseline better than benchmark but no trend available ●
1 Least urgent	Baseline better than benchmark *and* favourable trend ● + (↗,↘)

Categories for the assessment of the 'level of urgency' for each SDG indicator [2]

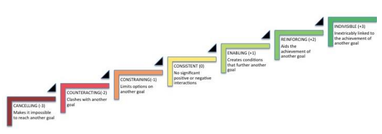
2.2 Assess interlinkages — Assess interlinkages between SDG and bioeconomy targets based on the databases (1.1 & 1.2) and identify high leverage targets

2.2.1 Correlation analysis [1,5,6]

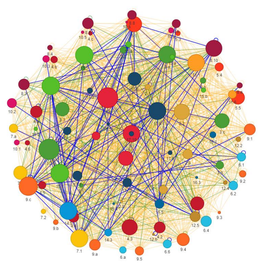


2.2.2 Causality analysis [7,8,9]

Categories types of interactions between SDG and bioeconomy targets [6] with direct or indirect impact



2.2.2 Network analysis [3,9]



2.3 Assess policy gap [2] — Assess alignment of SDG targets within existing EU country strategies

Category	Symbol	Score
Good coverage	●	0
partial coverage	◒	1
limited coverage	◉	2
no coverage	○	3

Categories and scores used for assessing the coverage of each SDG target in strategy papers [2]

3. Evaluation

- MCA evaluation to identify priority targets within the 2030 Agenda and the EU Bioeconomy
- Highlighting synergies and trade-offs between SDG and bioeconomy targets
- Create interventions to adapt either SDG or bioeconomy targets to national sustainable development strategies

***Fig. 1** SDG-Bioeconomy implementation Framework*

RESULTS

Our results will contribute to the debate on how bioeconomy implementation strategies in the EU benefit or hinder the fulfillment of the 2030 Agenda and where prioritization is needed. Further, we investigate how the SDGs can enable to achieve EU bioeconomy priorities. Since the world is not currently on track to meet the SDGs until 2030, bioeconomy strategies can function as enablers to drive rapid progress. However, an unsustainable bioeconomy can certainly hinder those synergistic developments [8]. Therefore, we detect those bioeconomy and sustainable development strategies that cause trade-offs and require revision. This creates intervention points for a successful implementation of the EU bioeconomy and 2030 Agenda.

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"PRATO CIRCULAR CITY": AN INTEGRATED STRATEGY TO ACCELERATE THE CIRCULAR URBAN TRANSITION THROUGH INNOVATION, REGENERATION, COHESION

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INTRODUCTION

A sustainable vision of the city gives rise to reflections on the need for a paradigm shift, involving the gradual abandonment of the linear use of resources in favour of one based on a circular logic, through innovative economies (Nebbia, 2002). The **ecological transition** and the circular economy are at the centre of recent European policies. Some European cities are experimenting model of urban governance of circular economy. Since 2006, as part of the **European Urban Agenda**, cities, regions and Member States, together with European institutions, have started to discuss about regulatory issues, funding opportunities and increased awareness. Among the various partnerships is the one on Circular Economy, which started its activities in February 2017. The participating municipalities are Oslo (coordinating the work), The Hague, Prato, Porto, Kaunas, as well as the region of Flanders. Also involved are ministries (from Finland, Poland, Slovenia and Greece), representatives of Directorates-General of the European Commission and other European institutions (Borsacchi et al, 2020).
The **Municipality of Prato**, with its almost 200,000 inhabitants, is the second largest city in Tuscany and the third largest in central Italy by residents. Famous worldwide for its textile district, it has over 3,500 enterprises. Alongside the **textile district**, since the 1990s the fast fashion district has grown, with a sector of over 4,000 enterprises. From the economic point, textile production in Prato has historically based its fortunes on the reuse of textile waste from manufacturing, and used clothing from all over the world. This activity was made possible in the past thanks to the support of the district's mechanical textile industry, which was able to design machinery to recycle the fractions that would otherwise have been considered waste. The application of circular economy principles to the textile chain has also created over the years virtuous symbiosis phenomena.
The Municipality of Prato's approach to sustainability issues and the application of circular economy concepts goes beyond efficient waste management. Thus, the administration has made the strategic choice to place the circular economy at the centre of the city's innovation and development policies. This decision led to the definition of the **"Prato Circular City"** (PCC) strategy and related methodology.

1. MATERIALS AND METHODS

Structured as a *Living Lab*, PCC operates to overcome the barriers that slow down the transition to the circular economy. For this reason, PCC focuses on better regulation, better funding and better knowledge. Working groups are set up and operate in three different ways. Based on the state of the art and existing initiatives at local and supra-local level, Operational working group (OWG) formulates a hypothesis of action to overcome at least one barrier. Thanks to the support of the action coordinator, OWG works on concrete and feasible proposals, with relevant impact on the transition whenever implemented. Cross-cutting working groups (CWG) are groups already operating prior to the launch of PCC. An Observatory (OSS) is a forum for discussion and the conduction of in-depth analysis of economic and social phenomena.

2. RESULTS AND DISCUSSION

Officially launched in July 2020, PCC, aims to promote and **accelerate the transition** of the city towards the circular economy. In fact, the strategy willing to strength the image of Prato as «circular city» and promote shared, integrated and participatory actions. The result is the creation of a permanent forum that involve all local stakeholders to co-create and implement shared circular economy actions and act as the governance of circular city. Thus, the approach followed by the Municipality of Prato in the adoption of circular economy principles within local policies and strategies takes into account innovation, regeneration, cohesion.

Innovation: For the textile district, the challenge of global markets requires a change in production processes towards more sustainable and innovative models, aimed at strengthening inter-district relations and increasing competitiveness, and considering the product's life cycle. A better legislation can facilitate the recovery and reuse of waste and by-products, better funding can help to adopt less impactful technologies, better knowledge can affect organizations on the one hand and citizens on the other to drive more informed consumption. More, the application of digital information technologies to cultural assets and, if extended to the tourism sector, further translate into increased attractiveness.
Regeneration: Increasing the competitiveness of businesses activities in the textile district also involves organizational reorganization in production chains. Better legislation can help in temporary or permanent change of destination, better funding can contribute to the necessary adjustments, and better knowledge can push more aware citizens to reclaim "forgotten" spaces. Participatory processes and co-design with residents can increase the positive impact of the interventions. The social dimension of urban regeneration also includes the promotion of health and citizens wellbeing.
Cohesion: Strengthen responsible production chains, encouraging virtuous initiatives and symbiosis phenomena. The textile waste can be directed, for example, towards other production sectors such as construction, furniture and automotive thanks to dedicated funds for research on materials and certification of the obtained products. At city level, by promoting participatory processes and active citizenship, it is possible to obtain positive results in terms of quality of life and increase collaboration at all levels.
The governance model of PCC depicts the relations between governance, priority areas and interactions between the specific topics and takes into account the digital transition. The complex system of interactions between priority areas and specific topics is depicted in Figure 1. It should be noted the dynamism of PCC. In fact, with the progress of the meetings, some working groups will progressively close (with the production or not of an output). PCC will remain active through the three-year period 2020-2023.

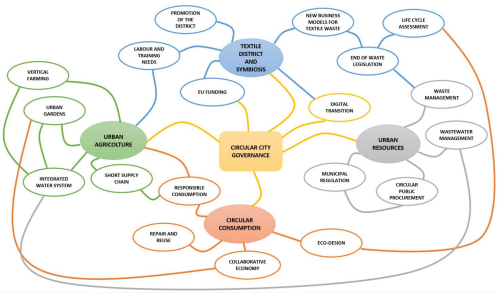

Figure 1. Prato Circular City, interactions between priority areas and specific topics (source: Authors)

The overall result is an increase in awareness among stakeholders of circular economy as pillar in the green revolution and ecological transition indicated as missions of the National Recovery Plan.

3. CONCLUSIONS AND FUTURE PERSPECTIVES

The methodological approach used by Prato Circular City is replicable in other urban contexts, regardless of size, with the appropriate adaptations related to the presence of prevalent productive sectors and previous initiatives and policies already in place.

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DISCLAIMER Prato Circular City is a strategy of the Municipality of Prato promoted by the Councillorship for Economic Development, Innovation and Digital Agenda, and the Councillorship for Urban Planning, Environment and Circular Economy, with the support of the local Europe Desk office. The technical-scientific coordination is carried out by the Circular Innovation and Sustainable Commodities Unit of ARCO - PIN University of Florence. The views expressed herein are those of the authors and therefore not necessarily reflect the official opinion of the Municipality of Prato.

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MID SWEDEN UNIVERSITY

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Circular Economy in the Event Sector - A Framework for Circular Festivals

Introduction

Events can have considerable economic impacts as well as significant social and environmental consequences:

Job creation, new infrastructures, destination branding, spending by visitors on accommodation ticket sales, tips, etc.

Community pride and cohesiveness, recreational activities, but also increase in crime rate, traffic, and pressure on local services.

Emissions from transportation of people and goods, waste, energy, and water use by venues and accommodations

Sustainable and Circular Events

- Sustainability is changing the culture and business models of the event industry
- Progressive adoption of solutions to reduce events' environmental impact.
- Circular economy as one the most effective strategies.
- A **circular event** is an event regenerative by design in which every single aspect of the organization is based on the principles of the circular economy.

COVID-19 can be seen as a starting point to plan the transition towards a greener and more sustainable event sector

Methodology

Focus on **Festivals** because of their relevance for the sector and their environmental impacts.

The goal of this work is to analyse the integration of CE in the event sector and to develop a framework to manage a **circular festival** throughout its entire life cycle.

Steps of the work

1. Understanding of CE and its potential to build a resilient event sector.
2. literature analysis integrated with a collection of case studies and best practices.
3. categorization of circular events best practices in a matrix built on three variables

Results

Elements of the matrix

Rs of CE

1. Refuse
2. Re-servitization
3. Reduce
4. Regenerate
5. Re-use
6. Repair
7. Refurbish
8. Remanufacture
9. Re-purpose
10. Recycle
11. Recover

Event's phases

1. Planning
2. Setting-up
3. Day of the event
   - transport,
   - event site
   - toilets
   - food court
4. Strip down

Environmental aspects

A. Resource utilization
B. Emissions
C. Biodiversity preservation
D. Waste production
E. Energy management
F. Water Use

Each circular best practice will be classified and positionated at the intersection between the festival phases and the Rs of CE

	PLANNING	SETTING UP	DAY OF THE EVENT				STRIP DOWN
			Transport	*Food Court*	*Toilets/Showers*	*Festival site*	
REFUSE	• "Fallow year" every four years of festival to give the land a rest •Reducing festival capacity to reduce the natural area • when choosing artists and workers/security involve locals as much as possible to avoid travel related emission	• Avoiding printing and when it is unavoidable it is done using solar-powered printer and sustainably sourced paper • Paint or projections instead of flags and banners • Choose wood instead of PVC whenever is possible	• Incentives on choosing train over plane (slow travel) • Special voucher to buy food or merchandise handled to those arriving by public transport or Bicycle • Combine amount of festival tickets with coach bus or public transport ticket • Train instead of flights for artists that live reasonably closely	• Choose food suppliers certified • vegan or vegetarian menu • Ban on unnecessary packaging • Ban on plastic straws • Ban on single portions for condiments and sauces, replacement with dispenser	• Banning chemicals on site • Charging a price to use showers as a deterrent	• Ban on samples from promoters (chewing gums, candies etc.), encourage companies to involve audience with activities instead of disposable giveaways	n.a.
RE-SERVITIZATION							
REDUCE							
REGENERATE							
RE-USE							
REPAIR							
REFURBISH							
REMANUFACTURE							
RE-PURPOSE							
RECYCLE							
RECOVER							

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5. Production, Consumption and Innovation

5d. Value chains and trade

Abstracts

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Using Input-Output Tables to Uncover Sustainable & Innovative Clusters in the German Regional Economy

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Abstract

The production of goods and services of an economy is made possible through a dense network of collaboration. Thus, economies can be understood as complex systems.

Input-output (I-O) tables offer detailed insights into interactions between sectors in an economy. Also, I-O tables offer useful data to analyze economic properties by means of the growing field of network science. Essentially, I-O tables can be interpreted as directed and weighted networks where each sector serves as a node and every I-O relation an edge between sectors. This enables the use of tools from graph as well as network theory to analyse properties of the economic production network.

This work focuses on finding clusters in the German production network and studying its regional properties. For this purpose, we use a highly regional disaggregated version of the German I-O table by Krebs (2020) which connects all 402 German counties (NUTS3) across 17 economic sectors in an interregional I-O table.

However, the massive data resulting from this table is not trivial to analyze. We reduce this complexity by employing the map equation framework to find clusters in the German I-O network and, most importantly, how these clusters interact with each other (Rosvallet al., 2009). Focusing on clusters rather than single sector/ region combinations enables us to account for the complex interactions in modern established production networks in highly industrialised economies. Furthermore, we are able to study properties of the resulting clusters, such as their spatial, innovative, and sustainability properties.

Consequently, the first step of analysis gathers descriptive information about the clusters found by the infomap algorithm. Here, we especially focus on the regional and sectoral distribution between and within clusters. As a next step, we analyze how clusters perform on dimensions of sustainability. This comprises the use of environmental accounts, like energy uses as well as CO2 emissions, computed for the WIOD (Corsatea et al., 2000). Also, we analyse innovative capacities for clusters through assessing real price returns of industries combined with their respective output multipliers (McNerney et al., 2018). From combining measures for sustainability and innovative capacities of clusters, we can assess if these predict the greening of trade within the German production network.

This work directly connects to the Sustainable Development Goals 9 (Target 9.2.) and 12 (Target 12.2) through assessing measures of sustainability and innovation for the production network within a highly industrialised country. Thus, we assess which sectors and regions within the German production network show capabilities to foster its greening.

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Managing sustainability and resilience: A multi-indicator framework in the Italian wine supply chain context

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Abstract

Measuring supply chain performance is a relevant topic in the sustainable development literature. Since the onset of COVID-19, demand shocks have troubled supply chains, highlighting their vulnerabilities and their lack of resilience. Despite the negative trend observed in exports and the decline in domestic demand, the Italian wine supply chain was resilient, and the original prices remained essentially stable, especially thanks to the fact that it is a storable product. Regardless of which performance should be measured, and how it should be measured, a poorly performing supply chain can destroy value for its actors, especially in terms of market share.

The lack of interest in the wine supply chain is mainly due to both the traditional character of the industrial and logistical processes; and the product target audience interested in taste experiencing. Evaluating the performance of the wine supply chain, beyond measuring production yields or wine quality, requires the adoption of a life cycle perspective. Wine supply chain sustainability can be achieved only through the total visibility of the flow of products and information designed to reduce costs and improve operational performance.

The target of actors' decisions throughout the supply chain should be the convergence of economic, social and environmental outcomes that can build commercially viable outcomes. The study proposes a comprehensive integrated framework of indicators currently used in sustainable and resilient supply chain paradigms, developed under the food convergent innovation hypothesis and applied to the supply chain management of a wine company, including procurement, processing plants and distribution of their products to customers. This framework could provide a wine company with a multi-indicator supply chain management tool designed to test its sustainability and resilience, accelerating progress towards SDGs in times of crisis. The proposed model can serve as a decision support tool to systematically assess and improve the wine supply chain from winery to retailers.

This study constitutes a step forward for a better understanding of the wine supply chain dynamics by viewing these supply chains in the light of the SDG 12 responsible production and consumption. The pandemic offers an opportunity to reverse current trends and shift our production patterns to a more sustainable course. A successful transition means improvements in resource efficiency, consideration of the entire life cycle of economic activities, and active engagement of each actor within the supply chain.

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Sustainable Development Goals: A stakeholder approach by Indian businesses to the agenda 2030

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Mr Avinash Pratap Singh

Dr Zillur Rahman

Abstract

India is home to one-sixth of the world population. Achieving the United Nations Sustainable Development Goals (SDGs) by 2030 is unimaginable without India's participation. Government of India is committed to the SDGs and seeks active participation of all stakeholders. Businesses will have a vital role

in realising agenda 2030 as they have the resources and capabilities to stimulate SDGs through innovation, research, technology, funding and employment. SDGs provide companies with the opportunity to deliver solutions to the world's leading challenges.

Agenda 2030 was set by the collective effort of all stakeholders including government, society and businesses. Transforming these challenges into opportunities requires the participation of all concerned stakeholders. Stakeholder involvement is important in the planning, implementation, and review of corporate actions on the SDGs. This study examines the stakeholder approach adopted by the top 100 companies by market capitalisation in India to accomplish SDGs.

This analysis uses published reports (annual reports, integrated reports, sustainability reports, CSR reports) and other information provided on companies websites. Our finding reveals the key actions, drivers and barriers for Indian companies engaged in addressing the SDGs. It also highlights the top SDGs addressed through corporate actions in India, and provides a broader perspective on stakeholder engagement for SDGs by businesses. We found that the accomplishment of the SDGs depends on the company's ability to develop more innovative and inclusive business models. SDGs offer businesses unprecedented economic prospects through new markets, new products and services.

By developing solutions for the SDGs, companies can find new growth opportunities and reduce the risks associated with their business profiles. Investors are interested in understanding how businesses are contributing to the SDGs and creating an impact. Not engaging with the SDGs can have major negative consequences for businesses and their finances.

Our analysis has several implications for researchers and practitioners.

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An end-to-end evaluation of socio-environmental hot spots in cross-continental supply chains: the case of ready-made garment industry.

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Abstract

International soft law norms mandate that businesses implement a due diligence approach in their international supply chain processes to identify human rights, environmental and social sustainability issues. However, despite these norms and an increasing attention to their social and environmental impact, re-emphasized with the introduction of Corporate Social Responsibility (CSR), firms fail to live up to expectations in identifying, managing and mitigating adverse sustainability impacts in their supply chain.

At least two reasons for such failure are debated in the literature. First, it is argued that an end-to-end supply chain view is to be embedded in the management and control of sustainability impacts to enhance the effectiveness of due diligence. However, the complexity of the supply chain network, in terms of multi-tier chains of suppliers with a diffuse geographical spread, can lead to missing information, a lack of transparency and hindered communication, hampering the due diligence process. Second, many of the existing methods and techniques tend to focus either on human rights, or environmental aspects whereas the due diligence calls for a holistic view on sustainability.

In this contribution the authors aim to contribute to the ongoing debate on “how supply chain sustainability due diligence can effectively be conducted”. To this end, the objective of this study is twofold. First, based on a ready-made garment case study, the application of an existing method, i.e., Sustainability Hot Spot Analysis (SHSA), is explored. It will be discussed how a relatively small extension of the method with the Value Stream Mapping (VSM) helps gain a more holistic view of the supply chain and its sustainability challenges. Second, the case study is used to identify several sustainability hot spots across the life cycle of two products, namely, a pair of jeans and a white T-shirt. As such, this study helps both scholars and practitioners by advancing our methodological understanding of supply chain sustainability due diligence.

The paper is structured as follows. First, the concept of SHSA in the context of supply chain is discussed. In this section, also, the VSM approach is detailed. Next, the research method is elaborated. Among others, a detailed account of the cases and the life cycles are provided. The paper continues with the findings of the case study, including the identified sustainability hot spots. The paper concludes by discussing the barriers and opportunities of using an SHSA in the RMG industry as a method for EU based brands (EUBBs) to manage product-specific life cycles. The case study results demonstrate that this method can fill in the gap as it provides manners to quickly identify sustainability risks. The SHSA method can support management of EUBBs in their decision-making processes concerning possible interventions to prevent or mitigate identified risks.

SDG: 12.6 *Relates to 'accelerating progress toward SDGs in times of crisis' by exploring a sustainability due diligence method which can be employed throughout a global value chain*

5. Production, Consumption and Innovation

5e. Sustainable consumption and consumers

Abstracts

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Overmoralization of (m)eating behavior? Sustainable consumption and food choices in Central Europe, Australia, and Indonesia

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Dr. Franzisca Weder

Abstract

Study

In recent years, there has been growing critical debate about meat consumption due to health risks, environmental concerns and economic aspects. Being one of the most energy-intensive and ecologically heavy foods, meat products are said to be highly unsustainable (Dagevos & Voordouw, 2013). On the contrary, the need for sustainable food choices has become more known to consumers, going hand in hand with organizations increasingly displaying more information on sustainability as core value in their production and processes (Wognuma, Bremmers, Trienekens, Vorst, & Bloemhof, 2011).

Furthermore, increasing information in the media and particularly in the social media (1) and knowledge about ecological costs of meat consumption (2) influence individual habits (Bellotti & Panzone, 2015; Verbeke, 2008) and the emergence of a concept of sustainble consumption (Fischer et al., 2017; Krause, 2009). With the empirical study at hand, we seek to better understand sustainability as moral compass, influencing eating behaviour and mainly meat or plant-based food choices. The methodological background is that narratives represent storied ways of those perceptions, meaning making and communicating, thus, have always been a key feature in media and communication research (Bryman, 2016; Weder et al., 2019b).

Convenience samples of individuals aged between 20 and 40 years in Austria (n = 20), Australia (n = 10) and Indonesia (n = 5) were interviewed in face-to-face settings, in telephone interviews or online-sessions depending on current Covid19-restrictions. The interview guideline addressed the following dimensions: What are your beliefs and values about food and nutrition? What factors influence individual's food habits? How did eating behaviours of people change and which factors make people

change their eating behaviour. As well, we were interested in the attitudes towards meat consumption and the thoughts with regards to food choices and the environment?

Findings

The two major findings, that we would like to put up for discussion at the conference are that (1) sustainability apparently plays a minor role in food choices; furthermore, even if climate change is perceived as threat, thinking about the horrors of industrial livestock farming, animal rights, pollution and waste, it does not directly influence people to change from a meat- to a plant-based diet; (2) individual food choices and changes from meat consumption to veganism or becoming vegetarian are mainly influenced by being exposed to new ideas within the closer network of family and friends, rather than media or key events.

Outlook

Thus, apparently, ethical reasons and sustainability as moral compass play a smaller role than we assumed and apparently are rather insignificant when people consider their eating behaviour. The discussion at the conference will be particularly valuable due to the fact that comparative data in different cultural settings was gathered and will be again gathered later this year to generate comparative data as well. A constructive debate related to SDG #12 will help refining questions and sample choices and shape future studies to enhance and empower responsible consumption.

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Routes to a more effective advertising text for inducing sustainable consumption practices

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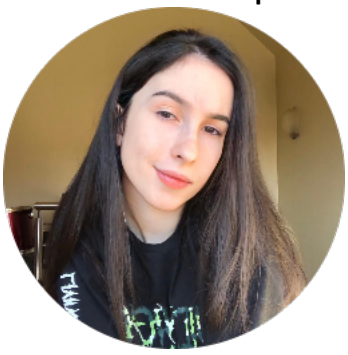

SI Researcher Isadora Ambrós Samudio

PhD Lisiane Hermes

Abstract

Academic research has increasingly addressed the analysis of motivations and barriers to the adoption of pro-environmental behaviors. However, although research related to sustainable consumption has expanded in the last decade, the purchase of environmentally friendly products represents a small percentage of the global purchase value of products. The numbers related to reduced consumption and the adoption of recycled products are low too. This scenario makes it possible to infer that, although public policies and proactive environmental management practices draw the attention of public opinion to the urgency of the environmental issue, population adherence does not occur as expected. We also realized that, although there is a lot of information designed to promote the awareness of the population and the incorporation of green practices, most of the messages used do not generate the desired effect. Therefore, we need to qualify persuasive practices to make society aware of green actions. What arguments should be used for individuals to revisit their consumption habits and choices? With this question in mind, and having the Evolutionary Psychology theory as a reference, the present study verified, from an experiment, which type of advertising text is most effective in inducing

consumers to pro-environmental consumption behaviors. The factors and levels studied were: (i) advertising argument adapted to the five evolutionary behavior trends (Griskevicius, Cantú and Vugt, 2012); (ii) type of creative approach to the text (apollonian/rational and dionysian/emotional) (Nietzsche and Friedrich, 1999); and (iii) demographic (gender, age, education) and psychographic (psychological types) variables. For most combination levels, ads based on apollonian (rational) text have a higher acceptance rate than ads with dionysian (emotional) text. Regarding the type of advertising argument, ads based on common arguments, tangible aspects and short-term objectives (in that order) support the most effective messages in the perception of consumers. Arguments centered on self-interest, relative status or copying from others did not show the highest average acceptance for any level of combination. However, even though it is not the better attractive option, older non-graduates and extroverted non-graduates individuals' best perceive self-interest messages. Likewise, messages based on relative status are attractive to women who are not graduated. The results can contribute to the practice of advertising work in promoting green behavior. This study is related to SDG12, specifically to the item "sustainable lifestyle and education for consumption" in the topic "consumer engagement and environmental communication". Finally, regarding the adequacy of the study to the event's theme, "Accelerating progress towards SDG's in times of crisis", we emphasize that advertising is an important tool for promoting products and, more importantly, ideas. Its significance is primarily aimed at adhering to the social consensus that suggests. It is, therefore, a relevant means not only to inform, but also to persuade.

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DEPOSIT COLLECTION AND RECYCLING SYSTEM AS AN INSTRUMENT SUPPORTING SUSTAINABLE PLASTIC PACKAGING MARKET. POLISH CASE STUDY.

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Abstract

Part of Europe's transition to a more circular economy (CE) is a plastic strategy adopted by the European Union (EU) in 2018. According to its assumptions, by 2030 all plastic packaging on the EU market will be recyclable, the consumption of single-use plastics will be reduced, and restrictions on the intentional use of microplastics will be introduced. This can be achieved by changing the design (single-material, biodegradable, from secondary raw materials), manufacture, use and recycling of plastic products. The strategy aims to reduce pollution levels while offering support for economic growth and innovation.

New legal requirements, as well as consumer expectations resulting from care for the environment influence the packaging market. Dynamic changes are visible and cover both the stage of packaging design and improvement of collection and recycling methods. New instruments are introduced to support such activities, including the principle of extended producer responsibility (EPR), which in the case of beverage packaging waste in many countries is implemented through the introduction of a general deposit system.

The aim of the article is to present the way the deposit collection and recycling system can work in Poland and the benefits of its introduction. Based on a solution developed by the food producer, Maspex Group and the EcoTech System start-up, a pilot implementation of a comprehensive waste collection and recycling system is planned as part of a project implemented by both companies together with the Mineral and Energy Economy Research Institute of the Polish Academy of Sciences with the support of the National Center for Research and Development. Such a system is based on the introduction of recycling machines and includes monitoring and accounting of the entire process of information and recyclable material flow in real time. The system promotes the segregation of packaging waste (e.g. PET bottles) by creating incentives for all participants in this process. The conducted analysis showed that the model of sustainable packaging management, with the use of a comprehensive collection and recycling system of an incentive nature, is justified not only due to its environmental character, but also business aspects.

The more detailed description of the deposit collection and recycling system and benefits of its implementation will be given.

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Left or Right? The Role of Political Ideology on Sustainable Consumption

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Abstract

Introduction: While holistic international commitments such as Paris Agreement and European Green Deal are necessary to mitigate climate change consequences, country-level commitments depend on national political forces and public sentiment. Climate change is a heavily debated topic among politicians. With political parties communicating and acting differently regarding the climate change, it can be expected that consumers' political ideology influences their climate change beliefs and pro-environmental behaviors. Individuals' political ideology, including their visions and goals for social and political systems and their ideologies for how society should function, are shown to influence their consumption beliefs and behaviors. Against this background, the aim of this study is to investigate the link between individual's political ideology, climate change beliefs/concerns and sustainable consumption. This is an important relationship to investigate because it can identify those segments in society which can be targeted for sustainable consumption and educated on matters related to climate change and responsible consumption. This line of inquiry can further emphasize the responsibility of political parties for influencing climate change beliefs among their supporters by effective communication.

This study aims to investigate the link between political ideology, and consumer intentions to reduce energy consumption. The mediating effect of climate change beliefs and moderating effect of political interest have also been investigated:

H1: Climate change beliefs and concern mediate the relationship between political orientation and sustainable consumption (i.e. buy sustainable products and boycott least energy efficient product).

H2: Political interest moderates the relationship between political orientation and climate change beliefs such that the relationship is stronger for consumers with higher levels of political interest.

Method: This study utilizes 34,788 responses from individuals in 23 European countries. conditional process modelling is conducted by SPSS PROCESS macro (Hayes, 2017) since it enables us to answer how and when (mediation and moderation) political ideology is going to effect the pro-environmental behavior, simultaneously in one analysis.

Results: Political orientation does not have a significant direct relationship to sustainable purchase, but it influences the purchase through beliefs and concern. Climate change beliefs and concern fully mediate the relationship between political orientation and sustainable purchase. Political orientation significantly and negatively correlates with sustainable boycotting both directly and indirectly through beliefs and concerns.

Political interest moderates the relationship between political orientation and climate change beliefs such that the relationship is the negative association is stronger among individuals with higher levels of interest in politics.

Research relates to several goals of the 2030 agenda for sustainable development including 7.2, 7.3, 12.1 and 12.2.

Contribution relates to the topic of the Conference: The role of political leadership as a source of information, education and awareness is emphasized. Strategies for influencing public behavior through sustainable policies and political debates will be proposed.

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Fear and Guilt – The Role of Emotions in Advocacy Campaigns for Sustainable Clothing Consumption (UN Sustainable Development Goal 12)

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Abstract

Yearly, clothing mass-production evicts 4 million tons of CO_2 and releases toxic materials into rivers and on land (Quantis, 2018) (negatively affecting UN SDGs-13, 14 and 15). Clothing is continuously produced faster (*Fast Fashion;* Greenpeace, 2018) with 2 million tons of clothing discarded yearly in Europe. How can advocacy campaigns communicate for sustainable clothing consumption (SDG-12) and protect overall biodiversity?

One strategy to engage recipients is making specific aspects salient – *framing* (Entman, 1993). Bettinghaus (1973) suggests activating emotions regarding one's actions as relevant for behavior change. Nabi (2003; 2019) proposes in his theory of emotions-as-frames that media messages can trigger emotions in recipients. Eliciting negative emotions connected to behaviors can heighten recipients' need-for-action (negativity bias; Kanouse & Hanson, 1987), while positive emotions do not activate as successfully. Emotions-as-frames analyzed in political communication showed fear- and anger-frames affecting information seeking and policy preference (Nabi, 2003), anger- and sadness-frames impacting information processing (Kim and Cameron, 2011), and fear- and hope-frames affecting information-search intention (Sones, 2017).

In the environmental context, emotions were analyzed as mediators with gain-loss-framing showing positive or negative behavior consequences: In Bilandzic and colleagues (2017), portraying negative behavior consequences heightened willingness-to-sacrifice via fear and guilt, and positive consequences via hope. With emotions-as-framing used effectively within political communication and emotions as mediators relevant for environmental behavior change (negative emotions: fear and guilt), this study analyzes fear-frames and guilt-frames for sustainable clothing consumption.

Fear-appeal research (Witte, 1992) with the mediator fear showed that threats should be communicated with resolving actions to translate emotional reactions into behavior. This study therefore analyzes emotions-as-frames (2: fear vs. guilt) with follow-up information (x 2: behavioral suggestions vs. factual depiction) in a between-subjects online-experiment.

218 participants (72.9% female) (18-79 years, M = 27.14; SD = 10.35) read a modified advocacy campaign and answered valid scales.

Two-factorial ANOVAs showed no effects on attitude, behavioral intentions or information-search intentions (ps > .05). Significant mediation effects of factual depiction versus behavioral suggestions via the induced emotion fear on attitude, as well as on behavioral intentions, were found. So, induced emotions as mediators showed also as relevant (as in other research), here via fear as a mediator for using factual depiction. No mediation effects were found for the independent variables via perceived

responsibility or induced emotions on attitude or intentions (*p*s > .05). Descriptively, the fear-frame as well as the guilt-frame generated higher scores with factual depiction for attitude and behavioral intention.

This study analyzed the effectiveness of advocacy campaigns for sustainable consumption (SDG-12: 12.2/12.5/12.8), by addressing recipients' fear and guilt towards their consumption. As the results show, in an environmental advocacy campaign, emotions for negative influences of previous and possible future behavior seem to be both equally relevant in their connection to behavior. With emotions-as-frames communicated regarding behavior, the connection to behavior might already be sufficiently inherent with behavioral suggestions not necessary. Future research should further analyze fear and guilt in environmental behavioral decision-making, and compare emotions-as-frames in experimental settings to other communication strategies, for effectively advocating for UN SDGs.

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Economies of Scales in Household Consumption: How much do a housemate weigh?

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Abstract

Sustainable consumption is an umbrella term that brings several key issues together, such as meeting needs, enhancing the quality of life, improving resource efficiency and minimizing waste. We draw attention to the beneficial practice of "common consumption" mainly by the effect of economies of scale in households with several members.

The needs of the household grow with each additional member – but not in a constant rate, thus, due to the economies of scale in consumption we do not need directly multiply the household needs by the number of the household members but we can calculate it with equivalence scales. While this type of economy of scale has been a popular research area for the last fifty years among mainstream economists and statisticians, it is mainly neglected in relation of sustainable consumption. Nevertheless, there is no generally recommended and accepted equivalence scale. There are the main equivalence scales recommended by international institutions on one hand and national equivalence scales in practice on the other hand.

Based on the above, our (1) first hypothesis is that national statistical institutions use equivalence scales when calculating poverty and inequality accepting economies of scales in consumption. Our (2) second hypothesis is that there is a pattern among countries regarding the type of the equivalence scale is actually used.

In order to answer these questions, we collected data from institutional websites all around the world, and contacted statistical offices via email in 2018–2019 for further information. We examine whether statistical offices use modified OECD scale or square root scale or any other kind of scales for calculating equalised household sizes. We sent out messages to statistical offices of 183 countries and received answers from 74 countries, which is more than 40% response rate covering 45% of the world population. We analyse the collected data, search for group-forming criteria reflecting the essential characteristics of the variables in order to explore and analyse the basic differences among country practices.

We conclude that (1) majority of the countries do calculate the needs of the households with using equivalence scales and (2) there is a wide range of scales in use while there is no any spatial or other kind of characteristics revealing any patterns. Thus, there is room for further research on this area in order to achieve sustainable consumption.

Our paper is related to the Sustainable Development Goal 12 which is 'Ensuring sustainable consumption and production patterns'. The paper helps to find a better understanding of the measurement methods regarding sustainable consumption. This paper (1) helps theoretical and

practical development of the concept of economies of scale, and (2) support policy-makers towards the better understanding diversity of national practices (SDG12a). Finally, we (3) orientate consumers to reach a sustainable lifestyle (SDG12.8) with resource efficiency (SDG12.2) and minimizing waste (SDG12.3) by revealing advantageous patterns of a specific population in order to utilize economies of scale in consumption.

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Conservation of World Heritage Sites and host communities in the Global South: Assessing sustainability and handling complexities in line with SDGs

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Abstract

Natural and cultural sites are an essential component to create tourism activities in different destinations. This research explores how to maintain and sustain these properties and host communities against the destructive effects of neoliberal tourism. The purpose of this study is not detouristification but to curb unbridled tourism in line with UN SDGs. World Heritage Site (WHS) branding was one of the programs promoted by UNESCO to preserve these sites. Around 94% of WHSs labeled In Danger are

currently located in developing countries, which shows a failure to fulfill the World Heritage treaty goal in these states. The central theme of current research is to indicate under what conditions effective conservation of natural and cultural sites can be achieved and how the strategies based on SDGs mitigate the risks related to the conservation of WHSs in the Global South in the post-pandemic era? To handle this challenging issue, we apply both qualitative and quantitative operational research approaches, namely soft systems methodology (SSM) and data envelopment analysis (DEA) to examine the impacts of factors like level of democracy, crony capitalism, and international debt sanctions, and poverty. Despite its effectiveness in policy implication, SSM was widely neglected to deal with grand challenges like sustainability issues. The current project employs SSM, discussing CATWOE and BATWOVE mnemonics related to effective conservation of natural and cultural sites by answering the following question: "who is doing what for whom, and to whom are they answerable, what assumptions are being made, and in what environment is this happening?" Empirically, we go beyond the existing conservation efforts and analyze hidden reasons for failure in fulfilling the World Heritage treaty goal in developing countries like systemic corruptions, crony capitalism, and neo-colonialism. This work also examines pathways such as tourism degrowth toward sustainable tourism and conservation of WHSs based on United Nations sustainable development goals (SDGs) for safeguarding heritage and sustainable communities (SDG 11, Target 11.4), for reducing consumptionism and production of waste in the tourism sector and turn it to more sustainable and responsible practice (SDG 12, Target 12.5), and for fair and non-hegemonic partnership between advanced economies and developing countries (SDG 12, Target 12.a; SDG 17, Targets 17.3 and 17.7). The proposed contribution of this study is related to accelerating progress towards SDGs in times of crisis. In terms of WHS conservation, COVID-19 restrictions have forced overtourism to fade, and the biosphere now has temporary relief from harmful anthropogenic activities. Hence, the pandemic can be seen as a transformative pathway toward more sustainable tourism in the future. Depending on policymakers' will, the current lockdown can be used to reset the industry in favor of wildlife and local communities, and new regulations can be set to transform tourism in line with SDGs. Otherwise, the world is about to witness the return of unsustainable tourism in the post-pandemic era, specifically in developing countries that are already under economic pressure because of COVID-19 impacts. The findings may be of practical value to decision-makers aiming to improve tourism and heritage management.

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Using Protected Values and the Halo Effect to Explain Consumers' Decision Making when Evaluating Electricity Providers' Energy Sources

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Abstract

The increasing use of fossil fuels in the last decades has resulted in more emissions of CO_2, which is one of the main causes of global warming, contributing to the climate crisis that leads to serious threat of all possible forms of life on Earth.

Companies that reduce their carbon footprint by adopting environmental strategies play an important role in this crisis. For instance, although the energy generation sector contributed to almost 40% of the global CO_2 emissions in 2010, and produced 33.1 gigatons of CO_2 in 2018, this same sector could contribute to the shift from fossil fuels to renewable energy sources.

In this context, it is important to understand if consumers are willing to adopt and pay for those energy companies that use renewable energy sources and openly communicate their efforts. Consumers' preferences for renewable energy sources could become a central factor in the adoption of renewable energy sources at household levels. Hence, understanding consumers' choices of electricity providers based on their evaluations of electricity providers' energy sources could contribute to global environmental sustainability.

According to previous research, the communication of companies' energy supply has an influence on consumers' willingness to pay a premium (WPP) and adoption intention (AI). However, there is a necessity to better understand the mechanisms that link the communication of companies' energy sources and consumers' WPP and AI. Consequently, this research set out to study the mechanisms used by consumers to evaluate companies that employ renewable energy sources and describe their efforts to their consumers.

To explore this link, this study draws from two psychological approaches—research on protected values and on the halo effect. Protected values are values that guide people's behavior and go beyond monetary evaluations. The halo effect refers to the observation that consumers generalize positive impressions of an object or entity to unrelated positive attributes.

The study proposes and tests a model in which the halo effect is represented in consumers' perceived comfortableness (PC) at households, which mediates the effect of companies' renewable energy sources (relative to that of fossil fuels) on consumers' WPP and AI. Protected values are represented in consumers' moral orientation toward the environment, which moderates the effect of companies' energy sources on consumers' WPP, AI and PC.

The model is tested in a scenario-based behavioral experiment. Participants are asked to choose between electricity providers that systematically vary in the degree to which the provided energy comes

from renewable sources or fossil fuels. Participants also evaluate the expected comfortableness at home and the companies' environmental friendliness.

This study innovates by using two psychological approaches to explain consumers' decision making and evaluation of companies' energy sources, and contributes to the understanding of the communication role in the context of climate crisis.

- **SDGs + Targets: 7.2, 12.6**

This research relates to the conference's topic by understanding companies' efforts in developing a portfolio of renewable energy sources toward a cleaner and greener society. Additionally, this study aims to understand consumers' response to the implementation and communication of companies' sustainable efforts.

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The attractiveness of national and regional destinations: Exploring “staycations” across social media

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Abstract

The Covid-19 pandemic has decreased international travel by as much as 72 percent and travel have for many people been limited to national or regional destinations. While this affects many companies that depend on tourism, the consequences are not only negative. Travelling close to home for leisure purposes, so-called “staycations”, is positive for the ecological sustainability of our planet since long-distance travel, particularly by airplane, contributes to large emissions of CO2. For this reason, it is important to understand attitudes and behaviors associated with staycations at present to be able to maintain such environmentally beneficial behaviors in the long run, after the health risk of the pandemic is over. Aiming at learning what people think of travelling close to home and the extent to which such travel experiences are published and interacted with online, this study employed web scraping techniques and sentiment analysis to collect and analyze social media content related to staycations. This method enabled the researchers to quantify the number of posts and interactions as well as to study attitudes towards staycations and related Swedish and English keywords. Data collection is still in process and the results will be presented at the conference. However, the researchers anticipate a growing interest for staycations but different levels of content generation and interaction in different areas. The study will have important practical implications for marketers and tourism operators. A thorough understanding of where, when and in what way people talk about staycation experiences is essential in the development of effective campaigns aimed toward appropriate target audiences, which will contribute to building competitive advantages based on ecological sustainability. Furthermore, studies that employ automated tools for data collection and analysis in the tourism field are scarce and this study could potentially contribute to methodological progress in the research area.

This study is especially connected to SDG and Target: 13.3. The study is related to the conference theme since the pandemic can be a turning point for the tourism industry with lower CO2 emissions even after the virus is gone. This could be possible if people travel to national and regional destinations to a greater extent than before the virus changed tourism completely. If such staycation behaviors can be maintained, that would contribute to the progress towards meeting SDG 13 before 2030.

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Sustainable Food Production and Consumption: the case of Associations for the Maintenance of Proximity Agriculture in Northern Portugal

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Abstract

At the end of the 20th century, the study of development diverged decisively from the economic notion of growth and began to take in the complexities of the process to promote the sustainability. Nowadays a lot of conceptions about sustainability can be found in the environment movement. Some of them have strong connection with the solidarity and sharing economy. Furthermore, some proposals to the sustainability try to improve the traditional economic relations and the capitalist way of organizing enterprises and manage the labor. The sustainability movements face a lot of challenges and contradictions to make the social, economic and environmental challenges that we need as society and planet.

At the same time, the questions about our model of growth find expression in the movements of solidarity and sharing economy. Its numerous forms of economic activities are based on autonomy, cooperation and democratic management (Laville and Gaiger, 2009).

This study analyzes how the production and consumption practices within an organization based on the values of solidarity and sharing are related to the dimensions of sustainability (environmental, economic and social). It applies, as a case study, the Associations for the Maintenance of Proximity Agriculture (AMAP), in Northern Portugal, whose principles are based on agroecology, human scale relations and food as a common good. Therefore, this study sought to answer the following research question: How does AMAP´s food production and consumption contributes to sustainability in northern Portugal?

The three dimensions of sustainability (environmental, economic and social) represent differing aspects of a multifaceted process, while their conceptual distinctiveness enables scholars to analyze the process.

The qualitative field research took place in 2019 and consisted of a multiple case study in four AMAPs in the northern Portugal cities of Porto, Vila Nova de Gaia, Famalicão, and Guimarães. Thirty-one interviews were carried with several subjects.

The environmental, economic and social pillars of sustainability are present in the AMAP and were studied by way of participant narratives. Both the interviews and the speeches or practices observed highlighted narratives calling for the enhancement of the economy of proximity, environment and solidarity. The importance of consuming pesticide free, healthy products (environmental dimension) also received attention. Thus, the importance of organic farming was emphasized as the concept of fair

trade for producers which would eliminate the role of middlemen and yield greater profits for producers (economic dimension).

AMAP represents a model of organic farming that is more participative and shared between producers and consumers. The field research identified a sense of solidarity among producers and between them and consumers, which was exemplified by volunteer work that strengthened the local economy and contributed to the livelihood of producer families. However, lack of consumer´s participation and difficulties in understanding the AMAP´s concept as an alternative to current pattern of consumption imposes a challenge to its functioning (social dimension).

The results identified production and consumption practices encompassed within the three pillars of the sustainability paradigm, and the organizations studied demonstrate the challenges to promote Sustainability through solidarity and sharing entrepreneurship.

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Behavioral theories, psychological factors that influence the intention to reduce the car use

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Abstract

From the incorporation of well-founded theories to the process of analysis of experimental studies of a predominantly empirical character, the theoretical basis was established to outline and base these studies' results. Based on the study carried out by Abrahanse (2009), this work used the constructs of the Theory of Planned Behavior of Ajzen (1985), the Norm Activated Model of Schwartz (1977) and the habit variable described in the work of Chen & Chao (2011), to establish as their main objective, which psychological factors are considered when opting for the use of the car in daily commuting and which have greater influence in reducing this use.

Considering that in 2019 the city of São Paulo was appointed as the second most congested city in Brazil and the fifth in the world by the Inrix institute and that the levels of pollutants and particulate materials emitted by automobiles go beyond the levels recommended for health as pointed out by the Energy and Environment Institute in 2018, the factors with the greatest influence in the process of reducing the use of this means of transport, should be considered and incorporated by public managers in their planning. Within this premise, the theory of planned behavior - TPB is recognized for the robustness of its constructs in this theme. The behavioral attitude assesses the individual's perception of how much to assume a certain behavior will result in positive or negative consequences.

The subjective norm considers how much the individual feels pressured by the opinion of the people with whom he relates. The perception of behavioral control assesses how much the individual believes that assuming certain behavior depends exclusively on his own will. The sum of these results defines a degree of intention that can become a behavioral action or not effectively. The norm activated model - NAM, seeks to evaluate altruistic behaviors through its constructs. As in other studies on the same topic, this theory is used because it considers that reducing automobile use involves the abdication of personal benefits such as safety, flexibility, comfort, etc., for the needs of others as a person, a community, the ecosystem, etc. With an exploratory quantitative research method of primary data and analysis carried out through the structured equations modeling - SEM, the results obtained to meet the established hypotheses, where the TPB constructs have greater relevance when explaining the preference for automobiles while the NAM constructs are positively related to the reduction of the use.

Positive results for the habit variable in relation to car use showed a positive correlation with the variable attitude from TPB towards the use and based on the same statement if the cognitive process for decision making is reduced as the habit becomes constant, the perception of behavior control has a negative correlation with habit. Finally, the perception of behavior control moderates the relationship between personal norms and the behavior itself. This work is related to SDG(s) 3 and 11.

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Habits, Behavior and Post-Consumption Disposal of Cell Phones from the Perspective of Sustainability Ethics: Case Study in Students of the Technical and Technological Superior Management Course in the Region of Rio de Janeiro, Brazil

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Abstract

In Brazil, the number of cell phones in operation exceeded the number of inhabitants in the country. According to the National Telecommunications Agency, in May 2019, 228.64 million cell phones were enabled, thus, the volume of old post-use and disposable cell phones in Brazil is increasing. Inadequate treatment, improper deposits, unsafe, burning in the open or in untreated landfills, increase the levels of electronic solid waste, with consequent damage to the environment and the health of the population. These facts challenge the correct management of electronic waste, hindering the achievement of the Sustainable Development Goals (SDGs) agreed in the Agenda for Sustainable Development 2030.

Research on the post-consumer management of cell phones in the Rio de Janeiro region, Brazil will help to better understand this phenomenon and will align with the SDGs, 3; 6; 8; 11 and 12. To select the results, the answers to the questions related to the two currents of anthropocentric environmental ethics (Ethics of the virtue of the environment and Ethics of environmental pragmatism) were interpreted and crossed and the association between categorical variables related to the Theory of Planned Behavior, as a theoretical framework in post-consumer research on cell phones, thus observing that the attitude must be translated into intention in order to influence conduct. In the anthropocentric framework, the research results point to a vision centered on the human being. When constructs are linked, love of nature and ecological citizenship, they produce an understanding and mitigation of the improper disposal of cellular equipment.

The feeling of inadequate management of solid waste, from a moral point of view, the human being takes responsibility in the face of protecting the environment, for his own survival and the challenges for future generations. The transforming potential of man does not remove him from responsibility for nature. As for the important actions of society, in the ethical disposal, the biggest highlight is the habit of sustainable consumption, which is related to the development of effective joint actions, which are the active participation of all actors involved in the product's life cycle.

Our research leads us to understand the changes in human behavior through Ajzen's Theory of Planned Behavior - TCP, assuming that individuals can plan their actions according to their own behavioral, normative and control beliefs. There is evidence of a significant association between knowledge about improper disposal, the existence of recycling companies and operators that maintain discounts for the reuse of used phones. Significant evidence associated with the knowledge of the risks to human health

due to improper disposal, the various chemical substances found in cell phones, safety in regular disposal and recycling when there are information and advantages, were also proven. There was no evidence of dependence between safety when deciding on regular disposal when associated with the destination given to the replaced cell phone. As for the association between the importance of environmental preservation and shared responsibility among the actors involved in the product's life cycle, there was also significant evidence.

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Practice of Reuse, Reduce and Recycle (3Rs) of Solid Waste among Households in Suburban Ibadan, Nigeria

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Abstract

The 3Rs concept is developed to reduce waste generation at source, rid the environment of waste, and reduce cost of transportation. The application of 3Rs at the household level to reduce solid wastes is important because waste is indiscriminately disposed in flowing streams, wetlands, vacant land, uncompleted buildings, road verges, and airspace of buildings in suburban Ibadan.

This study investigated the practice of 3Rs among households in suburban Ibadan. An average of 10 households was randomly selected from 23 communities in two suburban local government areas (Akinyele and Egbeda) to give a total sample size of 225 respondents. Qualitative data collected through questionnaire survey were presented with frequencies and percentages.

The findings revealed 47 as the average age of the respondents, majority (78.0%) were married and had formal education (73.2%). Majority (93.0%) were artisans. Kitchen waste (53.7%), grocery waste (28.8%), and animal waste (17.5%) were the major waste generated. Only 0.7% was aware of the 3Rs.

Inadvertently, 62.0% reused soft drink and bottle water containers, 7.6% reused cement sacks, and 4.7% reused milk tins. 67.8% disposed wastes at the backyard and burn, 24.7% deposited waste at the bank of streams, and 7.5% in the bush. Oyo State Waste Management Agency should create more awareness on the need to reduce waste at source.

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Regulatory focus and the adoption of environmentally friendly behaviors: A mediated model

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Abstract

This study relies on a hierarchical model for the effects of psychological traits on human behavior to predict the potential effects of regulatory focus (RF) on pro-environmental behavior (PEB). Our model proposes that promotion and prevention orientations are indirectly related to PEB, and that these relationships are mediated by materialism, perceived financial strain (PFS) and perceived consumer effectiveness (PCE). The research hypotheses are tested using structural equation modelling, with a sample of 925 Portuguese individuals.

The results provide support for our research model. The effects of both regulatory orientations on PEB are completely mediated by the predicted mechanisms. Both promotion and prevention show an indirect positive relationship with PEB, but this depends on the specific type of behavior (water conservation, energy saving, recycling and overall PEB). Moreover, the results suggest that both promotion and prevention affect PEB through positive and negative channels. Promotion and prevention are positively related to PCE and to materialism, as expected. Promotion is negatively related to PFS, and prevention is positively related to it, as predicted. In addition, materialism is positively related to PFS, and negatively related to PCE and to PEB, as predicted. Moreover, PFS is negatively linked to PCE, as hypothesized. The path from PFS to PEB, though statistically significant, is positive, contrary to expectations. Finally, PCE is positively related to PEB, as hypothesized.

This study produced a set of original insights to existing knowledge on the relationship between RF and PEB. Specifically, building on a hierarchical model for the effects of psychological traits on behavior, this study proposed, and found support, to a number of mechanisms, namely materialism, PFS and PCE, through which RF seems to influence the adoption of behavior that is environmentally friendly. Such mechanisms appear to completely carry the effects of RF into PEB. Moreover, both promotion and prevention relate positively to PEB, but they do so through sometimes opposing mechanisms. Moreover, we also enlightened how materialism reaches to PEB, identifying PFS and PCE as mediating mechanisms. This set of results advance on the scant past studies relating RF and PEB.

To ensure a more sustainable future it is critical to promote a parsimonious and more efficient use of resources, as well as to encourage the reduction of waste generation and the adoption of overall pro-environmental conducts (Targets 12.2 and 12.5). This requires behavioral and lifestyle changes, and this work contributes precisely to better understand what might influence the readiness of individuals to adopt PEB (Target 12.8). Further, the context of the environmental crisis can positively contribute to accelerate the pathway to sustainability, as the adoption of PEB not only promotes lifestyles in closer harmony with nature, as it might also generate household's savings, either by lowering consumption or by spending less to obtain the same level of service(s).

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Prosumer in the fashion context: implications for the distributed economy in a pandemic scenario

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Abstract

The pandemic has shown that more distributed economies offer more resilience to global crises. Indeed, from a sustainable perspective, practices and strategies that foster local production of goods and provision of services, with units integrated into networks, do contribute to reduce transportation, valuing local knowledge and resources and contribute to achieve higher social cohesion. In this paper the authors explore the concept of prosumer as a strategy to achieve a more distributed economy in the fashion sector, with a focus on the social dimension of sustainability. Prosumer can be defined as the individual that integrates the roles of the producer and consumer.

The study involved a systematic literature review and an evaluation of multiple-case studies, using pattern matching analysis. The theoretical framework compares the practice of these prosumer cases against the heuristics associated with distributed economy and the impacts on sustainability identified in the literature. In this study the authors have focused on the six types of prosumer archetypes proposed by Lang et al. (2020): DIY prosumers; self-service prosumers; customizing prosumers; collaborative prosumers, monetized prosumers, and economic prosumers.

The findings have demonstrated that prosumer experiences are aligned to distribute economy and do present direct win-win benefits on the social dimension of sustainability:
a) it can foster a culture of mutual help and empowerment in the fashion sector, enhancing the system social resilience;
b) It is a viable strategy to promote higher socio-economic equity via the fashion products and services, offering more opportunity to marginalized people to get involved on the provision of their own needs, thus accepting diversity;
c) It encourages the sharing of knowledge and skills in the fashion sector, providing a better environment for wide competence building;
d) it values local culture, knowledge and capabilities on the Fashion sector, by using local skills and native knowledge, enabling higher customer involvement into the Design process; and, finally,
e) on an appropriate context, it can contribute to promote social cohesion among local stakeholders, with a better cultural fit of products/services, creating meaningful and long-lasting relationships with customers, promoting mutual trust at local level.

All multiple case studies have shown that in order to achieve these social impacts, particularly during a pandemic, it is critical the wide availability of communication and information technologies. This paper offers a contribution to the SDG goal of responsible consumption and production" + Target: 8.b. The proposed contribution relates to the topic of the Conference because the existence of the prosumer, being a character that consumes and produces, can influence the improvement of economic conditions,

by people having a way of survival and, thus, reducing unemployment, in addition to the consequent improvement in their social conditions.

Keywords: fashion industry, prosumer, distributed economy, social dimension, pandemics, responsible consumption and production

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Behavioral background of adopting sustainable business models at the time of COVID

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Abstract

Sustainable business models can be structured in many different ways in literature, one of the most widely spread approach is of Bocken et al. (2014). They differentiate three major archetypes, technological, social and organizational. COVID has reshaped the spread of sustainable business models. Some researchers argue for an accelerated transition from a linear economy system to a circular approach.

Certain individual behavioral factors, setting the conditions for sustainable business models, changed during COVID times. Kirk and Rifkin (2020) addresses consumer behavior from this perspective during three phases, reacting, coping and longer-term adapting. COVID has reshaped lifestyles (working, studying, travelling behavior, relationships to relatives, friends etc.) significantly. The overall environmental and sustainability impacts of reshaping consumer behavior are yet to become clear, there are both positive and negative signs from empirical studies.

Young adults are key players in shaping the future scene of a sustainable economy. They can adapt more easily to new conditions than older, and their emerging consumption patterns will determine the chances of sustainability over many decades. We developed a questionnaire to reveal the changed conditions for adapting sustainable business models among young adults. Over 600 students responded, the data offered mostly opportunities for quantitative analysis with some qualitative variables offering deeper insights. The survey instrument included three blocks:

- The first block focuses on changes in attitudes and individual behavior due to COVID.
- The second one covers future expectations for the post-COVID times including the possibility of backfire effect.
- Finally, we asked some individual characteristics, including perceived change in subjective wellbeing.

We found that the impact of the COVID situation varied at large extent for different types of sustainable business models. On one hand, the impact on stewardship and environmentally conscious purchasing behavior, for example, did not prove to be significant. The value orientation, on the other hand, showed some shift from consumer society to a more sufficiency-oriented economy. The biggest losers of changes are public transport and some forms of sharing economy. Certain lifestyle changes may persist over the longer term, e.g. many respondents reported to maintain a more frugal lifestyle even after an economic recovery, which is promising in terms of the chances of sustainable business models.

ad 3.a.: this abstract/topic is mainly related to SDG 12 (especially for targets 12.2, 12.3, 12.8)

ad 3.b.: relevance to the conference topic is very direct, this submission intends to better understand how sustainable consumption (through the individual behavioral factors of accepting sustainable business models) can be better promoted in crisis (Covid) times.

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Full papers

Challenges in creating sustainable e-commerce and its proposed digitalsolutions - a literature study

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Abstract

With e-commerce expanding worldwide, not least during the current COVID-19 pandemic, our planet's consequences and society are becoming more visible. Therefore, it is critical to cultivate a business environment where companies in the digital market integrate sustainable business models. To further understand this area, we conducted a systematic literature study to describe the current knowledge about the challenges and solutions facing sustainable e- commerce and its business models. Based on 32 peer-reviewed articles published within the last three years, we categorised them into five focal areas of sustainability in e-commerce: (1) production, (2) logistics, (3) waste & recycling, (4) business & resellers and (5) the consumer's perspective. The results show that production should focus on digitalisation to become more intelligent and efficient, e.g., when it comes to energy consumption and decreasing waste. Current literature amplifies the last delivery route as attractive to create sustainability for logistics. The third category results add to the discussion on collecting information on how to use packing sustainably. The results show that businesses and resellers focus on sustainability, implying investments in new technology, changes in behaviour, and innovative business models. One result from the consumer category demonstrates the importance of online information related to sustainability since it affects the customers' behaviour. Suggestions for future research are to investigate the effects of e-commerce when increasing online product information and focusing on information as an essential aspect of increasing sustainability.

Keywords: e-commerce, sustainability, digitisation, challenges, business model

1. Introduction

Digitisation and the advancement of the Internet have changed perspectives on how business is done for both consumers and retailers (Oláh et al., 2019). Nowadays, consumers can choose to shop while sitting on the train, in the dentist's waiting room or from the lunchroom at their workplace. Delivery options cater to consumers by becoming increasingly flexible and fast, allowing the consumer to choose how and when goods are delivered by offering convenient deliveries directly to the door or a specific postal agent. However, the rapid and progressive growth of e-commerce cannot be discussed without talking about sustainability, as increasing e-commerce can have negative consequences on the earth's ecosystems (Oláh et al., 2019). The concept of sustainability is articulated as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987). Sustainability therefore demands focus across economic (e.g., intertwining profits and company growth with support of community and future generations), social (e.g., ethical treatment of employees, support of human rights in the community) and ecological (e.g., preventing depletion of natural resources) components.

Previous studies have shown a need to balance and expand knowledge about sustainable e-commerce, but to achieve sustainable e-commerce, the social, ecological and economic sustainability dimensions must be integrated (Oláh et al., 2019). As society is digitised and e-commerce grows explosively, consumers have become increasingly demanding for quicker delivery times and flexibility from companies (Ignat & Chankov, 2020), challenging sustainability. The fact that consumers have become increasingly aware of sustainability (Ignat & Chankov, 2020; Oláh et al., 2019) places demands on companies to work sustainably. Consumers are more likely to check on whether companies invest in sustainable methods in their business model (Bertram & Chi, 2018; Ignat & Chankov, 2020; Nero & Raman, 2019). This pressure also comes from other stakeholders and government policy. For companies, sustainability work is an effective way of maintaining competitiveness in the digital market (Ignat & Chankov, 2020; Ingaldi & Ulewicz, 2019). Companies that work according to a sustainable business model with a clear statement of goals and values focused on sustainability attract more consumers and create competitive advantages (El Hilali & El Manouar, 2019). For a business model to be considered sustainable, the focus is on all dimensions of sustainability, unlike a traditional business model that solely focuses on economic sustainability (Boons & Lüdeke-Freund, 2013).

Studies on sustainable e-commerce and its business models are gaining traction (Ingaldi & Ulewicz, 2019; Jaller & Pahwa, 2020; Oláh et al., 2019), and it continues as a highly topical subject due to the continued increased growth of the digital market. Studies have continued during the ongoing COVID 19 pandemic as e-commerce has been given a significant role (Tran, 2021). Still, there are several challenges related to e-commerce and sustainability, besides the aforementioned quicker delivery times. Other related challenges are the possibilities to return without costs (Bertram & Chi, 2018) and the increased use of packaging material (Yen & Wong, 2019). We argue for a literature study summarizing current knowledge and emphasize the result of this literature study as useful to increase sustainable e-commerce. There are few, if any, literature studies, synthesizing the current knowledge on e-commerce and sustainability and related challenges with a digital perspective on the challenges and solutions. Therefore, the aim of this literature study is to identify challenges and solutions with sustainability in e-commerce. Focusing on a business model perspective, we clarify the research

question as: How can challenges and solutions in sustainable e-commerce be described, using a business model perspective?

2. Methods

This literature review is done in two ways, primarily as a systematic literature review, using specified steps (Creswell, 2014; Machi & McEvoy, 2016). We used an exploratory strategy to fill specific gaps in previous findings. In conducting the systematic literature study, we found inspiration in *The Literature Review Model* by Machi and McEvoy (2016). We used their descriptions of the steps of literature search and organization.

The literature searches

We describe our database selection and the search string. We primarily used the Scopus database for the literature search, based on its widespread content and because it solely contains peer-reviewed material (Scopus, 2021). When articles appeared in a search but were unavailable through Scopus, we used other databases, such as Google Scholar, to gain access to the documents.

We chose the literature search keywords to be sustainable, sustainability, e-commerce, and business model. Based on these keywords, the search string was constructed to be: (sustainable OR sustainability) AND e-commerce OR {business model}. This search string was then used in two searches with different filters.

The first search contained a delimitation to the document type articles and conference papers and to the subject area Computer Science to find relevant documents specifying digital challenges or solutions to create sustainable e-commerce. To find newly produced knowledge, we limited the years for publishing the articles to 2018 to 2021. This resulted in 201 search results.

The literature study aims to investigate sustainable e-commerce and its business models, which means relevant documents are also found in other subject areas such as Environmental Science. To not miss these, a second search used the same search string and year of publication but instead delimited with keywords: sustainability, electronic commerce and e- commerce. The search was sorted by relevance to capture the most significant search resultsand yielded 438 search results.

Organization

In this step, we used three strategies to collect documents and organize them. First, we briefly scanned the title and abstract of each document to see if it had a focus on sustainability and e-commerce and by this determine its potential to include in the study. We describe the process in more detail below. The second strategy was Skimming to examine the documents more thoroughly and the third was Mapping to categorize documents (Machi & McEvoy, 2016). Wedescribe these strategies next.

Selection and Scanning

The first search resulted in 201 search results. We scanned the title and abstract of each document, resulting in a selection of 39 documents to be saved in the management program Zotero for a more thorough review. To proceed to the more thorough examination, each abstract needed to contain information about sustainable e-commerce and business models. If an abstract addressed sustainable

business models but also focused on specific areas such as healthcare, it was outside the scope of adding information about a digital challenge or solution and was not considered relevant to the study.

The second search was delimited with the keywords sustainability, electronic commerce, and e-commerce, resulting in 438 search hits sorted by relevance. Due to the relatively large number of hits, document headings were first checked for keywords such as sustainable, sustainability, electronic commerce, e-commerce or business model, or if there were indications that the documents dealt with the studied subject. If so, we scanned the abstracts of these documents to find relevant content for the literature study according to the criteria mentioned earlier. From these, 38 documents were selected and saved in Zotero. As a result, a total of 77 documents from the two searches were selected to proceed to the next step.

Skimming

The next step was to skim each of the 77 documents collected during the scan. In this step, we read each abstract. In cases where the abstract did not include enough information to determine the content's relevance, results and conclusions were briefly scanned. Based on the content of the article, which should include sustainable e-commerce and/or its business models, we decided if the document should be included or not in the literature study. In this step, we used a Google spreadsheet to capture details of each document. We included the title, author, document type and year of publication, and added a brief description of the purpose, problem area and main results. A total of 28 documents were selected to proceed to the Mapping.

Mapping

The 28 documents that proceeded from the review above were categorized overall using the information previously described. To create a better overview, the content of each document was briefly summarized. We could then find emergent patterns and subcategories based on areas within e-commerce and similarities between the documents. Overall categories were formed based on the main focus of the documents, which resulted in the following areas: production, logistics, recycling and waste, companies and resellers and the consumer's perspective. In addition, we used an exploratory literature search to add material to some categories to find more support for the arguments. This resulted in adding four additional documents, which meant that 32 articles became the basis for the analysis.

3. Results

This literature study on challenges with sustainable e-commerce and its business models resulted in five identified central areas: production, logistics, recycling and waste, business and resellers, and consumers. The first area production and its process addresses using digital technology to reduce energy consumption and improve control of data. Research in the area of logistics shows that the last delivery route and returns decrease sustainability for e- commerce. The third area, recycling and waste, attends to waste management and packaging. The area business and resellers shows that trust and risk-based transactions add to sustainable business and resellers. The area consumers focuses on the e-commerce'strustworthiness, like the online information.

Production

As digitalisation moves forward, production becomes intelligent i.e., using analytics and machine learning to optimize outcomes, and there is a strong demand to make the production process sustainable. Due to increased concern about resource shortages and environmental degradation worldwide, new rules and initiatives have been taken to introduce green methods in the industry (Yacob, Wong, & Khor, 2019). By integrating advanced technology, ecological sustainability can be achieved, which results in more resource-efficient production with reduced energy consumption and improved control of data. Sustainable production should include green technology, green product design and green production that are implemented throughout the life cycle of product manufacturing, according to Ghadimi, O'Neill, Wang, and Sutherland (2020).

The introduction of green technology in production means moving to new or improved processes, technologies or systems to reduce harmful effects on the environment from activities and human activity (Yacob et al., 2019). Companies that are considered the cause of environmental problems have had to review their production processes and supply chains due to pressure from the government and society (Çankaya & Sezen, 2019). Green methods include environmentally friendly design, raw materials, packaging, distribution and as well as reuse. With these methods during the manufacturing process, there is minor environmental damage through recycling, environmental protection, management and reduction of waste and control of pollutants (Yacob et al., 2019). Thanks to the advent of intelligent, electric and environmentally friendly transport vehicles and connections, and improvements for optimized technology, the possibility of reducing the environmental effects from logistics facilities increases through technological innovation that is growing faster than ever (Ghadimi et al., 2020).

Digitization has led the way to Industry 4.0, which has aroused great interest and is being studied more and more (Nascimento et al., 2019). There is a strong demand to make the production process as sustainable as possible (Birkie, 2018). Industry 4.0 is supported by the development of information and communication technologies and data storage. Integrating advanced technologies such as the Internet of Things (IoT), industrial automation, and cloud services can enable, for example, operational efficiency, improved control of data, and reduction of energy consumption from machines and processes (Nascimento et al., 2019). Cloud services are needed in e-commerce to handle the large amounts of data that arise in, for example, electronic payments on e-commerce platforms (Zhou, Lou, & Jiang, 2019; Zhou, Xu, & Yen, 2019). The higher the pressure on the internet, the more energy is consumed in the data centre, which is the core of the cloud service where the work is performed. Energy consumption of data centres is seen as a significant challenge as it increases day by day. Therefore, is it essential to optimize energy consumption, not to cause energy losses (Zhou, Lou, et al., 2019).

Logistics

With online shopping following demands on flexible delivery options. Presented here are the last delivery route, which is often inefficient at the same time as it contributes to significant carbon dioxide emissions and increased congestion, and returns. Returns are a significant challenge in e-commerce

that affects all aspects of sustainability. Technology is essential for streamlining logistics and, in particular, the last delivery route, for example, through useful applications and drones. The number of returns can be reduced by using modern technology.

Last mile delivery

The last mile delivery route is a phenomenon that includes the last part of the delivery process. It is a result of growing e-commerce and an increase in more final delivery routes, which are unsustainable in all sustainability aspects (economic, social and ecological), according to Ignat and Chankov (2020). The last delivery route is the part that is considered to be the least efficient part of the supply chain, and is challenging since it contributes to the most carbon dioxide emissions and pollutants (Ignat & Chankov, 2020; Manerba, Mansini, & Zanotti, 2018; Seghezzi, Mangiaracina, Tumino, & Perego, 2020; Tiwapat, Pomsing, & Jomthong, 2018; Velazquez & Chankov, 2019). These adverse effects are primarily the consequence of inefficient deliveries such as unsupervised and unsuccessful deliveries and the consumer's need for fast delivery or home delivery (Bertram & Chi, 2018; Velazquez & Chankov, 2019). The last delivery route is very costly and can account for half of the total logistics cost (Seghezzi et al., 2020).

Most studies on the last delivery route discuss the potential of e-commerce to reduce the negative externalities of the trade (Jaller & Pahwa, 2020; Manerba et al., 2018; Velazquez & Chankov, 2019). Driving vehicle miles is an example of an external negative effect that contributes to, among other things, air pollution by vehicles transporting goods. In the study conducted by Jaller and Pahwa (2020), the authors compare shopping that takes place online and in a physical store, where the results show that e-commerce can significantly reduce vehicle miles driven if all individuals were to use online shopping instead of going to a physical store (however, this does not apply to individuals who travel by public transport, bicycle or walk to a store). According to Bertram and Chi (2018), e-commerce contributes to 30% less carbon dioxide emissions than the traditional trade in physical stores and mentions that it depends on distance as shorter trips to stores can be more energy efficient than using e- commerce. Other influencing aspects are fast delivery, customer basket size and supplier consolidation (Jaller & Pahwa, 2020). Fast deliveries are deliveries within a predetermined time interval on the same day and usually within a few hours. To compete for short delivery times, this may mean that companies need to use alternative delivery methods that have adverse effects on the environment (Bertram & Chi, 2018; Jaller & Pahwa, 2020; Manerba et al., 2018). Jaller and Pahwa (2020) conclude that consolidation is an essential factor when comparing online shopping and physical stores in driving vehicle miles.

Part of the responsibility for a sustainable final delivery route lies with the consumer by trying to buy everything in the same order, according to Jaller and Pahwa (2020), which is also usually consumers' perception of what has the most negligible impact on the environment when ordering several goods (Bertram & Chi, 2018). However, Bertram and Chi (2018) say that it usually has the opposite effect because when a consumer orders several goods simultaneously, the order is more likely to be divided into several shipments, which increases the number of delivery journeys and increases the consumption of packaging. Suppliers have the responsibility to consolidate as many consumers as possible during one and the exact delivery trip (Jaller & Pahwa, 2020; Velazquez & Chankov, 2019), something that is

quickly undermined in fast deliveries as companies often need to split orders and send them separately to be able to provide the consumer with fast delivery (Bates et al., 2018; Velazquez & Chankov, 2019). According to Manerba et al. (2018), the number of miles and the number of vehicles used can be significantly reduced by knowing in advance which consumers are to be served, which enables a better structuring of delivery service, which in turn has a significant impact on the reduction of carbon dioxide emissions. Manerba et al. (2018) also claim that e- commerce companies that adopt fast deliveries increase the environmental impact by almost 400% if they reduce the time intervals from a full day down to two hours.

Online consumers are demanding in terms of service level and demand fast and flexible delivery times (Bertram & Chi, 2018; Seghezzi et al., 2020). Fast deliveries are very costly for companies, and companies cannot consistently deliver under these conditions. The consequence of the growing e-commerce is that more trucks than ever drive in and out of cities, contributing to increased congestion, pollution, noise, traffic jams and accidents (Manerba et al., 2018; Seghezzi et al., 2020; Tiwapat et al., 2018; Velazquez & Chankov, 2019). This, in turn, affects the quality of life in cities and human health and well-being (Manerba et al., 2018).

There is a demand for delivery prices to be kept low or entirely free for the consumer (Bates et al., 2018; Bertram & Chi, 2018), which puts pressure on e-commerce companies that become dependent on cheaper labour in the form of, for example, private messengers who deliver in their spare time with their vehicle (Bates et al., 2018). These drivers may lack fixed contracts, health insurance and earn less than the minimum wage, which is not sustainable from a social perspective (Ignat & Chankov, 2020). Drivers' driving style (based on the driver's experience, knowledge and relationships) affects delivery efficiency. According to Bates et al. (2018), is technology essential to support a more efficient delivery of goods.

In the MDI area (People-Computer Interaction), new technology can be created that is usefully designed to help drivers plan their routes more efficiently and contribute to sustainability within the final delivery distance. Bates et al. (2018) believe that MDI is a critical success factor in future business models that can contribute to ecological and social sustainability. Tiwapat et al. (2018) state that technology is the key to make the last delivery route more efficient, for example, through applications that enable suppliers to provide consumers with information so that the consumer can see the delivery status and the exact delivery time.

Drones that can deliver smaller packages in cities with technology as an aid and built-in GPS is another delivery method discussed for sustainable efficiency within the last-mile delivery area (Ignat & Chankov, 2020; Seghezzi et al., 2020; Tiwapat et al., 2018). There is great interest in applying the phenomenon of 'crowdsourcing' within the last delivery route. 'Crowdsourcing' means that private individuals pick up packages from a warehouse or store in connection with a route that will still take place for, for example, work-related reasons(Seghezzi et al., 2020; Tiwapat et al., 2018).

Returns

Consumers who order goods on the internet return to an increasing extent than those who shop in a physical store. The high volume of returns is one of the major problems in e- commerce (Bertram & Chi, 2018; Seewald et al., 2019). Often, the reason for return is that the product does not meet expectations (Bertram & Chi, 2018; Feuß & Brettel, 2018) as the consumer cannot physically see and feel the product (Bertram & Chi, 2018). Product insecurity is also considered a significant cause of return. It is widespread among ´credence goods´, a product or service that is difficult for the consumer to value, even after consumption (Feuß & Brettel, 2018).

E-commerce companies are aware of this and therefore make the return simple and convenient for their consumers. Many companies choose to fully bear the costs that come with the returns, which increases the probability that consumers will return their purchases (Bertram & Chi, 2018; Velazquez & Chankov, 2019). This type of return policy significantly impacts consumer behaviour as consumers become more inclined to shop when companies offer free returns (Velazquez & Chankov, 2019). Velazquez and Chankov (2019) believe that it is essential to analyze the last delivery route when goods return from consumer to supplier and that e-commerce companies should investigate return patterns and, based on that, develop anaction plan.

It is challenging to avoid returns altogether, but by integrating so-called green technology, the management of returns can be made more efficient (Bertram & Chi, 2018). For example, the software enables consumers to print their return label when needed and return in the original packaging, thus reducing pre-printed return slips. The consumer does not have to buy new packaging to return their goods (Bertram & Chi, 2018). Like Bertram and Chi (2018), Velazquez and Chankov (2019) believe that it is essential to ensure that the packaging is resealable to be reused for return. Another technology used is software that helps the consumer find the right fit and size with measuring tools that measure a product they already own and compare this with a product that they intend to buy online, which then visualizes this for the consumer who will then have easier to choose the right size (Bertram & Chi, 2018; Seewald et al., 2019).

A combination of machine learning and styling expertise in human form can also help with returns using lists that contain customer data on body size and complete history of returned goods (Seewald et al., 2019). Reverse logistics is seen as a challenge in e-commerce, which means that companies must accept a high number of returns (Bertram & Chi, 2018). The reverse logistics system consists of a value chain designed to handle the flow of products for resource-efficient reproduction, recycling, or disposal (Wit & Pylak, 2020).

Recycling and waste

Recycling is essential as it comes to packaging being used that otherwise could be thrown away. Packaging is considered to account for part of the greenhouse gas emissions in e- commerce, especially when cardboard packaging is used. With the help of advanced technology, the introduction of sustainable packaging can improve the logistics chain and customer satisfaction (Yen & Wong, 2019). When the last delivery distance is long, this often leads to challenges with packaging that need to last all the way, according to Yen and Wong (2019). They studied logistics chains for two of

China's leading e-commerce companies as sustainable packaging is a significant problem. Packaging that is not biodegradable exacerbates plastic waste and carbon dioxide emissions, but by implementing sustainable packaging solutions, pollution problems can be reduced (Yen & Wong, 2019). Using sustainable packaging in e-commerce has a significant impact on the environment, society and the economy.

Yen and Wong (2019) provide examples of how packaging can be reduced through, i.e., intelligent packaging technology that increases packaging efficiency. Another solution is the introduction of advanced technology such as drones to increase delivery efficiency (Ignat & Chankov, 2020; Seghezzi et al., 2020; Tiwapat et al., 2018). Yen and Wong (2019) suggest that companies implement strategic alliances as partnerships that can benefit companies that share, for example, costs and knowledge to reduce all unnecessary packaging. Velazquez and Chankov (2019) suggest that companies choose more sustainable, simple and smaller packaging options that are created to be returned (resealable) and create a plan for how they can recycle existing packaging. The suitable packaging material can reduce greenhouse gas emissions and environmental impact (Ingaldi & Ulewicz, 2019).

Yen and Wong (2019) believe that information technology can help companies and the entire logistics chain to share data with others. This data sharing can suggest what type of packaging is suitable to use and help facilitate, for example, warehousing. This is needed as e-commerce results in large amounts of packaging being consumed and thrown away. Packaging in e- commerce can account for many greenhouse gas emissions, mainly when cardboard packaging is used (Bertram & Chi, 2018; Velazquez & Chankov, 2019). According to Velazquez and Chankov (2019), this has such a significant impact on all individual packaging, as companies must take separate orders into account and ensure that they are adequately protected upon delivery.

There is also a social impact in those e-commerce companies that take measures, which with sustainable work on, for example, packaging, can benefit from being recognized by the public as a company that takes responsibility by protecting the environment (Ingaldi & Ulewicz, 2019; Yen & Wong, 2019). Economically, sustainable packaging can be seen as an expansion opportunity for a recycling business, and it can be an investment area for companies that, in the long run, can benefit from this that becomes more cost-effective (Yen & Wong, 2019).

Digital marketplaces in various websites where sales can take place between private individuals who make purchases/sales/exchanges can contribute to reduced waste. This has become a significant problem due to e-commerce when, for example, quantities of clothes are thrown straight into the trash. With this clothing waste comes increased methane emissions and groundwater pollution (Bertram & Chi, 2018). At a company level, companies should introduce management for internal waste with the help of technology and move to sustainable production with, for example, recycling and reduction of waste and packaging (Liu & Stephens, 2019).

Companies and resellers

Today's companies are increasingly aware of the importance of social and ecological sustainability, which requires a combination of new technology, changes in behaviour and attitudes, and innovative business models. The consumers are essential when it comes to e- commerce and their perception on the e-commerce platform's security is crucial. Therefore, it is in the best of interest to work with transactional activities that build trust and reduce the risks surrounding e-commerce transactions. The sub-sections related to sustainable companies and resellers are creating sustainable e-commerce and business models.

The organization's perspective

There are several challenges to overcome in order to achieve sustainable development in e- commerce. One is that organizations have a responsibility to inform consumers about sustainable consumption in e-commerce (Song, Zhu, & Zhao, 2020). For example, companies should clearly state what they mean by sustainability, how they are integrating it, and why it is important now and, in the future, preferable as a strategic document on their web-site.

One part of financial sustainability is that the consumer's perception of security on e-commerce platforms is crucial for the intention of making purchases (Tran, 2021). Therefore, companies need to work with transactional activities that create trust and involve few risks by offering consumers effective protection when buying online. According to Khayaiyam (2018), e- commerce companies that want to increase their competitive advantage should focus on building trust in e-consumers and reducing the risks in terms of systems and the transaction process. Proper management of trust and risk-based factors in cross-border e-commerce and domestic commerce will result in higher satisfaction and loyalty among consumers, according to Khayaiyam (2018). Tran (2021) believes that companies should build reliable platforms that promote secure online transactions. One example is using an e-wallet (electronic wallet), as it only requires the consumer to enter their username and password in connection with the purchase while all data is encrypted. By working with trust and risk-based factors and offering secure transaction alternatives such as an e-wallet, it can result in higher satisfaction and loyalty among consumers, resulting in financial sustainability.

Business models

Implementing sustainability in e-commerce business models can positively impact companies and communities (Nero & Raman, 2019). According to El Hilali and El Manouar (2019), companies that work according to a sustainable business model with a clear value proposition around sustainability attract more consumers and create competitive advantages. The study of Nosratabadi et al. (2019) showed that four main approaches are central for designing a sustainable business model. The first point is to design a sustainable value proposition, it should be clear what the e-store stands for and why products or services are of value to the customer. The second point is to design sustainable value creation, price and customer service are examples that create value in e-commerce. The third point is to design sustainable value delivery, which in e-commerce could be, as an example, offering customers various and flexible delivery options to make sure the customer is happy. The fourth point is to create sustainable networks for collaboration to be able to create and deliver sustainable values that can meet at the same time the economic, social and environmental benefits. In e-commerce networks can

include collaboration between the e-stores, manufactures and delivery companies. For companies working with a sustainable business model, the 'Triple Line Bottom' (TBL) concept is central. This perspective on sustainability attaches equal importance to all sustainability dimensions, i.e., economic, ecological and social sustainability (Liu & Stephens, 2019; Nero & Raman, 2019). Supporting sustainability in business models is generally of great importance for both research and an application to explain current challenges about the environment and society (Schoormann, Behrens, & Knackstedt, 2018).

As the use of advanced technology has increased, both the popularity and success rate of sustainable business models have increased and creating sustainable networks for collaborations and partnerships is, as mentioned above, an essential component in sustainable business models (Nosratabadi et al., 2019). Oláh et al. (2019) point out that essential aspects such as collaborations and partnerships can benefit sustainable e-commerce and the environment and society at large by companies taking advantage of what already exists through cooperation between companies. Through collaboration, all sustainability dimensions can be improved and lead to creating the best possible solutions (Oláh et al., 2019). Therefore, Liu and Stephens (2019) believe that collaboration and stakeholder involvement are effective components to achieve a sustainable organization.

Creating sustainable consumption and production is closely linked to product and service innovation, including innovation in material recycling, energy consumption, process technology related to waste, etc. (Liu & Stephens, 2019). At the company level, sustainable innovation collaborates with services, products, processes and business models, which all can create challenges according to Liu and Stephens (2019).

The consumer's perspective

Today's online consumers are becoming increasingly aware of sustainability and the importance of including sustainability work in business (Oláh et al., 2019). They are more informed about the social problems that exist and have an increasing interest in activities that relate to and can help the environment, and expect e-commerce companies to take their responsibility regarding sustainability (Ingaldi & Ulewicz, 2019; Nero & Raman, 2019).

Understanding the intentions of the e-consumer is a fundamental prerequisite for e-commerce companies (Xiao, He, Chi, Jeng, & Tomer, 2019; Zhou, Lou, et al., 2019). Satisfaction and trust are the factors that have a direct impact on the intention to buy back, and these factors affect consumers' shopping experience, which is expressed through, among other things, online reviews (Zhou, Xu, et al., 2019). For e-consumers, factors such as usability, responsiveness, security, and assurance are of great importance for an e-commerce platform's trust. Trust has a significant influence on consumers' loyalty to the company (Choi & Mai, 2018).

There are several challenges related to digitisation when it comes to sustainability. One such is based on the fact that loyal consumers are vital for e-commerce, as they are the key to sustainable success for the organization (Choi & Mai, 2018). Xiao et al. (2019) believe that understanding the ability to anticipate consumers' buying intentions has become essential in achieving sustainable cross-border e-commerce. Big Data is seen as a powerful weapon for providing customized services for the

consumer. E-commerce platforms collect personal information and data on behavioural preferences that can then be used to build their model for each consumer's shopping behaviour and provide the consumer with recommendations to meet their shopping needs (Xiao et al., 2019).

Another challenge related to digitization is online information. Ignat and Chankov (2020) argue that online information can influence consumers to choose more sustainable alternatives when buying via e-commerce platforms, such as selecting how their goods should be delivered. By presenting the alternatives' social and ecological effects, most consumers usually select the most sustainable alternative over the choice that they initially preferred as a delivery choice. Song et al. (2020) another perspective on online information about the products available. They claim that it is a challenge for sustainable consumption with insufficient online product information.

Synthesising challenges and solutions

The figure below (figure 1) displays some of the challenges and solutions presented in the result. First are the challenges presented and thereafter follows solutions for the challenges, based on current research that has been collected.

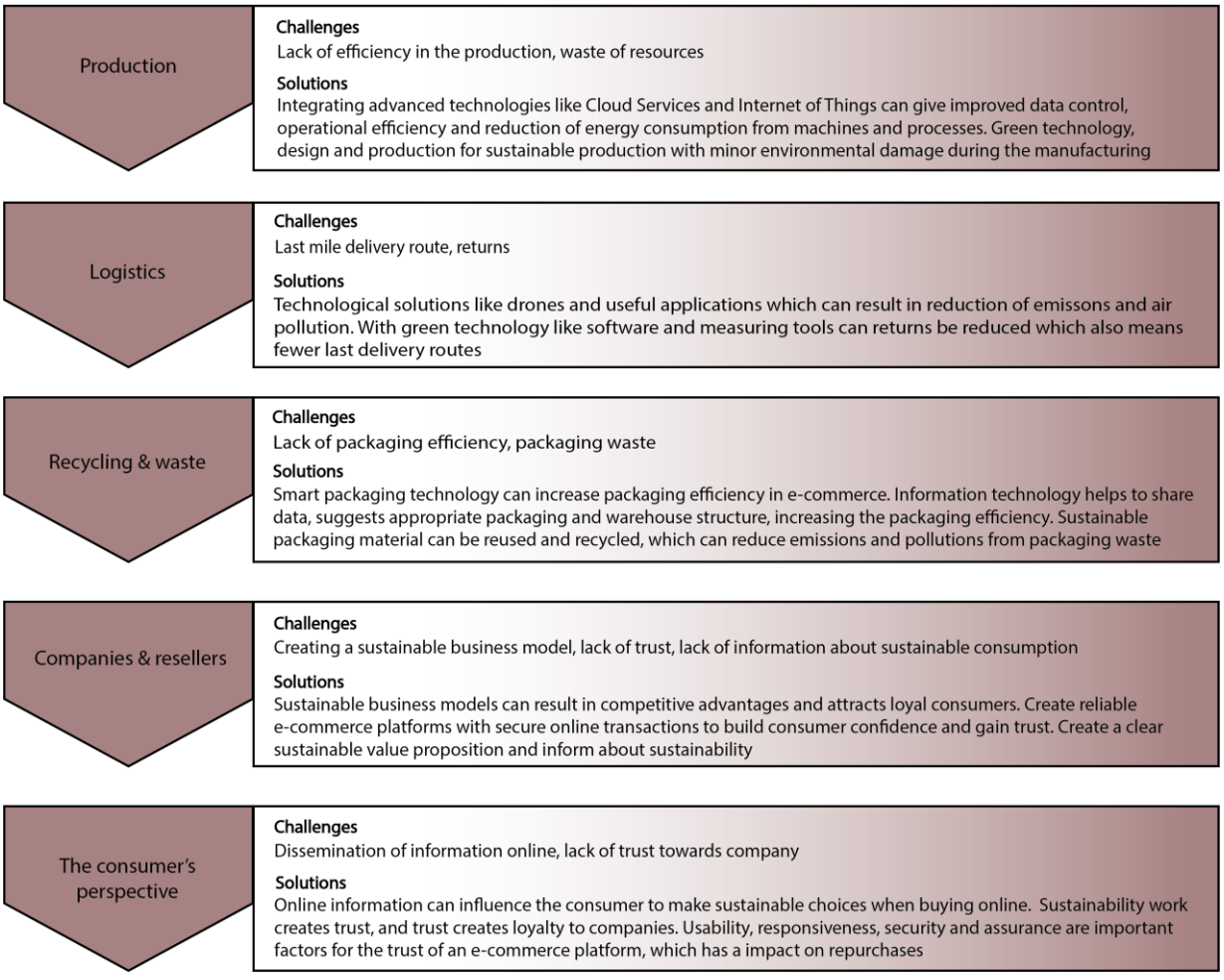

***Figure 1**. Summarization of challenges and solutions from the presented result.*

4. Discussion

This study has identified challenges and solutions with sustainability in e-commerce, in several areas. As the study had a digital focus, most of the identified solutions are technology based. Current research seems to agree that much can be improved within e-commerce in terms of sustainability aspects and that it is the advanced technology that paves the way for sustainable e-commerce by streamlining and improving the conditions. One ***ecological*** aspect on sustainable e-commerce is the last delivery route, where there is room for many sustainability improvements, where researchers discuss, among others, drones and 'crowdsourcing' as potential alternatives to the traditional delivery alternatives (Ignat & Chankov, 2020; Seghezzi et al., 2020; Tiwapat et al., 2018). Another often emphasized solution to make e-commerce more sustainable is information online. Both Tiwapat et al. (2018) and Song et al. (2020) believe that the availability of information online has a significant role for sustainable consumption, thus e-commerce companies have the opportunity to influence consumer behaviour in a more sustainable direction in terms of consumption through information dissemination while this also builds consumer confidence. Working with the challenges within the last delivery route is important to ensure ecological sustainability, along with work towards sustainable consumption with online information and reducing waste from e-commerce, to name a few important aspects.

In order for it to be ***financially sustainable*** for e-commerce companies, the companies need loyal customers and it is therefore important to create trust. E-consumers in turn value that companies integrate the ecological and social sustainability aspects into their business model. Therefore, sustainable business models are important for companies that want to establish themselves and maintain their place in the digital market as they increase competitiveness and attract consumers according to researchers (Bertram & Chi, 2018; Ignat & Chankov, 2020; Nero & Raman, 2019). In other words, it seems that business models that apply sustainability are important for survival on the digital market and an effective tool for achieving success.

However, the ***social sustainability*** dimension often seems to be overshadowed by the other two dimensions, the economic and the ecological. Many studies focus on the effects that e- commerce has on the environment, where social sustainability is only mentioned in passing. Ignat and Chankov (2020) confirm that the social dimension receives less attention from companies when it comes to establishing sustainability, and instead focuses on economic and ecological sustainability. Bates et al. (2018) addressed social sustainability in the form of working conditions as a result of tight logistics as e-commerce increases and consumers demand fast and flexible deliveries at very low prices or completely free, which can lead to companies using cheap labour without decent conditions or employment contracts. Oláh et al. (2019) also addresses the social sustainability dimension and emphasizes the importance of having a balance between all sustainability dimensions for e-commerce to be sustainable. It also requires that all identified areas in e-commerce take responsibility for sustainability, fromthe companies and consumer, to recycling and waste.

5. Conclusions

This study was conducted as a literature study to present current knowledge on e-commerce and sustainability, and related challenges. These challenges, and solutions, were reviewed and classified

into five main areas. These areas are production, logistics, waste and recycling, companies and resellers, and consumers' perspectives. Within these five areas, there are several challenges, such as last-mile delivery in logistics, which could be solved using drones or packaging waste that can be solved via correct data about the size of the products. Further synthesised is that research is prominent in ecological and financial sustainability, diminishingknowledge on social sustainability and e-commerce.

The synthesised knowledge can be helpful when trying to achieve sustainable e-commerce, where both researchers and companies can benefit. One suggestion for future research is to investigate how to publish online product information and what effects can be achieved on e- commerce when increasing online product information. Another suggestion for future research is to investigate how organisations publish their strategies related to sustainability and how customers choose when purchasing goods.

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Environmental Labelling and their Implications for Sustainable Marketing Practices Regarding Recycling

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Abstract

Green labels can be used as a marketing strategy based on the benefits of the product to the environment. Focusing on recycling and Brazilian ABNT norm, this paper aims to understand the types of labels used to communicate a sustainable image. It approaches the following research problem: What standard environmental symbology is used to inform consumers? The analysis observed a qualitative and inductive approach. A large Brazilian supermarket was visited in mid-2018 and a sample of 60 products from 15 segments and 50 different brands was observed in the field. Data collection involved primary and secondary data. The first consists of empirically verified labels and the secondary ones found in the literature and documents, specially, the ABNT norm. A comparison of the existing environmental labeling based on Brazilian ABNT norm typologies (I, II and III) and its effective use in the researched packages was performed. For typology III, audited by ISO 14024 and more aligned with the precepts of the circular economy, there was no occurrence in the collected sample – which allows us to infer that this typology is little used by manufacturers. Concerning the products surveyed, most had Type II labeling, auto declaration seems good to the consumer due to the rich amount of information presented. In some cases, symbols and phrases were used to explain and encourage consumers to adopt greener practices. However, at times this Type II symbology may create multiple interpretations and miscommunication. Some symbols were unclear and even contradictory. A better way of informing the consumer, would be to specify the potential for recycling or reuse of each item of the package, separating symbols and discrimination of the plastic-type and packaging element for recycling. The study found that manufacturers do not yet use a standard symbology in environmental labeling. A wide variety of symbols and messages was found. It was inferred that this is partly due to the lack of knowledge about signs and typologies. From searches in other sources, it was found that this situation extends in general Brazilian labeling. Scarce and confusing information may cause a negative effect regarding correct disposal. Despite this, ABNT norm works to create standards to be used in packaging to communicate the consumer, such as whether the packaging is recyclable or recycled. As a

recommendation for future research, it is suggested the deepening of the relationship between recycling, circular economy, and environmental labeling.

Keywords: Recycling symbology, Environmental labelling, Circular Economy, Sustainable Marketing.

1. Introduction

Waste management has undergone many changes since the end of the 20th century therefore, green products have gained increasing attention. These changes include a crucial role in public policy, demanding a strategic planning position from governments. The UN 2030 Agenda brings 17 objectives for sustainable development, the Sustainable Developing Goals (SDGs), based on 169 targets, including concerns about sustainable production and consumption (UN, 2018). According to Yang (2017), in recent years, consumers pay more attention to products that are environmental and socially responsible, such products can be called "green products". These are mostly designed or manufactured in a way that minimizes the environmental impact involved in their production, distribution, and consumption. Its design, development, and offer in the market may involve the use of recyclable or recycled materials, biodegradable, low impact to the environment, whether by the reduced use of energy, carbon, or water.

The concept of the sustainability tripod (triple bottom line) corresponds to the results of an organization measured in social, environmental, and economic terms (Elkington, 1999). Green marketing is a strategy focused on the selling products process and services based on their benefits to the environment. According to Ribeiro, Corrêa and Souza (2015) the green marketing theme evolution in articles published in recognized scientific journals, in the period from 1992 to 2011 in Brazil, leads to conclude that the theme, at the national level, has not reached its maturity, being poignant the need for discussion of this subject, because Brazil is a signatory to the 2030 Agenda. The circular economy brings a new management paradigm mainly by proposing no longer the unbridled extraction of resources to produce products and services (Barros and Neto, 2011). Society would transpose the traditional linear model of production and consumption to make use of reuse and recycling in a systematic way to justify its economic viability in various production environments.

For the Brazilian Institute of Nature Defense (2018) sustainable labels are a source of communication of green marketing. This differentiation will attest to the consumer and society the good practices exercised in the production and distribution of the goods that uses it on its labels. There are still disagreements about a globally accepted labelling standard. The development of reverse logistics is the facet of the circular economy established by the Brazilian Solid Waste Policy, based on Law No. 12,305/2010. Establishing labelling criteria on waste generation, guiding disposal by consumers, is paramount for environmental management. The diversity of signs and lack of norms defined for their employment might hinder the consumer's information about the correct disposal and would contribute to the collection systems.

This article aims to understand the association between the use of labels to communicate a sustainable image by green marketing and its impact on consumer perception. For this, qualitative-quantitative research was carried out, of theoretical-empirical nature. The mixed-method research put on the spot the research problem in which results answered the following question: What standard environmental seal symbology could be used to better inform consumers? A sampling of 60 (sixty) packages was used to confirm the constructs predicted by the study, which is presented below.

2. Green marketing, circular economy, and environmental labelling

Studies state that the excessive energy demand and increased pollution from population growth would lead to the depletion of natural resources (Oliveira, 2006). Sustainable development allows them to meet the current needs, without compromising the capacity of future generations to supply their own supplies (Stuart and Brandemburg, 2016). Consumption, although sometimes considered an individual choice, is deeply rooted in culture, behaviours, and institutions, influenced by corporate and governmental practices (Orouke and Lollo, 2015).

With increasing awareness of the effects of environmental degradation, green marketing has entered the minds of consumers and corporations around the world. Dias (2007) proposes it is a strategy of linking the brand, product, or service to a conscious image and focused on sustainability. Companies have been slowly introducing green marketing into their business practices, reducing the impact of energy production, manufacturing, and use on the environment (Tando and Sethi, 2017). For Polonsky (1994), it was created to meet the desires and needs of consumers if the way these desires and needs will be met occurs sustainably about the environment. Besides, initially, the green marketing proposal had two main objectives as recommended by Ottman (1994):

> develop products that balance consumer needs, have a viable price and convenience with environmental compatibility; and project a quality tin image including environmental sensitivity as to the attributes of a product and as to the trajectory record of its manufacturer. At that time, there was a debate about the relevance of the use of environmental labelling that expressed this product differentiation for consumers (Ottman, 1994).

Churchill Jr. and Peter (2012) identified that organizations that practice green marketing often use recycled material in their products or at least cause little or no harm to the environment, also seek to pack their goods in ways that have a less environmental impact. This is closely linked to the practices and principles of the circular economy, which is a radical and disruptive innovation for the introduction of new production systems, consumption, and disposal systems (Rodrigues et al., 2013; Tukker, 2015; Chamberlin and Boks, 2018).

The report *Towards the Circular Economy: Economic and business rationale for an accelerated transition*, dated 2012, whose author was Ellen MacArthur, an instituter of the Foundation that bears her name. This milestone has brought to the fore the current concept of the circular economy, which replaces the concept of end-of-life with restoration, turns its eyes to the use of renewable energy in

various operations, eliminates the use of toxic chemicals that harm potential reuses, and aims to eliminate waste through the superior design of materials, products, systems, and models of companies (Ellen Macarthur Foundation, 2012). The World Economic Forum (2014) defines the term as:

> An industrial system that is restorative or regenerative by intent and design. It replaces the concept of end-of-life by restoration, changes in the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims at the elimination of waste through the superior design of materials, products, systems, and commercial models (FEM, 2014).

Yet, in the 1970s, it is perceived that industrialized countries responded politically with the combination of sanitation, environmental protection, and, mainly, commercial recycling and reuse practices, existing of modern waste management. The action of the United Nations (UN) contextualizes the phenomenon with its prominent role in the environmental research field (ISWA, 2011). Academics, intellectuals, and organizations from various fields have made practical applications by improving and developing the general concept of the circular economy (EMAI, 2017).

The structural transformation of economies is pointed out to achieve the SDGs. This is essential for increasing long-term growth rates and ensuring social well-being, with broad empirical support for the notion that investment in productive infrastructure based on the concept of circular economy allows to drive innovations and increase Gross Domestic Product (GDP) growth in the long term (ONUBR, 2017). Brazilian publications on the subject emphasize its importance but are not yet expressive (Sellito, 2018; Braga Junior et al., 2019).

Europe is the most advanced continent in this interest. Since 2015 it has developed the European Union Action Plan for the Circular Economy, which defines ways for the transition from a linear economy to a circular economy through legislative proposals. Furthermore, the European Centre of Excellence for the Efficient Use of Resources has been helping small and medium-sized enterprises benefit from business opportunities arising from increased resource efficiency; *Horizon 2020 Programme* for the promotion of industry in the circular economy, providing for funding of more than EUR 650 million; and the creation of a platform, in association with the European Investment Bank and national banks, for circular economy financing (Eco. Nomia, 2018).

Specifically related to the circular economy, there is the Cradle-to-Cradle Products Innovation Institute, known as C2C, focused on innovations for the circular economy through products that have a positive impact regarding social and environmental issues. There is a minacious parcourse to achieve its certification, described below.

> To receive certification, products are assessed for environmental and social performance across five critical sustainability categories: material health, material reuse, renewable energy and carbon management, water stewardship, and social fairness. A product is assigned an achievement level (Basic, Bronze, Silver, Gold, Platinum) for each category. A product's lowest category achievement also represents its overall certification level. The standard encourages continuous improvement over time by awarding certification on the basis of ascending levels of achievement and requiring certification renewal every two years (C2C, 2021).

Unfortnatly this certification is not yet popular in developing countries because of many reasons as the complexities of the value chain to be traced and the price for the companies to renew it every two years.

In Brazil, Law 12.305/2010 defines the National Solid Waste Policy (PNRS), which characterizes reverse logistics as a set of actions, procedures, and resources aiming to enable the collection and refund of solid waste to the business industry, for reuse - in its cycle or other production cycles - or for another environmentally appropriate disposal being directly associated with the circular production cycle.

According to the Institute of Economic Research (IPEA) in Brazil (2013), the environmental labelling mechanism is based on information made available on packaging labels so that consumers can choose to purchase products with less environmental impact compared to competing products available on the market. Historically the first label or environmental seal was established by the German Environmental Agency, the "Blue Angel" (Blau Engel), in the 1970s attesting to products from recycling and those with low clarity. Since 1993, Brazil has had the Environmental Quality Seal of the Brazilian Association of Technical Standards (ABNT) on behalf of the International Standard Organization - ISO in the country. The ISO (2009) verified by the ABNT standard divided the labelling into three categories described below:

Table 1. *Categories of environmental labeling in Brazil*

CATEGORY	CATEGORY DESCRIPTION
Type I	● Granted and monitored by an independent third party (third party programs), such as government agencies or internationally recognized institutions – are generally better accepted by the consumer due to greater exemption and reliability. The symbology is audited by ISO14024.
Type II	● It specifies the environmental self-declarations requirements, including texts, symbols, and graphics, for products. It also describes selected terms commonly used in environmental statements and provides qualifications for their use. It also describes a general assessment and verification methodology for environmental self-declarations and specific assessment and verification methods for the statements selected in this standard.
Type III	● It is audited by third parties and consider the evaluation of the entire life cycle of the product – life cycle analysis (LCA), also called "cradle to grave" analysis. It does not have standardization to achieve, though, they are the most sophisticated and complex in their implementation, because requires extensive databases to evaluate the product in all its stages, providing the exact dimension of the impacts they cause. Symbology is audited by ISO 14025.

Source*: ABNT (2010, 2015, 2017)*

In sum, the adoption of environmental labelling type II (self-declarations) is mandatory by ISO 14025, so that the best way to handle packaging after use is always clearly indicated. The adoption of type I environmental labelling (green seals) is desirable. Given the conceptualization of the circular economy, the labelling most adherent to this type of production model is type III. Since it is considered the

Environmental Declaration of Product (DAP), synthesizing an environmental profile of the product, with standardized information. This characteristic of information uniformity, which is not yet in fact, would be crucial for the implementation of methodologies for comparison between products within the national territory and abroad (ABIPLAST, 2016).

3. Methodology

Bibliographic research was an initial step of this research (Webster and Watson, 2002). Primarily based on a systematic research *in* the Web of Science (ISI) database, articles published in journals and event annals were selected to support the analyses of this study. The research was carried out using as descriptors "green marketing", "circular economy", "green symbology" and "environmental labelling". The initial search returned 8210 articles in the initial database.

However, in the process of refining the base and when considering publications of Brazilian origin, this amount decreases for 201 and only 73 results identified a direct relationship with the key terms. There was a concentration of papers published in the circular economy and industrial practices (22%), integration of social and environmental responsibility (12%), green consumption and green makeup (11%) having little explored the process, the final product, and the marketing practices in the thematic section explored here.

It is noteworthy that in the period between 2018 and 2019 the number of publications is more evident (an increase of 63% in 2018 and 36% in 2019). The results revealed a strong association between green marketing applications and circular economy regarding management models, however, industrial symbology and labelling are not highlighted as an important factor for conscious consumption and environmental disposal.

With a transversal horizon, the interpretative paradigm is assumed, to reflect on the practices of using the symbology of green seals in products sold in supermarkets and wholesalers, especially cleaning products, personal hygiene, food, and beverages. The analyses of the symbology observed a qualitative approach (visual and content), using the quantitative when necessary, to broaden the understanding of the problem. A study of a large Brazilian wholesale network was visited in mid-2018 and a sample of 60 products from 15 segments and 50 different brands was observed in the field. The analytical comparison of the existing environmental labelling categories and the effective use in the researched packages were performed. Data collection, therefore, involved primary and secondary data. The first consists of the sampling of empirically verified labels and the secondary ones found in the literature and documents referring to environmental certifications of interest to the research.

Meanwhile an inductive approach (Marconi and Lakatos, 2010; Yin, 2015), we considered a range of products selected from stratified sampling to justify the analysis of the results concerning the symbology used as green seals and their effective and correct communication in the packaging. The

methodological framework can be summed up in the following figure, based on Marconi and Lakatos (2010); Creswell (2010), and Yin (2015):

Paradigm	• Interpretativist
Approach	• Quali-quantitative
Logic	• Inductive
Reserach strategy	• Case study, bibliografic and documental reserachs
Goal Nature	• Exploratory e descritive
Temporal horizon	• Transversal
Data collection	• Primary and Secondary

Figure 1. *Methodological framework of the research.*

Source*: Prepared by the authors (2019).*

This study is classified as applied research because it aims to understand a problem in practice (Miguel et al., 2012). According to Yin (2015), a case study points to an experience for replication, contrast, elimination of alternative explanations, and extension of theory and the combination of field analysis with bibliographic and documentary research allows a more comprehensive exploration of the theme and greater theoretical elaboration, through multiple lenses.

4. Results and Discussion

Despite the existing environmental labelling typologies, there is still no certification to ensure that a particular product is aligned with the precepts of the circular economy popularized in Brazil. The Cradle-To-Cradle certification has only three Brazilian brands on its platform. Other symbols (related to the ABNT types) were find and cannot be affirmed that one or the other of the observed standards perfectly meets, a priori, the purpose of communicating to the consumer the correct disposal or reuse. Thus, it was observed whether the packaging contained visual communication that could inform the consumer if there is any kind of concern with the correct destination of that product at the end of its life cycle. The more information there is, the better the consumer will make his decisions at the time of purchase and concerning his attitude towards the environment (Jugend et al., 2017).

From the universe of 60 products, only 5 products, being: beans, steel straw, shampoo, bottle juice, and powdered juice, did not present any type of symbology, both for the packaging and for the label. At the second moment of the analysis, once some symbology was identified, a tabulation of data was made, which presents the product, its brand, the packaging material, which symbols, or phrases focused on environmental awareness, and, finally, its typology. Based on the data generated from the tabulation cited, the following amounts of environmental labelling typologies presented in Table 2 below were perceived.

Table 2. *Environmental labeling identified in the sample.*

Typology	Quantity
Tipo I	**8**
Tipo II	**85**
Tipo III	**Unidentified**

Source*: Prepared by the authors (2018).*

Within the theme of the various pictograms used for a product, labelling is Green Dot, most often used in Europe, and Forest Stewardship Council (FSC). The symbology Type I covers the signs Green Dot and FSC, having appeared in the sample researched.

FSC Brazil (2018), represented by the Forest Stewardship Council in the national territory, is the body to certify the forest certification seal by valuing products originating from responsible forest management. The FSC seal can be considered as a tool to control forest production, which aims to guide the consumer in their purchasing decisions, offering a reliable link between responsible production and consumption of forest products, allowing consumers and companies to make decisions for the benefit of people and the environment. The certification system is not unique in Brazil since there is also reliable forest certification CERFLOR (Brazilian Forest Certification Program). Created in August 2002, CERFLOR follows national criteria and indicators prescribed in the standards elaborated by ABNT and integrated into the Brazilian Compliance Assessment System and the National Institute of Metrology, Quality and Technology (Inmetro).

Green Dot is a symbol of funding for the organization of recovery, classification, and recycling of sales packaging. This pictogram on the packaging means that, for that packaging, a financial contribution has been paid to a qualified national packaging recovery organization. It has the trademark symbol designated by ® of the registered and authorized commercial logo. Currently, responsible organizations in about 29 countries are using Green Dot as a funding symbol to fund the organization of the collection, classification, and recovery of used packaging, particularly domestic ones (Pro Europe, 2018). The use of Green Dot may lead to doubts as to its suitability. This is because only a few countries can use it. The observed brands that make use of this seal are Quilmes and Corona, founded in Argentina and Mexico, respectively, which are countries not signatories of The Green Dot. However, those marks were acquired by ABInBev, a merger in which a Belgian company participates. Therefore, the use of Green Dot is due to this fact, since the marks distributed by the signatories may present the seal in the importing countries even if not participating in the Green Dot.

A curiosity to be recorded is that most of the packaging analysed is made of plastic or contains plastic in its composition. The number of Type II environmental labelling is predominant, with 85 items checked. Among the 85 examples of Type II labelling, 66 are plastic or plastic packaging and other material (e.g., aluminium).

For Type I there are eight appearances and for Type III none. This is since Type II labelling is created by self-declaration, that is, the manufacturer does not need to comply with any standard or present any environmental statement of its product or packaging. Therefore, there is greater ease in implementing purely informative symbology, as seen on Figure 2.

LABE TYPE	IMAGE	LABE TYPE	IMAGE
Use of Green Dot		**Type II environmental label closest to Type III**	
Type II labeling		**Type II labeling with separate symbols**	
Type II labeling with interrelated symbols		**Type II labeling with symbols separated by material**	

Figure 2*. Use of Labels and classification by type*

Source*: Photo captured by the authors (2018)*

What was observed in the self-statement is the wide variety of symbols and messages employed. At times, symbols accompanied by phrases are very useful to explain and encourage consumers to adopt practices of care for the environment.

In this case, it is noted that in addition to the stimulus to the referral of the packaging to recycling, there is the identification of the place by colour and type of plastic. However, it is liable to doubt, since the dumpsters of the selective collection are segregated only by colour and not by the number that indicates the type of plastic. At times, the symbology is unclear, being even contradictory. For example, when they indicate that the packaging is recyclable in writing or by symbology, but at the same time on the

label, there is the *Pictogram Anti Littering*, which encourages the garbage to be thrown in the trash but is for ordinary garbage (not recyclable).

A similar situation occurs when the manufacturer wants to inform you that the PET bottle is recyclable, but its label is not. But without specifying the condition of each of the plastics, it can also generate doubt.

A better way of informing the consumer would be to specify the potential for recycling or reuse of each item of the package, as was perceived in the Colgate product, with separate symbols and discrimination of the plastic-type and packaging element for recycling.

For typology III, which would be more aligned with the precepts of the circular economy, there was no example of use in the sample – which allows us to infer that the typology is little used by manufacturers. From searches in other sources, it was found that this situation extends in the labelling of the whole of Brazil due to the complexity of obtaining this type of seal (Cempre, 2018). However, attempts were perceived in the field to approach a typology III.

As seen, concerning the products surveyed, most had type II labelling, which is natural, and at times the self-declaration was beneficial to the consumer due to the rich amount of information presented. However, at times this type of symbology was not adequate, as it gave room for multiple interpretations as could be noted by the appraisers' perceptions.

5. Final Considerations

The study found that companies in Brazil do not yet use a standard symbology in environmental labelling. It is inferring that this is partly due to the lack of a specific certification on labelling aimed at the circular economy and, in part, by the lack of knowledge about signs and typologies. Despite this, ISO and ABNT work to create naming standards and images to be used in packaging to communicate various information to the consumer, such as whether the packaging is recyclable or recycled.

Scarce and confusing information, disarmed, suggesting a negative effect regarding disposal. There would be no problem in maintaining the use of type II labelling, self-declaration if it were clear and objective as to its characteristics and how it should be forwarded at the end of its life cycle in line with the SDGs.

As a recommendation for future research, it is suggested the deepening of the relationship between circular economy and environmental labelling, with emphasis on productive and managerial processes, final product, and marketing practices.

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To what extend does a sporting good impact on the environment and how to communicate?

A case study of a cycling product

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Abstract

In recent years, different studies have explored the environmental impacts of sport from different point of views, for instance about sporting events, recreational activities and sport facilities. However, a further area of concern exists associated with sporting in general, and it is represented by sporting goods which is still explored in a limited number of studies. In this context, the aim of this study is to quantify to what extent sporting goods impact on the environment and define how to communicate their environmental burdens to stakeholders. The final intent is to support companies in the integration of environmental impact information into their communication reporting. In order to reach our aim, a sporting good of a seldom investigated sport has been selected as case study, namely a cycling pad. The selected cycling pad weights 40 g and it is composed of a base and a cover both produced with textile and polyurethane foam. The methodology chosen to conduct this study is a combination of life cycle assessment (LCA) methodology according to ISO 14040 and ISO 14044 to quantify the impacts of the product and of ISO 14021 to identify the communication requirements. The steps of the combined methodology were: identification of the scope definition, development of the life cycle inventory, assessment of the environmental impacts and development of a self-declared environmental claim. The system boundaries for the LCA study include the process units according to a "from cradle to gate" application and the functional unit chosen for this study is: "One pad for technical cycling shorts, including primary packaging". The primary data are collected for energy and resources' consumption, waste and emissions generated during the production of the pad under study. The results show that the most significant impacts are associated with the utilization of polyurethane foam and energy consumption for the coupling and thermoforming phases. In addition, our study highlights the impact associated with distribution separately, revealing to what extent the impacts increase for all the categories, in particular for the climate change and ozone depletion. The outcome of the study was the development of a self-declared environmental claim in accordance with the requirements of ISO 14040, ISO 14044 and ISO 14021 standards. The novelty of this study is that this is the first combined analysis

of LCA and self-declared environmental claims about the environmental impacts of sporting goods and can be a common practice to integrate environmental communication in companies' reporting. This abstract relates to SDG12+Target:12.6. This contribution relates to the topic of the conference because it proposes a combined methodology to encourage companies to communicate environmental impacts and see the environment as a competitive lever.

Keywords: sporting goods, cycling pad, life cycle assessment, environmental communication, sport sustainability.

1. Introduction

The European trade in sporting goods with the rest of the world reached the value of 21.3 billion Euros in 2017 showing a significant increase by 4.5 billion Euros in comparison with 2007 (Eurostat, 2020). Italy showed the largest trade surplus in Europe with export values almost twice as high as imports, associated with the export of boats and water sport equipment. Other European States recording a high export to imports ratio are Bulgaria and Hungary, due to bicycles' exports, and Romania, due to ski equipment and sport footwear. The largest European exporters of sporting goods are Germany, the Netherlands, Italy and Belgium (Eurostat, 2020). In terms of extra European imports, the main sporting goods imported are sport footwear, boats and water sports equipment, gymnastic, athletic and swimming equipment and bicycles, representing the 85% of total extra European imports (Eurostat, 2020; Eurostat 2018). Through the database developed by Andreff and Andreff (2009), it is revealed that sporting goods trade represents a range between 0.33% and 0.53% of all traded goods and that Europe is competitive in skis trade, Germany in boats, skis and table tennis trade, while Italy is competitive in sportswear, surfs, skates and gymnastic equipment trade. Based on their database, Andreff and Andreff (2009) argued that developed countries can gain advantages in sports goods trade increasing specialization in sport equipment and innovative products with improved quality. According to Subic et al. (2012) the sporting goods industry is characterized by mass volume production and distributed manufacturing across different geographical regions, with high levels of resources consumption, waste and environmental emissions. Subic et al. (2012) developed a sustainable manufacturing framework and capability assessment tool for companies producing sports apparels and footwear and identified three areas for sport sustainability, namely resource efficiency, emissions' reduction and management practices.

As stated by Casper and Pfhal (2015) sport creates environmental impacts like everything else in life, associated with general operations, events' hosting, sporting facilities and spectators' attendance (Casper and Pfhal, 2015). Several authors analyzed the implications of sporting on tourism, recreation and natural environment (Babi et al., 2019; Bazzanella 2019; Botella-Carrubi et al. 2019; Malchrowicz-Mośko et al., 2019) and of sport facilities (Chappelet 2008; Bunds et al., 2019; Meza Talavera et al., 2019; Triantafyllidis and Davakos 2019). Other authors analyzed the implications of sporting

management in different fields, for instance McCullough et al. (2016) explored examples from different sport organizations to classify their efforts in terms of environmental sustainability proposing actions to manage environmental issues, Moser et al. (2019) explored the influence of sustainability strategies of sport clubs to motivate spectators and supporters and Orr and Inoue (2019) highlighted that sport industry, especially outdoor and winter sports, can affect climate change. In this context, Trail and McCullough (2019) highlighted that the sport industry is improving its commitment to the natural environment but sport organizations implement campaigns for sustainability in differ way not standardized. Thus, they proposed a method to evaluate sustainability initiatives within the sport industry and the response of sport participants.

If we focus on the application of methods to calculate environmental impacts related to sport, it is apparent that several authors have explored this issue, with reference to events organization, such as Dolf and Teehan (2015), Edwards et al. (2016), Triantafyllidis et al. (2018) Tòffano Pereira et al., (2019) and Wicker (2019) and sport facilities, such as Hedayati et al. (2014) and Ip et al. (2018). Karaaslan et al. (2018) performed a comparative life cycle assessment of sport utility vehicles with different fuel options and Uberti et al. (2018) applied an approach which combined eco-innovation, technical factors and life cycle assessment for designing a low environmental impact off-road motorcycle. However, if we shift the attention to technical clothing, we can find a limited number of applications. Gül et al. (2015) developed a procedure for non-leather shoes in the context of the Product Environmental Footprint using sport shoes as an example and showing that the hotspots on climate change are consumption of electricity, polyurethane and nylon and Moazzem et al. (2016) calculated the carbon footprint of a polyester sports shirt. An analysis of a sporting good was conducted by Ribeiro et al. (2019) who performed a technical, economic and environmental evaluation of a snowboard made of three alternative materials, namely carbon, glass and flax fiber reinforced plastics. They showed that life cycle evaluations can support the design and development of sporting products.

Subic et al. (2009) highlighted the need for sporting goods industry to embrace sustainable design based on the fact that sporting products have a shorter life cycle than years ago and disposal rates and waste have increased. They argued that the request of performance materials in sports equipment and apparel have increased the burdens on the environment, as also highlighted by Scherer et al. (2018).

In this context, the aim of this study is to quantify to what extent sporting goods impact on the environment and define how to communicate their environmental burdens to stakeholders. The final intent is to support companies in the integration of environmental impact information into their communication reporting.

In order to reach our aim, a sporting good of a seldom investigated sport has been selected as case study, namely a cycling pad. The cycling pad is the most important component of a cycling short as it supplies protection at a perineal and ischiatic level. Several studies about its protective functions have been

conducted (Marcolin et al., 2010). The novelty of this study is that this is the first combined analysis of LCA and self-declared environmental claims about the environmental impacts of sporting goods and can be a common practice to integrate environmental communication in companies' reporting.

2. Methods

The methodology chosen to conduct our study is a combination of the life cycle assessment (LCA) methodology according to ISO 14040 (ISO, 2020a) and ISO 14044 (ISO, 2020b) and of the requirements of ISO 14021 (ISO, 2016) for self-declared environmental labels. The steps were: identification of the scope definition, development of the life cycle inventory, assessment of the environmental impacts and the elaboration of environmental claims. Figure 1 is a scheme representing the main steps for the combination of LCA with the development of self-declared environmental claims. The cycling pad selected for our study weights 40 g and it is composed of a base and a cover both in coupled material (Table 1), it is a for long distance cycling, on road.

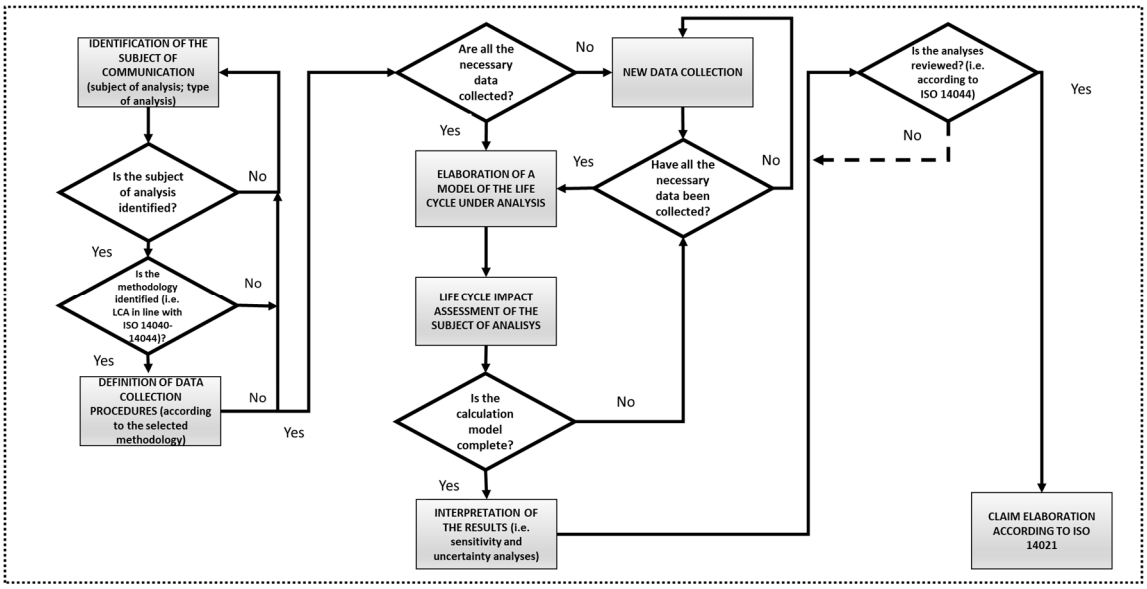

***Figure 1**. Scheme representing the main steps for the combination of LCA with the development of self-declared environmental claims*

***Table 1.** Composition of the pad under study*

Component	Material	Type of material
Base	Textile and foam	Textile: Polyamide 80% and Elastane 20% Polyurethane foam
Cover	Textile	Polyamide 100%

The production process consists of the following phases: shearing of the base and cover, skiving of the base, thermoforming, cooling and packaging. The shearing phase has the aim of giving shape to the base and the cover; the skiving phase eliminates excess foam from the base and avoid the formation of uncomfortable compressions; the thermoforming process consists in the union of the cover and the base through a special mold. The system boundaries for this study include the process units according to a "from cradle to gate" application as reported in Figure 2.

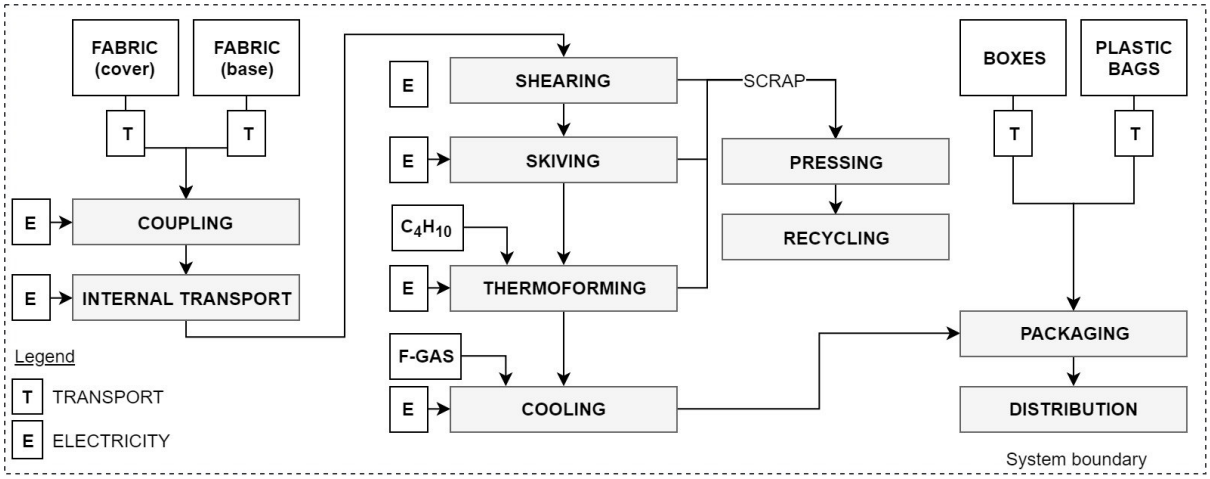

***Figure 2**. System boundaries.*

The functional unit was defined by the function of the examined product, i.e. providing support on a saddle. Consequently, the functional unit chosen for this study is: "One pad for technical cycling shorts, including primary packaging". The pads have different weights and different thicknesses in general. However, despite the differences they maintain the same function. For this reason, a defined weight or thickness is not indicated within the definition of the functional unit. A pad is not a product intended to be sold to the consumer directly, but to companies that sew one pad in each short. Even if it is therefore a component of a finished product, a pad has a specific function. However, for "from cradle to gate" LCA studies a declared unit is defined rather than a functional unit usually, because at the gate of the manufacturing company it is generally not possible to know what will happen next. From this perspective, it was decided to refer also to a declared unit defined as: "1 kg of pads for technical cycling shorts, including primary packaging". Therefore, the results relating to 1 kg of pads were also calculated.

The primary data were collected at the company producing the pad in 2019. Table 2 shows the primary information collected and the data sources. In the event that primary data were not available, secondary data obtained through the consultation of scientific literature and internationally recognized databases were used (Table 3).

As regards the textiles used for the base and the cover, it was necessary to conduct a study of the scientific literature to understand the main processes of polyamide production and the related energy consumption. This information was obtained from the study of van der Velden et al. (2014), as reported in Table 4. As regards the coloring of textiles, it was assumed that that the color constitutes 2% of the textile composition. In this study, the allocation intended as "co-product allocation" was avoided as follows: the consumption of raw materials regards only the product under study, the energy consumptions of the different process steps were measured and then compared to invoices, regarding the consumption of packaging materials the final sales unit contains only the products under study. It was necessary to proceed with the allocation intended as "co-product allocation" in the following cases: the consumption for lighting and heating was allocated by comparing the total plant consumption with the total quantity of pads produced in 2019; the consumption of the forklift for the products under study was allocated by comparing the total hours of work with the total quantity of pads produced.

The methodology chosen to evaluate the potential environmental impacts is the ReCiPe Midpoint (H) method, described by Goedkoop et al. (2013). The results are calculated with reference to the functional unit (one pad) and the declared unit (1kg) and the main contributors are identified. The distribution phase, even if outside the defined system boundaries, is analyzed through a sensitivity analysis to investigate to what extent it can affect the obtained results.

Table 2. *Primary data and primary sources used for this study.*

Process units	Primary data	Primary sources
Transport of input materials	Distance travelled, type of fuels	Purchase invoices and interviews to suppliers
Materials used for base production	Quantity and type	Operating control documents
Materials used for cover production	Quantity and type	Operating control documents
Packages	Quantity and type	Operating control documents
Manufacturing	Input flows, output flows, waste produced, energy consumption	Operating control documents and invoices Energy supplier documents
Internal transport with electric forklift	Worked hours	Operating control documents
Distribution	Distance travelled, type of fuel	Sales invoices and interviews to clients

Table 3. *Secondary data and secondary sources used for this study.*

Process units	Secondary data	Secondary sources
Transport of input materials	Vehicle combustion processes: emissions, maintenance, use of the road network, fuel consumption	Transport freight lorry 7.5-16 metric ton EURO3 RER transport freight lorry 7.5-16 metric ton EURO3 (Ecoinvent 3.2)
Materials used for base production	Textile production process and foam production processes	Nylon 6 {RER}| production Nylon 6-6 {RER}| production Polyurethane, flexible foam {RER}| production (Ecoinvent 3.2)
Materials used for cover production	Textile production process	Nylon 6 {RER}| production Nylon 6-6 {RER}| production
Packages	Packaging production	Corrugated board box {RER}| production Polyethylene, low density, granulate {RER}| production (Ecoinvent 3.2)
Manufacturing	Energy production process	Electricity, low voltage {IT}| electricity voltage transformation from medium to low voltage (Ecoinvent 3.2)
Internal transport with electric forklift	Energy production process	Electricity, low voltage {IT}| electricity voltage transformation from medium to low voltage (Ecoinvent 3.2)
Distribution	vehicle combustion processes: emissions, maintenance, use of the road network, fuel consumption	Transport, freight, aircraft {RER}| intracontinental (Ecoinvent 3.2)

Table 4. *Secondary data for textile manufacturing processes.*

Process units	Primary data	Primary sources
Materials used for the production of the base	Spinning and weaving processes: 0.5 + 2.56 kWh / kg Textile colouring: 3.75 kWh / kg Extrusion for elastane: 1.7 kWh / kg Quantity and type	van der Velden et al. (2014) Operating control documents
Materials used for the production of the cover		

The environmental claims were developed according the requirements of ISO 14040, ISO 14044 and ISO 14021. The objective identified for the environmental claims are: i) provide accurate and verified environmental information that does not lead to misinterpretations; ii) improve the image on the market, iii) stimulating environmental improvements. The following requirements were considered according to ISO (2016):

- The claims must be clear and specific,

- The claims will not contain information relating to sustainability in general terms,

- The life cycle of the products will be considered (according to the LCA study),

- No comparative assertions will be made.

3. Results and Discussion

Table 5 shows the results of the impact assessment for one pad, identifying the contribution of the process units on the total overall environmental impact for each category.

The groups identified in Table 5 are:

• Textiles. The impacts associated with the use of polyamide and elastane are grouped here.

• Foam. The impacts associated with the use of polyurethane foam are included in this group.

• Transportation. The impacts associated with the transport of raw materials and auxiliary materials (boxes and bags for packaging) and internal transport by electric forklifts are grouped.

• Manufacturing: The impacts associated with the energy consumption of the coupling phase, but also of the previous weaving, colouring and finishing phases of the textiles are grouped. This analysis group covers also the impacts due to the shearing, skiving, thermoforming, cooling, packaging and the waste produced during the manufacturing process, the consumptions for lighting and heating.

The results for each impact category are illustrated below, highlighting the main responsible processes.

For the Climate change (CC) impact category, a value of 9.47E-01 kg CO2 eq is obtained due to the emissions of cabon dioxide equal to 7.74E-01 kg CO2 eq and methane equal to 1.30E-01 kg CO2 eq mainly due to the production processes of polyol and toluene diisocyanate for the production of the polyurethane foams with which the fabrics are coupled. These processes contribute more than 50% of the impact. The textile production processes, i.e. polyamide production, contribute to 12% of the total impact; while electricity consumption contributes to 17% of the impact.

Table 5. *Environmental impacts of the product analysed (1 pad).*

Impact category	Unit	Total	Textiles	Foam	Transport	Manufacturing
Climate change	kg CO2 eq	9.47E-01	1.86E-01	5.36E-01	6.35E-03	2.18E-01
Ozone depletion	kg CFC-11 eq	4.34E-08	3.76E-09	1.37E-08	3.82E-09	2.21E-08
Terrestrial acidification	kg SO2 eq	3.57E-03	6.05E-04	2.10E-03	5.84E-05	8.15E-04
Freshwater eutrophication	kg P eq	1.36E-04	1.42E-05	6.64E-05	1.06E-06	5.47E-05
Marine eutrophication	kg N eq	6.88E-04	9.21E-05	5.58E-04	1.50E-06	3.63E-05
Human toxicity	kg 1,4-DB eq	1.11E-01	9.60E-03	5.30E-02	2.47E-03	4.56E-02
Photochemical oxidant formation	kg NMVOC	2.78E-03	5.33E-04	1.72E-03	4.07E-05	4.93E-04
Particulate matter formation	kg PM10 eq	1.55E-03	2.13E-04	1.03E-03	2.13E-05	2.87E-04
Terrestrial ecotoxicity	kg 1,4-DB eq	4.37E-05	2.94E-06	2.49E-05	2.75E-06	1.31E-05
Freshwater ecotoxicity	kg 1,4-DB eq	8.76E-03	8.05E-04	2.42E-03	7.84E-05	5.45E-03
Marine ecotoxicity	kg 1,4-DB eq	7.92E-03	7.18E-04	2.32E-03	8.87E-05	4.79E-03
Ionising radiation	kBq U235 eq	3.43E-02	4.37E-03	5.09E-03	4.86E-04	2.44E-02
Agricultural land occupation	m2a	5.09E-02	5.72E-03	3.18E-03	1.06E-04	4.19E-02
Urban land occupation	m2a	3.11E-03	2.82E-04	8.60E-04	3.36E-04	1.63E-03
Natural land transformation	m2	4.55E-05	4.81E-06	7.67E-06	2.30E-06	3.07E-05
Water depletion	m3	2.40E-02	2.74E-03	1.34E-02	2.97E-05	7.89E-03
Metal depletion	kg Fe eq	1.44E-02	1.07E-03	6.97E-03	6.76E-04	5.69E-03
Fossil depletion	kg oil eq	3.33E-01	5.44E-02	2.10E-01	2.20E-03	6.58E-02

For the impact category ozone depletion (OD), a value of 4.34E-08 kg CFC-11 eq is obtained mainly due to the emissions of Halon 1211 (38%), chlorinated hydrocarbons (20%) and Halon 1301 (20%) into the air. Halon 1211 emissions are mainly associated with the coupling and thermoforming phase and the related energy consumption. The emissions of chlorinated hydrocarbons and Halon 1301 are mainly caused by the foam production processes.

For the terrestrial acidification (TA) impact category, a value of 3.57E-03 kg SO2 eq is obtained mainly due to the emissions of sulfur dioxide and nitrogen oxides in the air associated with the processing of the expanded polyurethane of which the foam is composed.

For the freshwater eutrophication (FE) impact category, a value of 1.36E-04 kg P eq is obtained due to the phosphate emissions in water associated with the polyurethane foam and the coupling process because of the energy consumption.

For the marine eutrophication impact (ME) category, a value of 6.88E-04 kg N eq is obtained due to the emissions of nitrates (38%) and nitrogen (37%) in water associated with the production of the expanded polyurethane of which the foam is made (75%) and the production of textiles (10%).

For the human toxicity impact (HT) category, a value equal to 1.11E-01 kg 1.4-DB eq is obtained due to the emissions of manganese (49%) and mercury (10%) in water. Manganese emissions are mainly associated with the foam production process (33%) and the coupling phase (40%); while mercury emissions are associated almost entirely with the foam manufacturing process (88%).

For the photochemical oxidant formation (POF) impact category, a value of 2.78E-03 kg NMVOC is obtained due to the nitrogen oxides (64%) emitted into the air associated with the polyurethane of which the foam is made and the polyamide of the base.

For the impact category particulate matter formation (PMF), a value of 1.55E-03 kg PM10 eq is obtained due mainly to the emissions of sulfur oxides (32%) and nitrogen oxides (25%) in air associated with the use of foam.

For the terrestrial ecotoxicity impact category (TET), a value of 4.37E-05 kg 1.4-DB eq is obtained due to the release of chlorine (37%) and copper (15%) into the air. Chlorine releases are mainly associated (96.5%) with the use of polyurethane foam; while copper releases are also associated with transport, in particular the wear of vehicles.

For the freshwater ecotoxicity impact category (FET), a value of 8.76E-03 kg 1.4-DB eq is obtained due to the emissions of copper (71%) and nickel (10%) in water. Copper emissions are mainly due to coupling (45%); while nickel emissions are mainly due to foam (36%) and coupling (38%).

For the marine ecotoxicity impact category (MET), a value of 7.92E-03 kg 1.4-DB eq is obtained mainly due to the emissions of copper (68%) and nickel (11%) in water. Copper emissions are mainly associated with coupling (45%); the nickel emissions to the foam (36%) and to the coupling (38%).

For the ionising radiation (IR) impact category, a value of 3.43E-02 kg Bq U235 eq is obtained due mainly to the emissions of Radon-222 (60%) in the air associated with the coupling processes.

For the agricultural land occupation (ALO), urban land occupation (ULO) impact categories and natural land occupation, the impacts obtained are mainly due to the coupling phase.

For the water depletion impact category (WD), a value of 2.40E-02 m3 is obtained due to the use of polyol for polyurethane foam and the coupling of fabrics with foam.

For the metal depletion (MD) impact category, a value of 1.44E-02 kg Fe eq is obtained due to the consumption of nickel and chromium in the life cycle of textiles and foam.

For the fossil depletion (FD) impact category, a value of 3.33E-01 kg oil eq is obtained due mainly to the consumption of natural gas (49%) for the production of polyurethane foam.

Analyzing the contributions associated with the product under study as reported, it is clear that the most important factors that emerged from the evaluation are the use of polyurethane foam, of textiles and the coupling phase. It should be noted that the coupling phase also groups the spinning, finishing and coloring processes.

Table 6 shows the impact values calculated for 1 kg of bottoms. The main contributors to the impact are those reported for the analysis of 1 pad.

The results of the sensitivity analysis including the distribution of the pad to the clients are showed in Figure 2. It emerges that the impacts increase for all categories, in particular for climate change and ozone depletion.

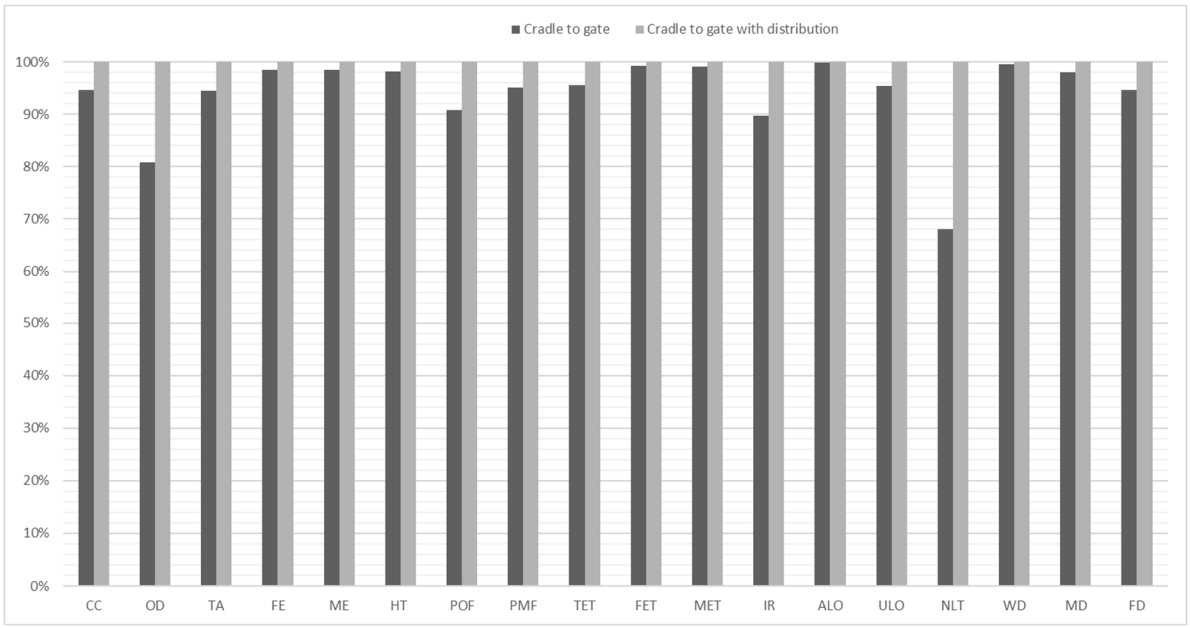

***Figure 2**. Comparison of the impacts calculated applying the system boundaries "from cradle to gate" and the impact calculated adding the distribution phase.*

Table 6. *Environmental impacts of the product analysed (1 kg).*

Impact category	Unit	Total	Textiles	Foam	Transport	Manufacturing
Climate change	kg CO2 eq	2.37E+01	4.64E+00	1.34E+01	1.59E-01	5.46E+00
Ozone depletion	kg CFC-11 eq	1.08E-06	9.41E-08	3.42E-07	9.55E-08	5.52E-07
Terrestrial acidification	kg SO2 eq	8.94E-02	1.51E-02	5.24E-02	1.46E-03	2.04E-02
Freshwater eutrophication	kg P eq	3.41E-03	3.55E-04	1.66E-03	2.64E-05	1.37E-03
Marine eutrophication	kg N eq	1.72E-02	2.30E-03	1.40E-02	3.75E-05	9.08E-04
Human toxicity	kg 1,4-DB eq	2.77E+00	2.40E-01	1.33E+00	6.17E-02	1.14E+00
Photochemical oxidant formation	kg NMVOC	6.96E-02	1.33E-02	4.29E-02	1.02E-03	1.23E-02
Particulate matter formation	kg PM10 eq	3.88E-02	5.33E-03	2.58E-02	5.32E-04	7.17E-03
Terrestrial ecotoxicity	kg 1,4-DB eq	1.09E-03	7.36E-05	6.23E-04	6.88E-05	3.28E-04
Freshwater ecotoxicity	kg 1,4-DB eq	2.19E-01	2.01E-02	6.06E-02	1.96E-03	1.36E-01
Marine ecotoxicity	kg 1,4-DB eq	1.98E-01	1.79E-02	5.81E-02	2.22E-03	1.20E-01
Ionising radiation	kBq U235 eq	8.59E-01	1.09E-01	1.27E-01	1.22E-02	6.10E-01
Agricultural land occupation	m2a	1.27E+00	1.43E-01	7.95E-02	2.66E-03	1.05E+00
Urban land occupation	m2a	7.78E-02	7.04E-03	2.15E-02	8.39E-03	4.09E-02
Natural land transformation	m2	1.14E-03	1.20E-04	1.92E-04	5.74E-05	7.68E-04
Water depletion	m3	6.01E-01	6.85E-02	3.35E-01	7.44E-04	1.97E-01
Metal depletion	kg Fe eq	3.60E-01	2.67E-02	1.74E-01	1.69E-02	1.42E-01
Fossil depletion	kg oil eq	8.32E+00	1.36E+00	5.26E+00	5.50E-02	1.65E+00

The environmental claims based on the results obtained through the LCA study, in line with the requirements of ISO 14040, ISO 14044 and ISO 14021 are reported in Table 7.

Table 7. *Final environmental claims.*

First claims	The environmental impacts along the "from cradle to gate" life cycle were accounted through a Life Cycle Assessment (LCA) study compliant with International Standards
Second claim	Through a Life Cycle Assessment (LCA) study compliant with ISO International Standards 14040 and ISO 14044 it was possible to quantify the impact of the pad under study on climate change equal to 947 g CO2eq. The quantification is based on system boundaries "From cradle to gate" and on data for the year 2019.

4. Conclusions

Our study investigates to what extent a component used for technical clothing impacts on the environment and explores the main contributors. The study was conducted analysing the consumption of resources, waste and materials for the different phases of the product life cycle from cradle to gate, such as the extraction and use of raw materials, the production process of the product, the waste produced. For the data collection, the period January-December 2019 was covered and specific data were collected for the product system analysed. In particular, the main data from primary sources concern the quantity of raw and auxiliary materials used, the energy consumption, the transport, the waste produced, the fate of these waste, internal transport and the energy mix of the plant. What the results tell us is the environmental impact of one pad or of 1 kg of pads with "a cradle to gate" perspective. The results also show that the most significant contributors are associated with foam and energy consumption for the coupling and thermoforming phases. In addition, our study highlights the impact associated with distribution separately, it is apparent that the impacts are increased for all categories, in particular for the climate change and ozone depletion categories.

Our results contribute advancing the discussion about the application of environmental impacts' quantification methodologies in the sporting sector and the progressive achievement of valuable sustainability assessment of sporting goods. Our study is a starting point for the development of studies of cycling technical apparel adding information to the environmental analyses of bicycles' production or surveys about cyclists' attitudes towards sustainability. Our study also led a development of a self-declared environmental claim in accordance with the requirements of ISO 14040, ISO 14044 and ISO 14021 standards showing a methodology to include the environmental profile of a product in companies' reporting.

The main limitations of this study were related to the fact that the system boundaries are "from cradle to gate", thus the impacts due to further processing of the pad, its utilization and disposal are not included. To face this limitation, a further phase namely the distribution was analysed in a sensitivity analysis. Another limitation regards the production of the foam, which was revealed to be one of the most significant contributors and for which it was necessary to use secondary data in place of primary information. A further development of this study will be to explore how to include quantified economic and social profiles of different products in companies' reporting.

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Covid-19 Pandemic and Sustainable Consumers Behaviours: Consumer's Perspectives During the Lockdown

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Abstract

Covid-19 is a public emergency but also an experiment in downsizing our consumer economy. Since researchers have called for more studies about sustainable consumer behaviour and because it seems that Covid-19 spread begins a sustainable consumption transition, the current research aims to understand the impacts of Covid-19, and the subsequent first lockdown in a Western country, on consumers behaviours in terms of sustainability and social responsibility. The importance of a shift toward more sustainable consumption and production patterns is also underlined by Goal 12 of the 2030 Agenda. The current research uses a qualitative methodology grounded on 133 in-depth interviews with customers. The major contribution lies in identifying five themes (Social factors, Knowledge, Habits, Values and Price) describing the main consumer behaviour dimension influenced by Covid-19 and lockdown in terms of sustainability and social responsibility. This paper invites us to reflect upon the unusual moment we are living in and is an attempt to learn something from the emergency and turn past mistakes into positive knowledge to build a more sustainable future.

Keywords: Sustainable consumer behaviour, Sustainability, Social responsibility, Sustainable consumption, COVID-19

1. Introduction

The Covid-19 infection originated in Wuhan, Hubei province, China, in December 2019 (Severo et al., 2020); it spread rapidly across the world and on the 11th of March 2020, it has been characterised as a pandemic by the World Health Organization. Since then, many countries have adopted a lockdown strategy and introduced measures to guarantee social distancing, movement and travel restrictions to contain the virus diffusion (Yunus et al., 2020). Italy has been the first Western country to face this threat and implement lockdown measures, and they are also considered one of the most restrictive

(Cavallo et al., 2020). The first total shutdown in Italy started on the 8th of March 2020 and lasted until the 3rd of May 2020.

The Covid-19 Pandemic is considered as both a health and economic crisis (Lee, 2020); its impacts on the global economy are unprecedented since the 1930s Great Depression (HE and Harris, 2020) and are worse and long-lasting than that of the 2007-2009 crisis (Filho et al., 2020; García-Sánchez and García-Sánchez, 2020). The Covid-19 has certainly had negative impacts on the economy and health but has also brought some environmental improvements due to the quarantine measures (Dutheil et al., 2020; Muhammad et al., 2020; WHO Report, 2020), showing the real impacts of human activities. It was identified an association between better air quality, reduction of environmental noise, clean beaches and improvement in surface water quality (Zambrano-Monserrate et al., 2020). It was registered a decrease in CO2 emissions (IEA, 2020), a lower concentration of particulate matter (Dantas et al., 2020; Yunus et al., 2020) and a decline in global energy demand (IEA, 2020). Covid-19 diffusion shown that the planet has a limited capacity to satisfy our unlimited needs and desires (ONU, 2020). Moreover, Fattorini and Regoli (2020) showed the correlation between air pollution and Covid-19 spread. At the same time, the emergency can be a threat to sustainable development, and it is likely to slow down implementation of the UN Sustainable Development Goals (SDGs), considering that there was a delay even before the outbreak (Barbier and Burgess 2020).

Due to the pandemic, profound and pervasive social changes will likely occur over the next few years (Sarkis et al., 2020). Cohen (2020) stated that Covid-19 is a public emergency but also an experiment in downsizing our consumer economy. Policymakers and sustainability scientists have tried to achieve similar objectives during last years regarding sustainable consumption evolution (e.i. O'Rourke et al., 2020; Welch and Southerton, 2018). Consumers have modified their behaviours in response to the pandemic and government restrictions; they have reorganised their purchases, habits and experimented with innovative practices (Degli Esposti et al., 2021). As declared by Cohen (2020), Covid-19 begins a sustainable consumption transition. The virus seems to have forced people to rethink their connection with nature and act in a more responsible way, enhancing their sustainable awareness. A greater number of individuals has developed more attention regarding the impacts of their consumption behaviours (Degli Esposti et al., 2021). For example, Jribi et al. (2020) demonstrated that the virus spread has impacted in a positive way awareness and behaviours regarding the food waste in Tunisia. Social scientists observed that disasters catalyse processes of social change (Cohen, 2020). At the same time, there is the risk that when the emergency is over, we will be pushed back to "normal" (Cohen, 2020). These improvements can only be temporary if society does not learn how to manage in the long term the new knowledge acquired (Muhammad et al., 2020). In addition, the current generations are responsible for the future actions that will impact the environment, quality of life and economy (Severo et al., 2021).

While studies about sustainable production continue to expand in recent years, less attention was given to the notion of sustainable consumption (Cohen, 2019). Researchers have called for more studies to

identify predictors of sustainable consumer behaviour (White and Simpson, 2013). In addition, the 2030 Agenda underline in Goal 12 the need to shift toward more responsible consumption and production patterns and that Covid-19 represents an opportunity to reverse trends toward a more sustainable future. As consumers, we can help in two ways, reducing our waste and being aware of our role in promoting sustainability (ONU, 2020). In general, the SDGs more than ever represent a means to restore quality of life and face social, economic, and environmental issues (Leal Filho et al., 2020).

Sustainable consumer behaviour was defined by Epstein (2008) as a behaviour based on awareness of the long-term effects on the natural and social environment. Hosta and Zabkar (2019) incorporated the concept of social responsibility in sustainable behaviour definition identified a responsible sustainable consumer as "someone who carefully weights what s/he truly needs and considers also how this will affect others (nature, society)". Finally, Lee et al. (2015) defined sustainable consumer behaviour as "a consumer's wise balance of financial responsibility, environmental stewardship, social equity and sustenance of personal health".

Due to what authors have identified regarding opportunities triggered by Covid-19 in changing sustainable consumer practices; and the research gap enlightened about sustainable consumption studies, the current research aims to understand the impacts of Covid-19 spread, and the subsequent first lockdown in a Western country (Italy), on consumers behaviours in terms of sustainability and social responsibility. In particular, the research question is:

RQ1. Have Covid-19 and authorities' restrictions affected consumer sustainable and socially responsible behaviour, and how?

The following article contributes to the existing literature about sustainable consumer behaviour by investigating the effects of the Pandemic caused by Covid-19 and the first travel and movement restrictions imposed in a Western country on consumer behaviour. Specifically, the major contribution lies in identifying five themes (Social factors, Knowledge, Habits, Values and Price) describing the main consumer behaviour dimension influenced by Covid-19 and lockdown in terms of sustainability and social responsibility. This paper invites us to reflect upon the unusual moment we are living in and is an attempt to learn something from the emergency and turn the past mistakes into positive knowledge to build a more sustainable future.

The paper is organized as follows: first, the methodology is explained in terms of data collection and data analysis; second, authors present findings and discussion regarding the impact of Covid-19 and restrictions on consumer sustainable and socially responsible behaviour; finally, conclusions with implications, limitations and future research are outlined.

2. Methods

a. Research design

The research uses a qualitative methodology to understand the impacts of Covid-19 spread, and the subsequent first lockdown in a Western country, on consumers behaviours in terms of sustainability and social responsibility. Qualitative methodology is considered appropriate to study how individuals and communities interpret a specific issue (Boulay et al., 2014; McCusker and Gunaydin, 2015). An empirical investigation was carried out through in-depth interviews with 133 university students of Corporate Social Responsibility and Sustainability (CSRS) course. A purposive sampling strategy was used to select the participants (Bernard, 2002; Tari Kasnakoglu, 2016); this approach is typically used in qualitative research (Etikan et al., 2016). The data collection took place at the end of the CSRS course; thus, students were customers and acquired the knowledge and skills necessary to analyse the phenomenon critically.

Interviews were conducted in May 2020 during the first Italian lockdown and online due to the government travel restrictions; the average length was 40 minutes. They were audio-recorded and then transcribed; transcriptions were entered into data analysis software MAXQDA Analytics Pro 2020 to be coded. An interview guide was developed based on the literature analysis. Then questions were divided into two sections: pre-emergency and the emergency phase to better analyse the impacts of pandemic and restrictions on consumers' sustainable behaviours.

b. Data Analysis

Once all the interviews were completed and transcribed, the data were analysed using thematic analysis. This approach is commonly applied in qualitative research (Braun and Clarke, 2006), and it helps researchers identify key features in a data set through a structured process (King, 2004). In the current article, authors followed the six phases identified by Braun and Clarke (2006) to conduct the analysis: 1) Familiarising Yourself With Your Data: the first step aims to familiarise with all the data collected. Authors transcribed the interviews; then each file was named, dated and stored; 2) Generating Initial Codes: during the second phase, authors produced codes to simplify the data collected. Multiple investigators were involved in the coding procedure to guarantee the research's credibility and rigour (Côté and Turgeon, 2005; Lincoln and Guba, 1985). Files were entered in MAXQDA Analytics Pro 2020 to work efficiently with a large amount of data; 3) Searching for Themes: once the list of codes has been developed, authors grouped the relevant coded data extracts into themes (Braun and Clarke, 2006; Charmaz, 2001). Specifically, codes were examined considering relevant literature and models utilised for interpreting sustainable consumer behaviours (i.e. Schwartz, 1977; Stern et al., 2000; Triandis, 1977); 4) Reviewing Themes: during this step, the researchers reviewed the codes for each theme to verify if they formed a coherent pattern considering the research question; 5) Defining and

Naming Themes: in the fifth phase authors depicted each theme and its scope and identified names; 6) Producing the Report: authors established the final themes, they wrote up the report to illustrate how findings were developed and proposing the final interpretation of the data set. As suggested by King (2004), quotes from participants were used to support the understanding of the themes. The output of the process is provided in Table 1.

Table 1. *Coding process output.*

Theme	Codes	Frequencies
Social Factors	Personalisation	80
	Unsustainability/Unethical	75
	Social identification	72
	Trend increase	95
	Demonstration/new economic paradigm	62
	New generations	50
	Insecurity	111
	Consumption rationalisation	77
	Health and Safety	108
Knowledge	Knowledge limitation	45
	Awareness-raising campaigns	60
	ICT Role	50
	Digitisation revolution	105
	Evidence of negative impacts of human activities	82
Habits	Unsustainable habits	89
	Fast-paced lifestyle	55
	Smart working	113
	Slower lifestyle model	91
Values	Egoistic values	71
	Future impacts myopia	75
	Re-evaluation of altruistic values	97
	Companies' assessment	90
Price	Price influence	74
	Economic uncertainty	82

3. Results and Discussion

This section presents the findings and discussion to address the research aim which is to understand the pandemic impact on consumers' sustainable and socially responsible behaviours. To achieve the study objective, the authors asked respondents to express their perceptions regarding consumer behaviour before the pandemic and describe any changes triggered by the emergency. The main themes identified are presented: Social factors, Knowledge, Habits, Values and Price. An explanation of themes and synthesis of the Covid-19 impacts on customer behaviour is provided in Table 2.

Social factors (Self-concept, Roles and Norms)

According to respondents, the consumer of the pre-emergency phase sought personalised products that allowed him to express his individuality and distinguish himself from others. Thus, the consumer bought what allowed him to define himself based on what he wanted to communicate about himself externally. The main element that respondents claimed was that the average consumer did not have a strong, sustainable identity, which prompted him to make unsustainable and unethical decisions.

"The consumer orients his consumption choices mainly towards the satisfaction of the personal interest, without considering the impact that it can have on the society or the ecosystem in which he lives".

At the same time, the consumer felt the need to identify himself in the group in which he belongs. He is described as a fickle and easily influenced who changes his purchasing choices in relation to the moment's trend.

"He is an easily influenced subject and follows fashions and influencers".

However, based on respondents' point of view, there has been a general increase in the trend of consumers interested in sustainability and social responsibility issues with a corresponding increment in ethical purchases in recent years. They argued that this reversal of the trend of rampant consumerism of previous years has been fostered by greater attention of the Governments in these issues but above all by the events that in recent years have contributed to raising citizens' awareness (i.e., Greta Thunberg demonstration). In addition, respondents associate change of vision, especially to the new generations. In the interviews emerged that consumer empowerment is essential for building a sustainable society.

"The demonstrations have raised awareness of the unsustainability of the current development model and the need to put in place concrete actions to protect our world".

During the interviews, it emerges that the spread of the Covid-19 has involved the establishment of new social norms regarding what was accepted or not accepted by the community. According to the respondents, the pandemic has led to greater empowerment of the citizen/consumer due to increased awareness of its role in contributing to the virus spread. The health and safety of all have become the main goal. Moreover, respondents noted that there was more rationalisation of purchases during the

emergency phase as the consumer experienced a sense of confusion and insecurity with respect to the relationship with himself, society and the future that led him to reconsider his priorities.

"However, in my opinion, if there is one possible positive aspect in consumer behaviour resulting from this crisis, it is that people are certainly shopping more consciously. Consumers are more careful about what they buy."

"The main problem is not to avoid an infection of your own. It is more important to behave exemplary to save the people who are in the risk groups. This was the way I felt. I felt socially responsible for elder people, who could die if I am ignorant and do not stick to the government's regulations".

In consumer psychology is widely recognised that people's consumption behaviour has a role in determining the concept of the self (Belk, 1988). In general, people want to distinguish themselves from others and develop a sense of self-identification (Trudel, 2019). Studies demonstrate that the individual identity has a role in enhancing sustainable behaviour (Trudel, 2019). Thus, someone with an environmental self-identity will probably be more environmentally active (Haws et al., 2014; Van der Werff et al., 2013; Whitmarsh & O'Neill, 2010). Trudel et al. (2016a) found that people wanted to recycle more of the products associated with the self. Moreover, Tajfel (1982) affirms that people are affected not just by their individual identity but also by their social identity thus social groups influence their behaviours. This mechanism can have repercussions also on people' sustainable behaviours (Trudel, 2019). For example, Brough et al. (2016) demonstrated that men do not have green behaviours if they think their masculinity is threatened. This happens because sustainable behaviours are often associated with females. In addition, many studies demonstrated that Social norms influence consumer behaviour and consumption (Allcott and Mullainathan, 2010; White and Simpson, 2013; Meng and Trudel, 2017). In particular, studies show that social norms and social influence affect sustainable behaviours (Trudel, 2018). Norms are social rules about what should or should not be done (Cialdini et al., 1991) and go against them lead to social sanctions and disapproval of peers (Cialdini 2004; Cialdini and Trost, 1998; Sunstein, 1996). Roles are defined by Triandis (1977) as "sets of behaviours that are considered appropriate for persons holding particular positions in a group". In the Theory of Interpersonal Behaviour (Triandis, 1977), "Social Factors" (composed of roles, self-concept, and norms) is a variable that can influence intention and, in this way the consumer behaviour. There is, already, some attempt in literature in using this model to interpret the sustainable consumer behaviour (i.e. Bamberg and Schmidt, 2003; Jackson 2005).

Knowledge

The respondents affirmed that before the pandemic, there had been dissemination of information about social and environmental issues that had contributed to raising awareness of the impact of consumers practices, even if not sufficiently. For example, they said that the numerous awareness-raising campaigns by public and private organisations and the development of the 2030 Agenda had helped to make consumers more informed about the past and more sensitive to ethical and sustainable issues.

According to respondents, new technologies (social networks, Internet) have also played a central role in making it easier to find information. They have enabled the creation of virtual communities in which participants exchange opinions and assess the companies' behaviours. The lack of knowledge is, according to the respondents, one of the main causes of not responsible choices.

"The dissemination of information on the environmental and social impacts of human lifestyles has increased responsible consumption".

According to respondents' point of view during the emergency phase, it becomes impossible for the consumer to ignore the environmental impacts of human activities. They affirmed that citizens, after an initial phase of uncertainty, began to question themselves more and more about sustainable issues because of the diffusion of information about the possible causes that led to the development of Covid-19. Moreover, respondents noted that the closure of factories leads to a sharp decrease in environmental pollution, making evident their impacts. The interviewees also enlightened that the pandemic has contributed to accelerating the process of society digitisation, consumers were forced to use new technologies due to the impossibility of going to stores. In addition, there has been a widespread of practices such as ATM payment. All this, according to the respondents, have contributed to enhancing consumer awareness regarding social and environmental problems and will lead to the development of a more sustainable society.

"As a result of the pandemic, people are more aware and informed of the environmental and social negative impact of human activities, and this has helped to make more virtuous decisions".

Knowledge is considered in literature a predictor of sustainable consumer behaviour; indeed, more awareness about environmental issues determines more motivation to act in a responsible way (Peattie, 2010). Consumers are influenced by the quality and quantity of information (De Pelsmacker and Janssens, 2007), and information availability is very important to enhance environmental and social sensibility about consumption practices (Schrader, 2007). At the same time, the lack of information can be an obstacle to this trend (Dupré, 2005; Leire and Thidell, 2005). Authors demonstrated that some determinants of behavioural intention were influenced by providing information (Vermeir and Verbeke, 2006). Hosta and Zabkar (2020) found that information availability has a positive influence on environmental and socially consumer behaviour.

Habits

Respondents affirmed that habits played an important role before the emergency phase in developing consumer ethical and sustainable behaviour. Indeed, they felt that what was missing was not consumer awareness of the impacts of their actions as much as a lack of willingness to change their habits.

"Consumers were mostly aware of their power to influence business and the social and environmental impact of their behaviour, but they lack the willingness to change their habits and the collective commitment to do so".

According to the respondents' point of view during the emergency, the consumer is forced to a radical change in his habits. The government restrictions forbade citizens to move freely within the national territory and carry out normal daily activities. The respondents pointed out another significant change in the habits of consumers/citizens, the introduction of smart working, not widely used by Italian companies before the Covid-19. In the interviews, it emerged that the result was the establishment of a less frantic and slower lifestyle model. The interviewees indicated some examples of the new and more sustainable habits such as the use of slow mobility (bicycles, electric kick scooter); a lower purchase of unnecessary products with an impact also on the fast fashion industry; new families eating habits who have begun to prefer healthier foods, have found pleasure in producing bread, pizza and pasta at home and have paid more attention to food waste.

"The travel and movement restrictions have led to a change in consumer habits. This has resulted in greater responsibility in purchases and greener practices".

Changing consumer's habits represent a challenge for the development of sustainable practices (Kostadinova, 2016). As also indicated by Peattie (2010), habits, together with other factors such as financial constraints, lifestyles can obstacle green behaviours. Jackson (2005) stated that habits are central in many activities that can affect the environment (i.e., travels, leisure activities, shopping). Habitual practices often prevent intentions to change and determine a behavioural "lock-in" (Jackson, 2005). Stern (2000) affirmed that dimension habits need to be included in a model that analyses consumer behaviour. Triandis (1977) defines habits as the level of routinisation of behaviour. According to his Theory of Interpersonal Behaviour, habits is one of the three dimension that determines the behaviour, and it can also have an influence on the dimension "Affect" (that represents the emotive component).

Values

Most of the respondents affirmed that the consumer of the pre-emergency phase based his consumption choices on individual egoistic values. Decisions were made mainly assessing the personal benefits that the purchase could generate without considering the impact on society's well-being. Consumers were more sensitive to social and environmental issues if they were directly linked to their well-being. For example, the interviews revealed that the dissemination of organic products was not due to the consumer's desire to reduce environmental impacts but to safeguard personal health. Therefore, respondents identified that consumers were less interested in issues that did not directly affect them, such as respect for human and workers' rights in developing countries. In addition, this led people to have a poor vision of the future and to be predominantly focused on benefits that could be achieved in the present.

"They considered environmental and social aspects only if they also affected their personal well-being".

"The citizens tended to ignore issues and problems that did not directly affect their personal sphere".

The Covid-19 emergency brought, according to respondents, a change in the values on which most consumers/citizens had based their lives. Respondents noted that during the emergency and the subsequent lockdown, there was the return to altruistic values and the sense of belonging to the community that led to greater solidarity. The numerous activities developed during the emergency phase by citizens to help those most in need were highlighted, such as the "suspended grocery shopping", the collection of food for families in economic difficulty, donations to the Civil Protection. According to the interviews, the pandemic has contributed to a reflection by citizens/consumers which has led them to understand the importance of common well-being and that they are part of a community. This new system of values has also been extended to assess companies; respondents declared that the consumers' attention towards gestures of solidarity of companies has been high. It emerged from the interviews that consumers are asking businesses to be responsible and contribute to the community well-being.

"Who can donate, who cannot take".

"Maybe the difference is that the concept of sustainability in consumer mind evolved, from environmental concerns to a raise of awareness regarding the social and human well-being in general".

"Now, in this second phase, consumers claim firms to be more engaged in helping communities. There is an increase in consumers' awareness about CSR and responsibility issues, seeing the companies as the drivers of social and financial recovery."

In literature, it is possible to find some attempts to study the influence of values in promoting sustainable consumer behaviours. Schwartz (1977) developed the Ecological Value Theory and affirmed that environmental behaviour depends on pro-social and moral values. People who have an egoistic orientation and are self-centred are less likely, according to the model, to engage in pro-environmental behaviours instead of individuals that hold altruistic values and have a pro-social orientation are more likely to adopt these kinds of behaviours. Stern et al. (2000), in his Value-Belief-Norm model, postulated that accepting the new environmental paradigm is positively correlated with altruistic and biospheric values and negatively with egoistic values. In addition, Thogerson and Olander (2002) demonstrated that individual priorities influence sustainable consumption patterns. Van Doorn and Verhoef (2015) found that egoistic values and price consciousness negatively impact organic purchases.

Price

According to the respondents, the price has a central role as a purchasing variable both in the pre-emergency phase and during the Covid-19 emergency and exerts a strong influence on consumer sustainability and ethical choices. Respondents pointed out that the consumer was oriented to buy products or services that guaranteed maximum price convenience in the pre-emergency period even if this meant sacrificing social and environmental benefits.

"First there is the price, then all the other considerations, including those of an ethical nature, it is useless to delude ourselves and think that the price does not come first".

During the health emergency, the population experienced a significant phase of economic uncertainty, many businesses have been forced to close, and many citizens had work issues. This condition, according to respondents, has accentuated the consumer tendency to assess their purchases based on the lowest price, that could result in a decrease in purchases of sustainable products that usually have a higher cost.

"The willingness to a pay premium price for low-impact products has given way to (necessary) savings."

In literature, several studies demonstrated that a higher price or a price premium influence the purchase of sustainable and ethical products in a negative way. Indeed, the price considerations prevail on the ethical ones (e.g. Gleim et al., 2013; Vermeir and Verbeke, 2006). Moreover, Yankelovich (2009) demonstrates that green practices and the acceptance of a price premium for a green product are two separate concepts, and the environmental concerns are not related directly to the will to pay more for the product. Therefore, price contributes to creating a gap between the environmental attitudes and belief and the final behaviour (Kostadinova, 2016).

Table 2. *Covid-19 and lockdown impacts on consumer sustainable and social responsible behaviour.*

Theme	**Explanation**	**The pre-emergency phase**	**Covid-19 and lockdown impacts**
Social factors	Self-identity, social influence, norms, and roles have an effect in determining sustainable consumption behaviours.	Personalisation of products. Unsustainable identity. Easily consumer influence. Awareness-raising. Involvement of new generations.	New social norms. Empowerment. Health and safety concerns. Insecurity and confusion. Rationalisation and change in priorities.
Knowledge	Information availabilities enhance the consumer knowledge that determines environmental and social sensibility during consumption practices.	Knowledgeable-but not sufficiently - due to the dissemination of information and the spread of new technologies.	Knowledge and technology boost. Nature-human connection rethink - Digitisation
Habits	Routinisation of daily practices can obstacle or promote sustainable and responsible consumption.	Lack of willingness in changing habits. Fast-paced life.	Radical change in habits following movement restrictions. Slower lifestyle model connected with more sustainable behaviours.
Values	The values system that guides consumer choices. Egoistic values are associated with less	Egoistic values. Personal benefit achievement. Interest in issues that affect the	Altruistic values. Sense of belonging to the community.

	sustainable behaviour in contrast to altruistic values.	personal sphere.	Solidarity. Importance of the community well-being. Business activities assessment.
Price	A price premium or higher price for sustainable products determine a gap between social and environmental concerns and the final behaviour.	Strong influence of price on consumer behaviour. Price concerns stronger than environmental and social concerns.	Price concerns stronger than environmental and social concerns due to economic uncertainty.

4. Conclusion

The central purpose of the current paper was to explore the impacts of the Covid-19 spread and the subsequent movement and travel restrictions on consumers behaviours in terms of sustainability and social responsibility. During the last years more attention was given to sustainable production than to sustainable consumption. Moreover, Covid-19 represents an experiment in downsizing our consumer economy and has led to a reorganisation of consumer purchases and more sustainable behaviours. The study contributes to the existing literature identifying five themes (Social factors, Knowledge, Habits, Values and Price) describing the main consumer behaviour dimension influenced by Covid-19 and lockdown in terms of sustainability and social responsibility. In this way, authors also identified a mechanism that could help achieve Goal 12 of the 2030 Agenda.

Respondents described the consumer of the pre-emergency phase as a person with an insufficient sustainable identity, interested in buying the product at the lowest price even if it means sacrificing ethical concerns, little motivated in changing his habits and driven predominantly by an egoistic vision. At the same time, interviewees pointed out that thanks to the numerous demonstrations, the advancement of a new economic paradigm focused on sustainability, and the increasing dissemination of information, the trend of consumers interested in ethical and sustainable issues was increasing. The Covid-19 spread and the subsequent travel and movement restrictions have accelerated some social mechanisms. First, there has been a change in the habits of the consumer/citizen that has contributed to the establishment of more sustainable behaviours. Moreover, consumers acquired more knowledge about the impacts of their activities on the ecosystem, making it impossible to ignore them. New social norms were established with a new definition of what is or is not accepted by society. A new system of more altruistic values and a sense of solidarity and belonging to the community have prevailed with numerous initiatives to help others. This new system of values was also used to judge the companies' practices. The respondents affirmed that people will not forget the companies' gestures of solidarity during the crisis and that the concept of Corporate Social Responsibility can no longer be ignored. Therefore, the current research shows that the emergency, although negative, has helped the consumer/citizen to be more informed, responsible, and aware of the direct impact that his choices may

have on society and the environment. The pandemic has made clear the negative effects that the unwise decisions have on the ecosystem and, according to the respondents, this awareness will accompany people in the future. The consumer has understood that his actions have consequences and that even alone, he can make a difference. However, price is an important variable that impacts the transformation of consumer concerns into a real contribution in purchasing sustainable products/services. A final graphic representation of the results is provided in Figure 1.

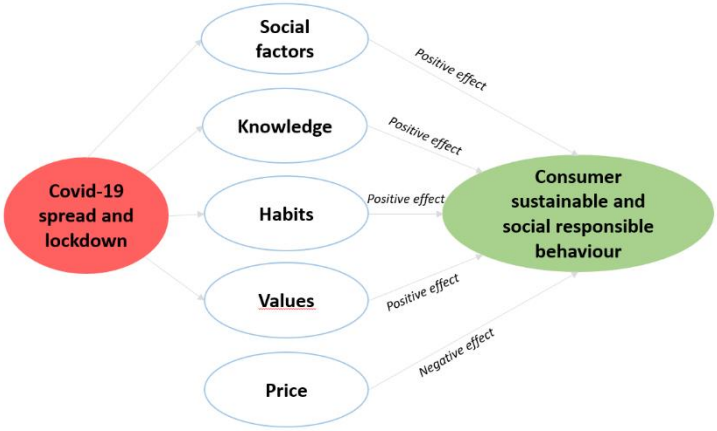

Figure 1. *Covid-19 and lockdown impacts-graphic representation.*

The study brings out also some implications for organisations and public policymakers. First, the research enlightened the importance of understanding the process that led people to make sustainable and responsible choices. Social norms, roles and the self-concept seem important in obstacle or promote sustainable consumption behaviours. Organisations and policymakers should contribute to changing social mechanisms so that people perceive sustainable and responsible behaviour as the new status quo, make the consumer feel that this type of behaviour leads to an improvement in his reputation within society, for example, through their communication campaigns. In addition, the dissemination of information plays a crucial role in contributing to sustainable behaviour, so it is essential to allow the consumer to acquire the necessary knowledge to make his choices. Policymakers and organisations should help to strengthen the sense of belonging to the community and increase awareness campaigns to support the social changes that occurred during the Covid-19 emergency. Moreover, they should analyse the mechanisms that led to changes in consumer habits during the pandemic linked to increased sustainability. Policymakers should, for example, increment incentives for slow mobility, build cycling routes, and limit cars' use. At the same time, companies could promote activities to support the work-life balance since a slower lifestyle is associated with more sustainable choices. In addition, Corporate Social Responsibility should be practised by all companies and become an engine to encourage changes in terms of sustainable consumption. On the other hand, price is a variable that has negatively affected sustainable choices even during the emergency phase. Therefore, it is necessary to develop ways to

reduce the premium price of sustainable products or identify tangible benefits that the consumer can associate with a more expensive product in terms of the environmental and societal effect.

The research also has some limitation. First, the study involved only one country. Thus, future research should extend the analysis to different geographical areas to understand if the vision expressed by respondents change in different social contexts. Second, the study adopted a qualitative method and provide themes to interpret the changes in sustainable consumer behaviour triggered by the Covid-19 spread and government restrictions. Accordingly, future research should continue the analysis by adopting quantitative methods to test current results. Future research should also investigate the changes caused by the emergency in companies sustainable and socially responsible behaviour. Finally, future research should strive to understand how it is possible to encourage sustainable consumption and not waste the opportunity originated by the current health and economic emergency.

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Challenges of young consumer behavior towards the UN SDG achievement

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Abstract

As a society, we have set out to achieve sustainable development goals by 2030, and one of the most important challenges is the preparation of all people on these issues. Therefore, there is an excellent opportunity for teaching and research on future professionals and their decision-making motivations with high social, economic, and environmental impact for universities. Thus, this research contrasts and analyzes the motivations that students must consume products and develop more sustainable habits before and after enrolling in sustainability and circular economy courses. The results have been satisfactory and surprising. First, it was confirmed that there has been an impact of the courses on the sustainable behavior of their students. For this reason, these training spaces should be an integral part of their education. On the other hand, there were no significant differences between men and women, which contrasts with the differentiated behavior found in studies carried out in older populations.

Keywords: Responsible consumer, young consumer behavior, circular economy, sustainable development, SDG-12

1. Introduction

Responsible production and consumption (SDG-12) are significant challenges facing society nowadays due to the increasing scarcity of natural resources needed to produce goods and services based on the culture of disposal and the linear economy. Moreover, the current unsustainable consumption is responsible for environmental pollution, resource exhaustion, and climate change (Booi-Chen and Teck-Chai, 2009; Liu et al., 2016). In consequence, consumers are no longer the last link in the production chain. Still, they have a protagonist role in closing the cycle by recovering materials that can then be recycled or reused in new production cycles in the circular economy framework (UN, 2015).

Therefore, changing the thinking of consumers is essential for the implementation of new paradigms, such as the circular economy, that allow achieving sustainable development. Thus, consumers as individuals or companies have the power to make more sustainable decisions.

In the literature on sustainable consumption, several studies have analyzed the attitudes, level of knowledge, or responsible consumption practices of people. Thus, for example, Orzan et al. (2018) analyzed the Romanian consumer's behavior concerning sustainable packaging, determining that most of them are aware of the impact of packaging on the environment and therefore they prefer to buy paper, glass, and cardboard packaging. Alfiero et al. (2019) studied food waste management in Italy, finding that its optimization favors sustainability development.

Other studies have analyzed the consumer motivations, finding, for example, that new consumers are increasingly inclined to use repair services for electronic devices, clothing, or furniture cheaper (Laitala et al., 2021) or that their sustainable development activities are related to their environmental attitudes (Fraj and Martinez, 2006). Moreover, various studies suggest that women are prone to buy sustainable products and services and encourage sustainable production and consumption at companies (Brécard et al., 2009; Graafland, 2020; Torres-Guevara et al., 2021). Then, considering the current Pandemic situation, the exploratory research of Kirk and Rifkin (2020) provides evidence about the novel consumers' behaviors after COVID 19 related to the satisfaction of functional needs by do-it-yourself projects such as creating furniture, gardening, cooking, or making protective masks with recycled items.

Likewise, the literature reports that older consumers tend to be less active in environmental causes (Cottrell, 2003) and prone to adopt sustainable behaviors such as curtail car use (Jansson et al., 2010) , recycling, or efficient use of resources to mitigate climate change (Semenza et al., 2008). It does not mean that the more mature segments cannot be responsible consumers. Even the pandemic showed that older consumers in Italy took an optimistic attitude towards the future and pro-environmental behaviors, which may broaden the consumer base of sustainable products (Peluso et al., 2021). Other studies claim that young people are usually more motivated to buy sustainable products because they have been highly exposed to environmental education, and the media make accessible information about social and environmental challenges around the world. In addition, there are multiple TV shows for kids with environmental content such as "Opa Popa Dupa", "Animal Manía" and "Nature Boom time" fron Nat Geo Kids and others from Nickelodeon like "Dora the Explorer" and "Blaze and the Monster Machines". Moreover, the magazine "The New York Times" recently published an article named "Nature Shows Are Hot Again" to expose that important streaming platforms such as Netflix, Disney and Apple are investing productions with environmental and wildlife contents(Koblin, 2020).

In this vein, Carvalho et al. (2015) defined five specific green consumer motivations dimensions: the sense of retribution, access to information, labeling and peer pressure, health issues, and crisis scenario. Then, Jaca et al. (2018) complete this list with a sixth dimension: the circular economy. Access to

information refers to the media, the internet, and key data on the environmental damage that increase environmental awareness (Navas-Sabater et al., 2002). Crisis scenarios such as individual or regional economic difficulties can prompt consumers to make better choices about what they buy and where they buy it. The health issues are important because some consumers consider that sustainable products and behavior positively impact their health, such as eating organic food and reducing meat consumption. Then, eco-labels and peer pressure generate reflections on people's consumption habits in the consumer environment and comparisons between conventional and sustainable products. The sense of retribution refers to the personal satisfaction that individuals can feel when making responsible decisions that reduce their impact on the environment (Maiteny, 2002). Finally, the circular economy dimension is intrinsically related to the motivation to avoid waste, reduce behaviors that generate pollution, and apply the 3Rs (Ferdousi and Qiang, 2016).

Despite all these achievements, some barriers prevent responsible consumer behavior, such as the quality, aging of goods, technical difficulty in repairing used goods, and new goods usually cheaper (Laitala et al., 2021). In addition, the COVID-19 pandemic also posed new challenges for responsible consumption and production, especially in the case of waste packing and new materials in the waste stream. For instance, waste packing of single-use plastic increased between 250 and 300 percent during the pandemic to prioritize biosecurity instead of sustainability. Biosecurity materials also include the use of disposable masks and plastic gloves, which become waste faster. Moreover, some reusable packaging programs were suspended, such as the IKEA reusable bags (Love, 2020) and reusable coffee cups (Hardie, 2021).

A key point in this process is undergraduate students' attitudes towards sustainable consumption since they are an essential group that can motivate changes inside their homes and companies where they will work (Mont et al., 2014). To contribute to this field of knowledge, this study aims to analyze the impact of sustainability and circular economy courses on the university students' behavior through the study of the six dimensions mentioned above, to measure green consumers' awareness of sustainability. To achieve this goal, we collect data from 203 students from three different universities in Colombia (South America) through two surveys, one applied the first-class day and the other, the last day of the course, from 2018-1 and 2021-1. Consequently, this study proposes the following research questions:

RQ1: Are there any significant differences in young consumers' motivations across the six motivational dimensions, before and after enrollment in a sustainability course?

RQ2: From the six motivational groups, measured in 23 items, which ones exhibited significant changes in these young consumers?

RQ3: Which are the motivations of green consumers has the most significant influence on other dimensions, before and after the course?

The contribution of this work is three-fold. First, results reveal a consistent correlational pattern with other studies / other populations across the six motivational dimensions. Second, it is shown that, there are no significant gender-related differences in any of the two scenarios (before and after). Third, it is shown that the course did impact students' motivations across the six dimensions of interest. .

The remaining of this paper is organized as follows: Section 2 explains the methodology used to develop the study. Section 3 shows the results and their discussion and finally, Section 4 presents the study's conclusion.

2. Methods

2.1. Data

The study explores the practices and motivations under which students perceive themselves as sustainable consumers, based on a sample of 208 students distributed from 16 to 25 years old from three universities in Colombia (South America), who took a sustainability or circular economy course between 2018 and 2021-1. The data was collected through a survey that was administrated online via Google Forms before and after taking the course. We used the same questionnaire designed by Jaca et al (2018), which consisted of 23 questions Likert-type scale, where 1 meant "I never take it into account" and 7 "I always take it into account".

Moreover, we add two questions to test before and after taking the course, the participants perception about how much they are responsible consumer and the frequency they purchase sustainable products.

2.2. Sustainability and circular economy courses

The sustainability and circular economy courses were designed in a premeditated way with shared content. The design of the course enables students to have the ability to answer the questionnaire at the beginning of the course with essential knowledge and the end of the course, 3 to 12 months later. At the end of the course, all students received training in sustainable development, circular economy, sustainable consumption, green products, and eco-labels. Afterward, all the data of the students analyzed in the study were stored in a confidential database, accessed only by the study researchers, and all the students completed the survey voluntarily. That is, they did not receive extra points or grades.

2.3. Summary of statistical results

With the aim to answer the research questions, this study followed Jaca et al. (2018) regarding the calculation of a correlation matrix among dimensions. Scores per dimension were averaged out from the question set about each of the six dimensions. All correlation values were significant at the $p< 0.01$ level. Then, the study compared the "before" and "after" scenarios for men and women separately across all dimension scores. For each dimension we computed a t-test for the two-group mean comparison. The study did not assume variance homogeneity, so we used the Welch test (which is the conservative strategy). Normality checks were not necessarily due to the large sample size (N= 208).

After running the test, we conclude that there is no significant gender-based mean differences; yet, the SR (before) and the HI (after) dimensions revealed weakly significant differences. In both, women appeared to have a slightly higher perception on sustainability.

Taking the whole “before” and “after” populations, we did observe significant differences (see the reported results) across all dimensions, implying that the course did impact students' perceptions on sustainability.

3. Analysis and discussion

Through a first descriptive analysis of the results (Table 1), it can be observed that in all the questions and dimensions of the motivations of green consumption, they revealed higher averages after the end of the course. This implies that courses in sustainability and circular economy may increase all the types of motivations evaluated.

The dimension that was most highly scored by the course was "Labeling and peer pressure," presenting higher averages in each item. This can be given by class activities that consist of knowing how to identify sustainable products and services in the market, experiential activities. Next, the course impacted "Access to information," which makes great sense considering the audiovisual material and compulsory readings of indexed magazines studied by the students. A similar increase in the means of the items was presented in the dimension of "Circular Economy," this possibly responds to the fact that the students are taught the concept, the fields of action of the circular economy, and analyzed some success stories.

At an intermediate point, there is the "Sense of retribution" category, which has high growth items such as those related to purchases of fair-trade products and small communities’ products; compared to low growth items such as those related to the purchase of organic products and products in recyclable packaging.

In contrast, the dimension that had the least growth in the mean of its items was the "Crisis scenario." This may reveal that young people are not yet sensitive to changes in their context since those who usually assume these crisis scenario changes are their parents or responsible adults, who can cushion these effects. Likewise, the "Health issues" category grew little, possibly because young people have less concern for their health given their vitality. However, it is striking that several of them have started following a vegetarian diet, which is an important message for food producers and university catering services.

Then, in terms of items, the one with the highest growth was "I began to be interested in information on product labels (eco-labels)" (1.01 nominal points), followed by "I was alerted to the importance of social and environmental certifications" (0.93 nominal points) and "I was taught about the 3Rs (reduce, reuse and recycle)" (0.81 nominal points). While the items with the lowest growth were "Economic

difficulties make me think about what I really need to buy" (0.01 nominal points), I started following a vegetarian diet (0.32 nominal points), and "I realized that some product packaging can pollute the planet "0.33 nominal points).

Table 1. *Descriptive statistics from 210 participants from the survey*

	Dimension	Description	Before		After	
			Mean	SD	Mean	SD
	Question: "I started consuming more sustainably when ...:"					
1	(AI) Access to information	I saw a documentary or shocking information that led me to be more careful about what I buy	4.89	1.74	5.57	1.47
2		I saw information on the media that led me to change my consumption patterns	4.31	1.70	4.78	1.68
3		I was alerted to the importance of social and environmental certifications	4.10	1.72	5.03	1.56
4		I realized we were polluting or destroying nature	5.87	1.25	6.22	0.99
5	(CS) Crisis scenario	Economic difficulties make me think about what I really need to buy	4.09	1.85	4.10	1.83
6		I prefer local products because I contribute to the country's economy	5.14	1.55	5.62	1.34
7	(HI) Health issues	I started to pay more attention to my health	5.04	1.30	5.41	1.37
8		I started following a vegetarian diet	1.97	1.69	2.29	1.86
9		I began to consume more fruits and vegetables	4.95	1.61	5.30	1.54
10	(LPP) Labelling and peer pressure	The product labels drew my attention to characteristics that fit with my own values	4.58	1.60	5.24	1.39
11		I started to buy sustainable products, even if their quality is lower	3.45	1.63	3.93	1.71
12		I began to be interested in information on product labels (eco-labels)	4.65	1.64	5.66	1.38
13		I wanted to try products/practices that people close to me recommended	4.80	1.55	5.44	1.35
14	(SR) Sense of retribution	I stopped buying products tested on animals	4.23	1.97	4.78	1.90
15		I started making an effort to buy products in recyclable packaging	5.59	1.42	5.98	1.19
16		I started buying fair trade products to help small communities to have better working conditions	4.31	1.74	5.03	1.56
17		I realized I wanted to give my contribution to my local community or society	5.18	1.46	5.78	1.27
18		I realized I could contribute to a better world by buying fair trade products	4.30	1.72	5.07	1.45
19		I realized the superior quality of organic products	4.78	1.70	5.17	1.38
20	(CE) Circular Economy	I realized that some product packaging can pollute the planet	5.82	1.32	6.15	1.09
21		I realized that some products that I used to consume include toxic components	4.54	1.83	5.20	1.63
22		I realized that some products generate waste that is harmful to nature	5.38	1.39	5.96	1.12
23		I was taught about the 3Rs (reduce, reuse and recycle)	5.59	1.58	6.40	0.85

3.1. Impact of sustainability courses in universities

All students were questioned about whether they consider themselves a responsible consumer and how often do they purchase sustainable products, also named "green" products, on a Likert scale from 1 to 7, where one is "Not at all agree," and y is "Totally agree." In this way, the questions could explore the perception of themselves as consumers, and the frequency of their sustainable purchases works as a confirmation question (Table 2). A descriptive analysis of the data shows no apparent differences between men and women, as explained below. Still, the most important thing is that the total population analyzed was considered 0.4 (7%) points more responsible, and the frequency with which they buy sustainable products also increased.

Table 2. *Students' perception about their own sustainable behavior*

	Gender	Do you consider yourself a responsible consumer?	How often do you purchase sustainable products? (Also named "green" products)?
Before	Female	4.3	3.7
	Male	4.4	3.8
	Total	**4.4**	**3.8**
After	Female	4.8	4.2
	Male	5.0	4.3
	Total	**4.8**	**4.3**

Then, the correlations are positive for all dimensions and significant ($p < 0.01$) for both the "before" (Table 3, Figure 1) and the "after" (Table 4, Figure 2) of the enrollment in sustainability and circular economy courses. Carvalho et al. (2015) study was carried out in Europe, that of Jaca et al. (2018) in Latin America with Spanish speakers of different ages, and the current study on young Colombians from private universities. This positive correlation confirms that the six dimensions of motivations do respond to those of responsible consumption in a population other than the one studied by Carvalho et al. (2015) and Jaca et al. (2018). With this it is inferred that the courses or training programs in universities and companies would have to include content that facilitates the increase of these six motivations to promote responsible consumption in people.

Table 3. *Correlation matrix "Before"*

	Dimension	AI	CS	HI	LPP	SR	CE
AI -	Access to information	1	0.334	0.295	0.636	0.579	0.552
CS -	Crisis scenario	0.334	1	0.231	0.354	0.420	0.377
HI -	Health issues	0.295	0.231	1	0.398	0.454	0.307
LPP -	Labeling and peer pressure	0.636	0.354	0.398	1	0.671	0.563
SR -	Sense of retribution	0.579	0.420	0.454	0.671	1	0.652
CE -	Circular economy	0.552	0.377	0.307	0.563	0.652	1

All values are significant at p < 0.01 level (2-tailed)

Figure 1. *Correlation matrix "Before"*

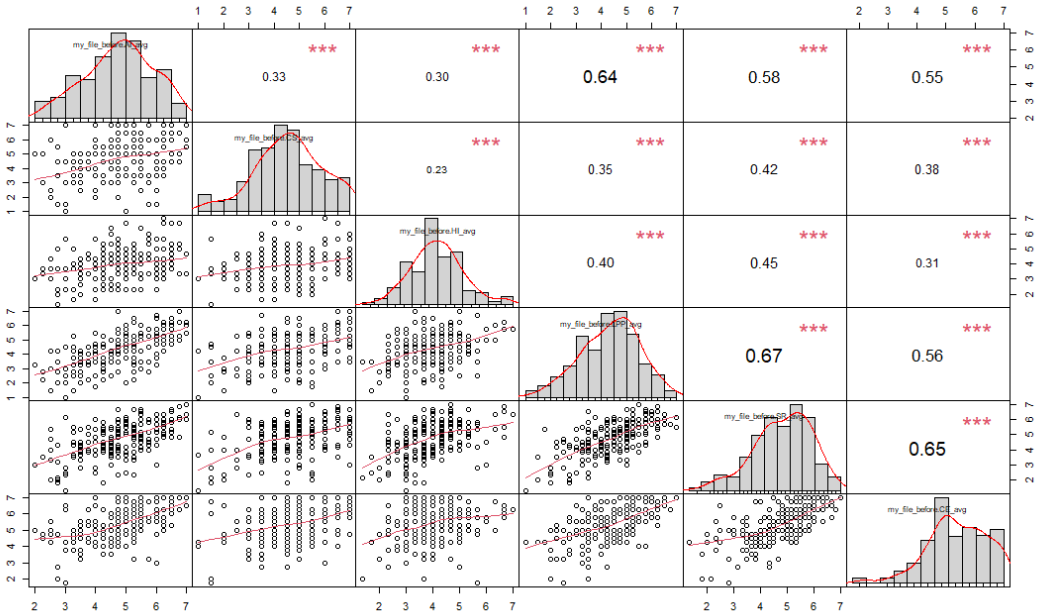
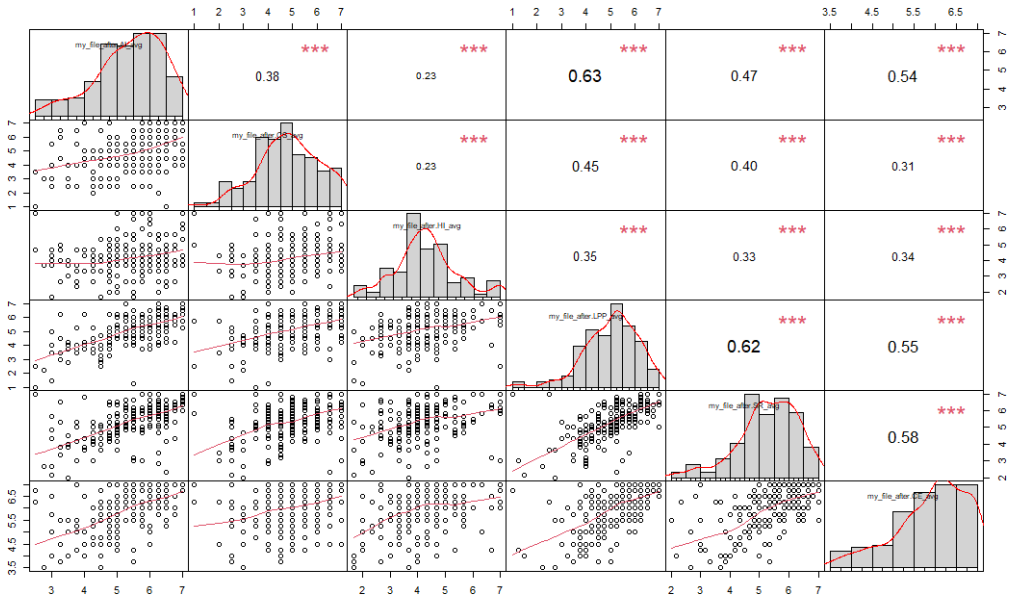


Table 4. *Correlation matrix "After"*

	Dimension	AI	CS	HI	LPP	SR	CE
AI -	Access to information	1	0.379	0.234	0.630	0.472	0.544
CS -	Crisis scenario	0.379	1	0.231	0.448	0.405	0.313
HI -	Health issues	0.234	0.231	1	0.350	0.330	0.335
LPP -	Labeling and peer pressure	0.630	0.448	0.350	1	0.623	0.549
SR -	Sense of retribution	0.472	0.405	0.330	0.623	1	0.579
CE -	Circular economy	0.544	0.313	0.335	0.549	0.579	1

All values are significant at $p < 0.01$ level (2-tailed)

Figure 2. *Correlation matrix "After"*



However, it should be noted that in general the correlations are lower after the course, which allows us to intuit that the greater knowledge and development of skills obtained in the subjects generate particular and more independent opinions between the items.

Before the course, the highest correlations characterized as a moderate positive correlation is given between "Sense of retribution" and "Labeling and peer pressure" (0.671); "Circular economy" and "Sense of retribution" (0.652), and "Labeling and peer pressure" and "Access to information" (0.636). In contrast to the low positive correlation resulting from "Health issues" and "Access to information" (0.295), and "Health issues" and "Crisis scenario" (0.231).

In the post-course scenario, the highest correlations characterized as a moderate positive correlation is given between "Labeling and peer pressure" and "Access to information" (0.630), and "Sense of retribution" and "Labeling and peer pressure" (0.623). Similarly, they remain the low positive

correlation resulting from "Health issues" and "Access to information" (0.234), and "Health issues" and "Crisis scenario" (0.231).

Taking the whole “before” and “after” populations, we did observe significant differences (see the reported results) across all dimensions, implying that the course did impact students' perceptions on sustainability. See Table 5.

Table 5. *“Before” and “After” differences across the six dimensions*

Dimension	Paired t-test value
AI	-7.03**
CS	-2.56*
HI	-4.29*
LPP	-8.13**
SR	-7.60**
CE	-7.98**

***p < 0.05, ** p < 0.01**
Alternative hypothesis: true difference in means is not equal to 0

3.2. Gender differences

Being a population of students, even from private universities, it is natural that most have incomes of less than 150 Euros. Still, others receive an allowance or live far from their parents. It was evidenced that, in general, that the population with the lowest incomes are women (Table 5). At the same time, men have access to higher incomes, which gives them greater decision-making power related to the purchases they make. This aspect is relevant because, according to various investigations, products recognized as “green” or sustainable tend to have a premium price which are around 5% and 10% higher than traditional products (Aguilar and Cai, 2010; Loureiro and Lotade, 2005), and responsible consumers may be willing to pay premium prices in comparison with conventional products. Nonetheless, The willingness to pay more is reduced or can be negative if the product’s categories have worse performance, have been remanufactured, or include recycled materials (Dangelico and Vocalelli, 2017; Michaud and Llerena, 2011). This explains why companies like Apple sell their refurbished line at a discount price in https://www.apple.com/shop/refurbished. So, it can be said that although men have more capital to buy green products with a premium price, that is not a limitation since in different categories, there are more sustainable products with a discount price.

Table 6. *Gender association to income*

Women	**56.67%**

Between € 2001 and € 4000	0.95%
Between € 701 and € 2000	3.81%
Between € 351 and € 700	4.29%
Between € 151 and € 350	16.67%
Equal or less than € 150	30.95%
Men	**43.33%**
Between € 2001 and € 4000	1.90%
Between € 701 and € 2000	5.24%
Between € 351 and € 700	8.57%
Between € 151 and € 350	9.05%
Equal or less than € 150	18.57%

We compared the "before" and "after" scenarios, for men and women separately, across all dimension scores. For each dimension we computed a t-test for the two-group mean comparison. We did not assume variance homogeneity, so we used the Welch test (which is the conservative strategy). Normality checks were not necessarily due to the large sample size (N= 210). After running the test, we concluded that there is no significant gender-based mean differences; yet, the SR (before) and the HI (after) dimensions revealed weakly significant differences (see Table 6). In both, women appeared to have a slightly higher perception on sustainability. See Figures 3 and 4.

***Table 6**. Welch two sample t-test value "Before" and "After"*

Dimension	Welch two sample t-test value (Before the course)	Welch two sample t-test value (After the course)
AI	-0.23	-0.72
CS	-0.64	0.37
HI	-1.32	-2.04*
LPP	-1.25	0.07
SR	-2.01*	-1.09
CE	-1.22	-1.03

***p < 0.05**
Alternative hypothesis: true difference in means is not equal to 0
Conclusion: There are no significant gender differences before and after

Figure 3. *Boxplot differences in the SR dimension ("Before" scenario). Labels "Femenino" and "Masculino" are drawn from respondent data, which refer to "male" and "female", respectively.*

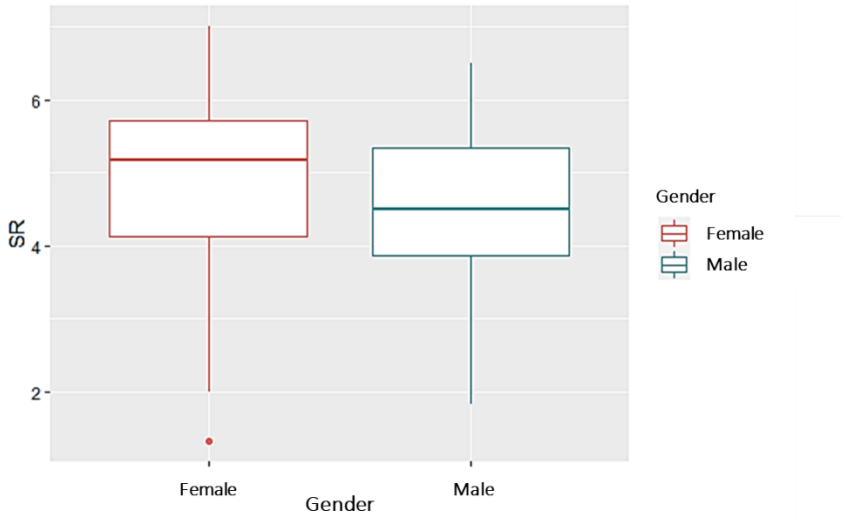
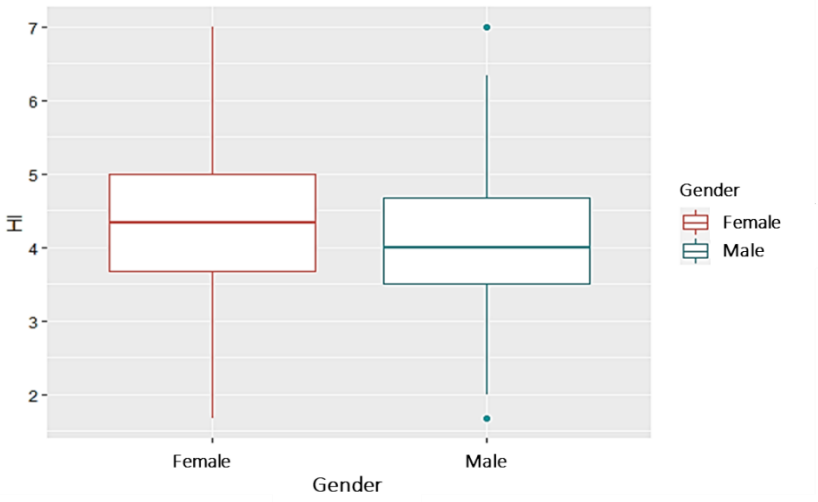


Figure 4. *Boxplot differences in the HI dimension ("After" scenario). Labels "Femenino" and "Masculino" are drawn from respondent data, which refer to "male" and "female", respectively.*



Multiple academics have affirmed that women, especially those married with children, have more sustainable decisions. But in a contradictory way it was observed that in no case does it give significant (although weakly in the Sense of retribution dimension "before").

Thus, it can be said that there are no gender differences before or after. This shows that at least in youth, men and women have the same opportunity to be sustainable consumers and that universities have a great opportunity and responsibility in their training.

4. Conclusions

The study showed an increase in the frequency with which students made decisions based on ecological behaviors and a greater interest in sustainable products after taking the sustainability courses. Likewise, the study measured the consistency of students' self-perception of sustainable behavior across various practices and how the degree of consistency varies after the student body has been exposed to the concepts of sustainability developed on the course.

In the future, it would be valuable to analyze the population analyzed in the study, in a period of 5 years or more when it is estimated that they have finished their studies and become independent to make their own decisions such as marrying, having children, making investments, etc.

The study also has some limitations, such as students who may have a predisposition, but many of them are still made by their parents or relatives. Likewise, in the future, it would be interesting to assess a similar population in greater detail in its age, more mature populations. In the future, differences by careers, the field of study of their profession, and the influence of their family and sociocultural environment could also be analyzed. On the other hand, it would be valuable to research with control groups that do not have any training in sustainability. This study represents an essential contribution to universities and those responsible for career design, such as deans and program directors. This study shows the high impact of including sustainability subjects to motivate future professionals to make more sustainable decisions that are probably related to their decisions as consumers and their professional decisions.

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"Please Reuse Your Towels"

Guest Insights of Green Practices in the Hotel Industry

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Abstract

In recent years, tourism has experienced a continued expansion and diversification to become one of the fastest-growing industries in the world, occupying a prominent role in the European economy. However, the growth of the tourism sector goes hand in hand with its increasing environmental impact. It is, therefore, necessary to find a balance between the tourism sector and its environmental dimension, to increase both the profitability of tourism and the quality of the ecosystem. Over the years, more and more hotels are integrating sustainability practices in the management of their operations. Academic literature shows that hotels go green for many reasons: financial savings, access to public funding, employee commitment, facing public scrutiny, investor relations and general social good. However, one of the main reasons for hotels to go green is to respond to consumers' growing green consciousness. Indeed, consumers are increasingly looking for environment-friendly lodging options, but they are also feeling uninformed about whether hotels are truly eco-friendly. Because of consumers' concern toward environmental sustainability, the hospitality industry is also developing voluntary-based tools to reduce its environmental impacts and to satisfy the increasing market segment of green customers. In this context, third-party certified ecolabels ensure hotel compliance with specific environmental performance criteria and offer reliable communication to their guests. So, understanding how consumers perceive and evaluate the environmental quality and eco-friendly practices in hotels helps to plan and define win-win strategies for tourism sustainable management. Starting with the analysis of literature, we propose a conceptual framework to investigate whether green practices implemented by the Italian "Legambiente Turismo" certified hotels contribute significantly to the formation of guest positive behavioural intention toward green hotels. Even if little research has been conducted on this topic, understanding the role of hotels' environmental practices is pivotal in the hotel decision-making process and strategy. To clarify this point, a survey was conducted with guests of two Italian hotels awarded with the ecolabel, and 335 questionnaires were usable and employed in the analysis, adopting Partial Least Square Structural Equation Modelling (PLS-SEM) to test the hypotheses. Research

findings are valuable for both hotel managers and decision makers, clarifying the role of environmental communication and guest environmental concern in the guest recognition of hotels environmental efforts. The study also confirms the relationship between the implementation of green practices and the rise of market awareness and loyalty towards green hotels.

SDG12 - Target 12.B: Develop and implement tools to monitor sustainable tourism. The current Covid-19 pandemic. caused an unprecedented crisis with strong repercussions for the tourism sector. Governments and international organizations must consider the long-term implications of the crisis, staying abreast of the digital curve, supporting the low carbon transition, and promoting the structural transformation necessary to build a stronger, more sustainable, and resilient tourism economy.

Keywords: Green hotels; Green practices; Eco-labels; Sustainable Tourism; PLS-SEM

1. Introduction

Tourism activity and the environment have always had a complex and dual relationship: on the one hand, tourism depends on the environment to attract tourist flows, on the other the environment depends on tourism as it generates negative impacts on tourism ecosystem, with the risk of damaging it permanently (Correia et al., 2016; Moeller et al., 2011). It is therefore necessary to find a balance between the economic profitability of tourism sector and the quality of the ecosystem in which tourism activities take place (Hunter, 1997). Tourism, as a dynamic industry subordinated to the changes in consumer preferences, has been influenced by the development of the concept of sustainability (Jarvis et al., 2010). In fact, part of the tourism demand has become more and more interested in a type of consumption that is sensitive to the environmental protection and to the respect of local populations' cultures (Lee et al., 2010). Consumers are increasingly looking for environment-friendly lodging options but they are also feeling uninformed about whether hotels are truly eco-friendly (Rahman and Reynolds, 2017). After this change in consumption styles, all the actors of the tourism system (tourism industry, local populations, non-profit organizations and local bodies) have worked both for the identification of strategies to satisfy these new needs, and to communicate to the public this new sustainable approach to tourism, in order to make customers able to perceive the added value of their choices. The assimilation of the concept of sustainable tourism is a long and challenging process: in fact, it requires a gradual collective path involving all the stakeholders operating in the industry. To encourage this involvement, ecolabels are useful tools for hotel facilities, as they support the management in meeting specific environmental performance criteria and help increase the business success of the hotel, thanks to the positive effects they have on the green image of the facility. In the Italian context, Legambiente Turismo Ecolabel supports tourism facilities in implementing green practices and in spreading sustainability values to customers and citizens. This considered, understanding how consumers perceive and evaluate environmental quality and eco-friendly practices in hotels, helps to plan and define win-win strategies for tourism sustainable management (Balouin et

al., 2014). In response to consumers increasing environmental concern, particularly when making a purchasing decision (Ham and Han, 2013), tourism facilities started "to go green" adopting more environmentally friendly practices. As a result of consumers' concern toward environmental sustainability, the hospitality industry is also developing voluntary-based tools to reduce its environmental impacts and to satisfy the increasing market segment of green customers. In this context, third-party certified ecolabels ensure hotel compliance with specific environmental performance criteria and offer a reliable communication to their guests. Starting with the analysis of literature, we propose a conceptual framework to investigate whether green practices implemented by the Italian "Legambiente Turismo" certified hotels contribute significantly to the formation of guest positive behavioural intention toward green hotels. Even if little research has been conducted on this topic, understanding the role of hotels environmental practices is pivotal in the hotel decision-making process and strategy. To clarify this point, a survey was conducted with guests of two Italian hotels awarded with the ecolabel and 335 questionnaires were usable and employed in the analysis, adopting Partial Least Square Structural Equation Modelling (PLS-SEM) to test the hypotheses. Finally, the paper discusses the results, presents implications both for academics and practitioners, and identifies potential future lines on research on the topic.

2. Literature review and hypothesis development

Environmental concern has been defined as: "*a belief, stance and the degree of concern an individual hold towards the environment*"(Mat Said et al., 2003). Previous research has identified that eco-friendly behaviour is under the significant influence of consumers environmental concern (Martínez García de Leaniz et al., 2017). Moreover, environmental concern has been found as a major determinant in consumers environmental responsible decision-making process and intentions formation (Han et al., 2018; Han and Hwang, 2015). Furthermore, research has shown that environmental concern has a significant influence on the way customers evaluate green practices implemented in the hospitality industry (Njite and Schaffer, 2017). In this context, environmental communication is pivotal in boosting guests concerns towards the environmental issues. Additionally, a higher environmental concern also led guests to perceive clearly the hotel's effort to communicate these green practices, developing a more positive attitude and confidence (Han et al., 2010; Martínez García de Leaniz et al., 2017).Bearing in mind these considerations and since environmental concern has been found as an important antecedent of an individual's eco-friendly purchasing behaviour, we hypothesize that the level of guest environmental concern has a significant impact on guest green practices performances evaluation (H1), and on perception of hotel environmental communication (H2).

H1: Guest environmental concern influences guest perception of hotel green practices

H2: Guest environmental concern influences guest perception of hotel environmental communication

Environmental communication is defined as: "*the process of communicating environmental information to build acceptance, reliability and partnerships, to raise awareness, and to use in decision making. The processes used and the content of environmental communication will vary with objectives and circumstances of the organization*" (Daddi et al., 2011). Through green marketing communication, green practices implemented by the hotel are more easily appreciated by guest (Gössling and Buckley, 2016; Wang et al., 2017). Therefore, green marketing can be an effective way to disclose hotels' efforts towards sustainability and can help to educate guests to develop a positive attitude toward green hotels (Martínez García de Leaniz, 2015; Wang et al., 2018). Based on these findings, we hypothesized that hotel environmental communication is pivotal in the formation of guest perception of hotel green practices. Moreover, we might expect that environmental communication may serve as a crucial link to consolidate the significance of the relationship between guest environmental concern and guest perception of hotel green practices. The following hypotheses are tested:

H3: Hotel environmental communication influences guest perception of hotel green practices

Several researcher found that the implementation of green practices is a powerful mean to increase customer loyalty (Gao et al., 2016; Yusof et al., 2015). In particular, scholars also studied both the impact of sustainable practices on willingness to pay for them (Sharma et al., 2018) and for green hotels (Chang et al., 2015; Line and Hanks, 2016). Particularly, Martínez García de Leaniz (2015) developed the concept of "green loyalty" defined as the "*consumer commitment to repurchase or otherwise continue using a green brand*". Martínez García de Leaniz (2015) found that guests tend to develop a specific kind of green loyalty toward the hotels that implemented eco-friendly practices. Indeed, this work tests weather a hotel with a higher rate of commitment toward green practices will lead guests to experience greater loyalty toward the hotel and toward the general category of green hotels. Thus, the following assumptions are formulated:

H4: Hotel environmental practices positively influence guest loyalty toward the hotel

H5: Hotel environmental practices positively influence guest loyalty toward green hotels

Numerous scholars have tested the influences of green practices and guest satisfaction (Roberto Merli et al., 2019; Xu and Gursoy, 2015; Yusof et al., 2017). For instance, Berezan et al. (2013b) tested the impact of the different sustainability practices on guest satisfaction. Han & Kim (2010) integrated satisfaction, together with other variables, in a Theory of Planned Behaviour model to investigate guest revisit intentions in green hotels. Accordingly, this work tests the impact of hotel green practices on hotel guest satisfaction.

H6: Hotel environmental practices positively influence guest satisfaction with the hotel

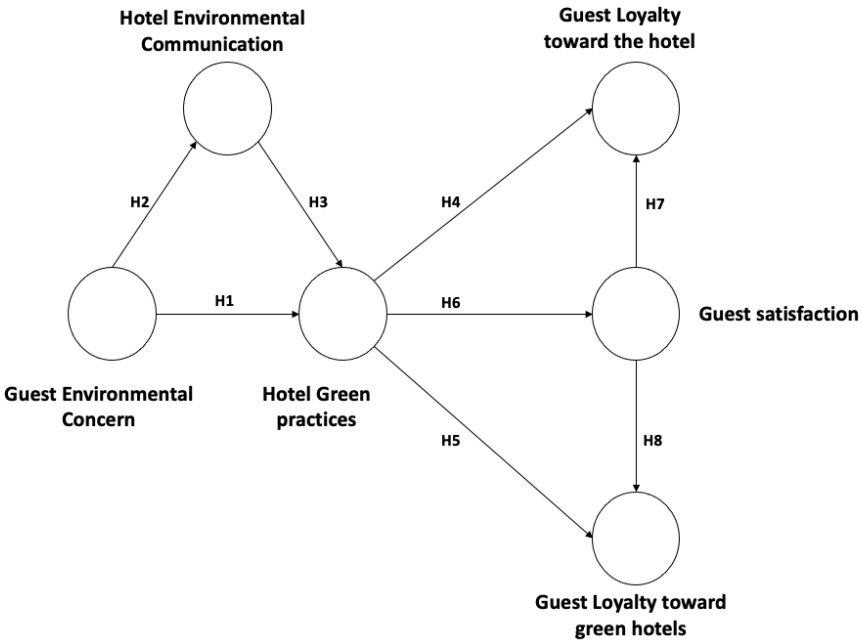
The academic literature suggests that customer satisfaction is an antecedent of customer loyalty (Martínez and Rodríguez del Bosque, 2013). Guest satisfaction with the green hotel and their loyalty

toward it has also been tested by several scholars (Gao et al., 2016; R. Merli et al., 2019; Xu and Gursoy, 2015). Thus, this work tested the following hypothesis:

H7: Guest satisfaction is a significant antecedent of guest loyalty toward the hotel

H8: Guest satisfaction is a significant antecedent of guest loyalty toward green hotels

***Figure 1**. Theoretical model and hypotheses.*



3. Methods

3.1 Survey design and Data Collection

A survey was developed and administered to the guests of two hotels to collect data and measure the constructs in the research model. The questionnaire was pretested with 30 hotel guests, randomly chosen, to assess the suitability of the questionnaire to test the hypothesis formulated (Castellanos-Verdugo et al., 2015). Results of this phase are minor changes on wording of sentences to improve readability and clarity of the questions. Finally, the questionnaire was reviewed and finalized. Subsequently, 500 questionnaires were sent to two Italian hotels awarded with the Legambiente Turismo ecolabel. The survey was conducted during summer, because this season seems to be the most appropriate as it is the period of greatest influx of guests. Eventually, 335 questionnaires were usable and employed for the subsequent analysis (210 from Hotel A and 125 from Hotel B).

3.2 Data analysis

Partial least squares structural equation modelling (PLS-SEM) was used to test the proposed hypotheses (Hair et al., 2011). SmartPLS (V.3.2.8) software was employed to build models and assess their validity (Ringle et al., 2015).

4. Results and Discussion

4.1 Measurement model evaluation

The PLS-SEM model's assessment is composed by two stages: the evaluation of the outer (measurement) and of the inner (structural) model (J. F. Hair, Sarstedt, Ringle, & Gudergan, 2018).The measurement model assesses that all constructs are correctly measured through the indicators (Klarner et al., 2013), and must be assessed for its reliability and validity. Table 1 shows indicators outer loadings for the reflective constructs. Internal consistency reliability for all constructs is satisfactory, well above the suggested threshold of 0.7 for both Composite Reliability (CR) and Cronbach's Alpha. For all constructs, the Average Variance Extracted (AVE) exceeds the threshold value of 0.5, suggesting adequate convergent validity.

Table 1. *Measurement model evaluation results*

Constructs/Indicators	Mean	St. dev.	Loading
Green practices (GP) α= 0.953; CR= 0.953; AVE= 0.742; rho_A= 0.955			
GP_1	6.112	0.808	0.937
GP_2	6.152	0.789	0.906
GP_3	6.101	0.847	0.889
GP_4	6.218	0.798	0.768
GP_5	6.096	0.846	0.800
GP_6	6.157	0.862	0.845
GP_7	6.207	0.847	0.874
Environmental Communication (Env_Com) α= 0.924; CR= 0.925; AVE= 0.755; rho_A= 0.927			
Env_Com_1	6.006	0.856	0.881
Env_Com_2	6.027	0.878	0.895
Env_Com_3	6.030	0.929	0.900
Env_Com_4	6.150	0.940	0.795
Environmental Concern (Env_Conc) α= 0.924; CR= 0.925; AVE= 0.805; rho_A= 0.931			
Env_Conc_1	5.792	1.100	0.928
Env_Conc_2	5.693	1.149	0.950
Env_Conc_3	5.625	1.163	0.807
Guest satisfaction (Sat) α= 0.962; CR= 0.962; AVE= 0.895; rho_A= 0.963			
Sat_1	6.048	0.950	0.940
Sat_2	6.096	0.971	0.950
Sat_3	6.030	0.984	0.949
Guest loyalty towards the hotel (Loy) α= 0.947; CR= 0.947; AVE= 0,.99; rho_A= 0.947			
Loy_1	6.146	0.943	0.947
Loy_2	6.150	0.955	0.950
Guest loyalty toward green hotels (Loy_env) α= 0.958; CR= 0.958; AVE= 0.920; rho_A= 0.959			
Loy_env_1	6.006	0.997	0.974
Loy_env_2	6.036	1.008	0.944
α= Cronbach's Alpha; CR= Composite reliability; AVE= Average Variance Extracted: Rho_A= reliability coefficient			

Next, both the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratios were assessed to ensure an adequate discriminant validity of the measurement model (Fornell and Larcker, 1981). All values of the HTMT are below the suggested 0.9 threshold, which confirms that there is no issue of discriminant validity (Henseler et al., 2015) (Table 2 and Table 3).

Table 2. *Fornell-Larcker discriminant validity criteria*

	Environmental Communication	Environmental Concern	Green practices	Guest loyalty towards the hotel	Guest loyalty towards green hotels	Guest satisfaction
Environmental Communication	**0.869**					
Environmental Concern	0.376	**0.897**				
Green practices	0.822	0.327	**0.862**			
Guest loyalty towards the hotel	0.442	0.561	0.424	**0.948**		
Guest loyalty towards green hotels	0.413	0.697	0.372	0.850	**0.959**	
Guest satisfaction	0.448	0.543	0.428	0.879	0.770	**0.946**

Table 3. *HTMT discriminant validity criteria*

	Environmental Communication	Environmental Concern	Green practices	Guest loyalty towards the hotel	Guest loyalty towards green hotels	Guest satisfaction
Environmental Communication						
Environmental Concern	0.376					
Green practices	0.821	0.324				
Guest loyalty towards the hotel	0.443	0.563	0.421			
Guest loyalty towards green hotels	0.413	0.700	0.369	0.850		
Guest satisfaction	0.449	0.545	0.425	0.879	0.770	

4.2 Assessment of the structural model

The structural model examines the relationships in terms of weights and magnitudes between the endogenous and exogenous latent variables in the model (J.F. Hair et al., 2011). The blindfolding procedure revealed that all the Stone-Geisser's Q^2 values were above zero, indicating the satisfactory predictive relevance of the structural model (Table 4). Next, the coefficient of determination (R^2) was calculated to evaluate the predictive accuracy of the model, that expresses the amount of variance in each endogenous latent variable which can be ascribed to all the exogenous latent variable connecting to it. In the model we have medium effects for Environmental communication (R^2= 0.142) and Guest satisfaction (R^2=0.183) and large effects for Green practices (R^2=0.677), Guest loyalty towards the hotel (R^2=0.776) and Guest loyalty towards green hotels (R^2=0.595). Thus, the predictive power of the model was generally substantial (J. F. Hair et al., 2014). Additionally, following the more recent guidelines of Henseler et al. (2016) that suggest applying the standardized root mean square residual (SRMR) as the only approximate model fit criterion, a SRMR value of 0.038 was calculated for our model, indicating a more than adequate model fit. A value of 0 for SRMR would indicate a perfect fit, and generally, an

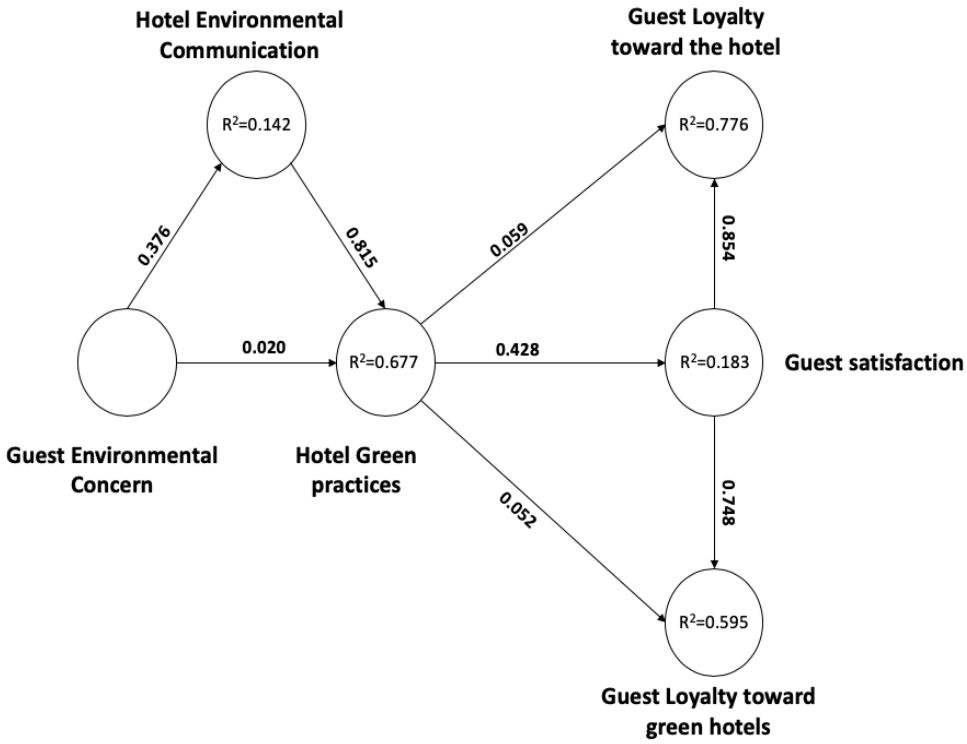
SRMR value less than 0.08 is recommended to be adequate for PLS path models (Henseler et al., 2016). Finally, to test the structural model and the hypotheses, a consistent PLS bootstrapping with 5,000 iterations was performed (Table 4). As we can see from the table, all hypotheses are accepted except for H1, H5 and H6. The p values assess the significance of the relationships but fails to account for effect sizes. So, the f^2, measuring relative impact of a particular exogenous construct on an endogenous construct, have been calculated. The guidelines of Cohen (1988) for effect size assessment, 0.02 for small, 0.15 for medium, and 0.35 for large effects, were followed. As displayed in Table 4, all the effect sizes were large (H3, H8, H9) or medium (H2, H7).

Table 4. *Model hypotheses statistics (bootstrapping) and endogenous constructs assessment (R^2, Q^2 and f^2).*

Path coefficients and bootstrapping				
Hypothesis	**Original Sample**	**T Statistics**	**P Values**	**f^2**
H1	0.020	0.484	0.628	0.001
H2	0.376	4.924	0.000***	0.165
H3	0.815	21.891	0.000***	1.763
H4	0.059	1.284	0.199	0.013
H5	0.052	1.051	0.293	0.005
H6	0.428	5.331	0.000***	0.224
H7	0.854	21.009	0.000***	2.663
H8	0.748	13.249	0.000***	1.130
*p < 0.05. ** p < 0.01. *** p < 0.001.				
Endogenous constructs assessment				
	R^2	**R^2 Adjusted**	**Q^2**	
Environmental communication	0.142	0.139	0.087	
Green practices	0.677	0.675	0.425	
Guest loyalty towards the hotel	0.776	0.775	0.640	
Guest loyalty towards green hotels	0.595	0.593	0.501	
Guest satisfaction	0.183	0.180	0.146	

Figure 2 provides a graphical description of the tested model.

Figure 2. *Structural model with β for path coefficients and R^2 for the exogenous constructs*



3. Conclusions

This paper presents the results of a quantitative study with the aim to investigates how consumers perceive actions implemented by hotels towards environmental sustainability and what drives guests in appreciate the hotels' green efforts. Results of a survey carried out through a questionnaire, targeted to the guests of two Italian hotel awarded with the Legambiente Turismo eco-label, have been presented. In the paper we hypothesized that hotels guests' environmental concern influences guests' perception of hotels green communication and green practices. Additionally, the positive influence of hotel's environmental communication on guests' perception of hotels green practices has been tested. Then, this paper tested the existence of a direct significant relationship between hotel green attributes and customer satisfaction, loyalty and loyalty toward green hotels. Finally, it analyses the influence of guest satisfaction in determining positive guest behavioural intentions. The Partial Least Square Structural Equation Modelling (PLS-SEM) analysis leads to accept five out of the eight hypotheses tested. Results from the model testing show the role played by guest environmental concern in influencing guests' perception of hotels' green communication. This aspect is of great interest for hoteliers as it highlights that consumers concern about the environment led guests to perceive more clearly the hotel's effort to communicate these green practices (Han et al., 2010; Manaktola and Jauhari, 2007; Martínez García de Leaniz et al., 2017). Therefore, through the identification of these niche market, they can foster their results on the market by increasing customers' environmental concerns (Ham and Han, 2013) and by communicating to uninformed customers the negative impacts that non-environmentally certified hotel companies have on the environment (Martínez García de Leaniz et al., 2017). Moreover, the model also

confirms that guest perception of hotel environmental communication has a positive influence in guest perception of green practices implemented. Consequently, to allow guests to understand and process the information associated to an ecolabel, hotels should develop communication strategies in order to make the eco-labels and their green efforts visible and salient to guests (Penz et al., 2017). As observed by Wang et al. (2017), communication support consumers to observe hotel's commitment to help the environment, visibly revealing the hotel efforts for environmental sustainability. The strategy for undertaking this path is to engage in environmental campaigns and green marketing (Dodds and Holmes, 2016), but also invest in advertisement on existing sustainability programs (Ham and Han, 2013), such has the ecolabels ones. Managers may also collaborate with governments or local authorities to raise tourists' awareness by informing and educating them about the environmental impact of the tourism sector (Chen and Tung, 2014; Yusof et al., 2017). The model does not confirm the direct relationship between guest environmental concern and green practices appreciation. Indeed, in order to be recognized, green practices need to be communicated (Gössling and Buckley, 2016; Wang et al., 2017), through a proactive green marketing strategy, addressed to all relevant stakeholders (Hudson and Miller, 2005). Moreover, it is important to focus more on the creation of an identity between the guest and hotel, as well as on an affective relation, instead of just passively informing guests, as suggested by Lee et al. (2010) and Martínez and Rodríguez del Bosque (2013). This aspect has important implications for the sustainable management of the hotels, because results confirm that consumers with a high level of environmental concern will be more likely to have a positive attitude towards green practices that can facilitate the choice of ecolabel facilities as opposed to regular one (Han et al., 2009; Manaktola and Jauhari, 2007) and the development of positive behavioural intentions (Lee et al., 2011). Additionally, results from the model testing suggest that the hotels environmental commitment is positively recognized by customers, influencing their satisfaction. However, this study found that there isn't a direct positive effect between hotels' green practices and loyalty towards the hotels and towards green hotels as customer satisfaction may fully mediates the relationship between green practices and loyalty towards the hotel and towards green hotels. These findings have meaningful implications for hoteliers and practitioners since guest's loyalty towards the hotel pass through their satisfaction with the hotel. Satisfaction with the hotel is a multi-attribute construct, only partially explained by environmental attributes, and influenced several variables of service quality and consumers attitudes (Um et al., 2006). In this sense, hoteliers should concentrate their efforts not only on green practices but also in delivering a high-quality service. Indeed, in case of a failure in service delivery of non-environmental attributes, satisfaction, and consequently loyalty, may decrease. Therefore, green practices may have a positive effect on satisfaction only as long as there is no service failure (Gao and Mattila, 2014). Results of this work are contributing to the body of literature concerning the role of green practices in influencing customer behavioural intentions. Both theoretical and practical implications can be drawn from the results obtained. Considering that the role of guest environmental concern and hotel environmental communication have been scarcely studied in the

context of Italian environmental certified hotels, this work contributes to enrich the academic literature on the topic. Moreover, the construct of loyalty towards green hotels has been proposed, contributing to establish a new relationship between hotel green practices and this construct and enriching the literature of a new research concept. Five out of the eight research hypotheses tested in the research model proposed in this study were accepted.

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Sustainable practices in the hotel industry

A systematic literature review

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Abstract

The environmental impacts generated by the tourism and hospitality sector have gained considerable attention from scholars in recent years. Green hotels and sustainable practices have been largely studied as a way to respond to the growing consumers' environmental awareness and to improve the environmental, social and economic impact of the sector. This growing body of literature uses different points of view, methodologies and theories, also investigating different geographical areas. The aim of this review is to give a comprehensive overview of the academic studies on green hotels research, to identify research gaps and to provide potential future research directions on the topic. The paper explores the body of literature on sustainable practices in hotels, revisiting 600 articles, collected through the Scopus databases, and evaluating it using specific structural dimensions to group the selected literature into analytical categories. Several studies reviewed green and sustainability research in hospitality. With respect to past reviews produced by other scholars, this study contains various novelties that provide added value to better understand the topic under investigation. First, it explores the topic with a systematic approach to provide an exhaustive and comprehensive analysis of the phenomenon with rigorous and reproducible research criteria. Second, it includes a wide spectrum of scholars' publications (600 papers), in comparison with other reviews previously produced and it specifically explores the research about sustainable practices in hotels. Additionally, the investigations on the topic have considerably increased during the last years, and this work provides an updated overview on this research field. Finally, the paper presents the main limitations of the study and identifies opportunities for future research.

SDG12 - Target 12.B: Develop and implement tools to monitor sustainable tourism. The current Covid-19 pandemic. caused an unprecedented crisis with strong repercussions for the tourism sector. Governments and international organizations must consider the long-term implications of the crisis,

staying abreast of the digital curve, supporting the low carbon transition, and promoting the structural transformation necessary to build a stronger, more sustainable, and resilient tourism economy.

Keywords: Sustainable tourism; Sustainable hotels; Green hotels; Sustainable practices; systematic literature review (SLR).

1. Introduction

Academic research has tried to give concrete answers to hotel managers who were looking for sustainable solutions for their accommodations. However, this growing body of literature has often been considered fragmented (Kim et al., 2017), or unstructured (Aragon-Correa et al., 2015) or inconclusive and full of contradictory findings (Farrington et al., 2017). This study will try to systematically analyse the academic literature on the topic of green hotels. The aim of this review is to give a comprehensive overview of the academic studies on green hotels research, to identify research gaps and to provide potential future research directions on the topic. Several studies reviewed green and sustainability research in hospitality. Some of these are specifically focused on hotels (e.g. dos Santos, Méxas, & Meiriño, 2017; Y. H. Kim, Barber, & Kim, 2018; Nisa, Varum, & Botelho, 2017), while others analysed more than one hospitality facility (e.g. Chan & Hsu, 2016; S.-H. Kim, Lee, & Fairhurst, 2017). For example, Myung, McClaren, & Li (2012) analysed 58 environmentally related research articles, published in hospitality journals, focused on three hospitality areas: lodging, restaurant, and meeting and convention. Moreover, Chan & Hsu (2016) have investigated 149 hospitality-related studies in the research area of environmental management. Manganari & Dimara (2015), instead, reviewed 59 studies in the area of green lodging. A systematic literature review with a focus on the accommodation and lodging industry has been conducted by Hall et al. (2016). These authors studied the consumer and producer behaviours and attitudes with respect to the greening and sustainability of accommodation and lodging. Additionally, S.-H. Kim et al. (2017) reviewed 146 articles on green practices published in eight hospitality journals in order to provide a more "pragmatic" definition of green practices in the context of the hospitality industry. Other reviews have been focused on sustainable hotels research. For example, dos Santos et al. (2017) performed two bibliometric studies to analyse the Triple Bottom Line (TBL) approach of academics in the hotel industry-related research. In the hotel industry, Y.H. Kim et al. (2018) performed a comprehensive literature review on environmental sustainability of hotels. Academics also reviewed the experimental field studies carried out to promote sustainable hotel guest behaviour (Nisa et al., 2017). Finally, Tölkes (2018) conducted a SLR on sustainability communication in tourism and hospitality. With respect to past reviews produced by other scholars, this study contains various novelties that provide added value to better understand the topic under investigation. First, it explores the topic with a systematic approach providing an exhaustive and comprehensive analysis of the phenomenon with rigorous and reproducible research criteria. Second, it includes a wide spectrum of scholars' publications (600 papers) in comparison with other reviews produced previously that

investigated roughly 150 papers (e.g. Chan & Hsu, 2016; S.-H. Kim, Lee, & Fairhurst, 2017; Y. H. Kim, Barber, & Kim, 2018). Moreover, it explores specifically the green hotels research as it has been done before by Y. H. Kim et al. (2018). However the Y. H. Kim et al. (2018) paper examines only 128 records, ranking them to select 10 to 15 articles for each year. Additionally, the investigations on the topic have increased considerably during the last years and this work provides an updated overview of this research field.

2. Methods

A systematic literature review (SLR) methodology has been chosen for its comprehensiveness when performing the search of all the publications concerning a specific theme (Petticrew and Roberts, 2008). This methodology provides a powerful tool to synthesize the literature through a series of pre-defined steps allowing to provide a transparent and reproducible process of selection, analysis and reporting of previously conducted research on a specific subject (Denyer and Tranfield, 2009). Material collection was carried out through Scopus, which is one of the most inclusive and exhaustive scientific databases (Aghaei Chadegani et al., 2013), supporting the production process of a reliable bibliometric investigation. In order to capture green hotels studies across the scientific community, the following query has been formulated:

TITLE-ABS-KEY ((hotel OR hospitality) AND (green* OR sustainab* OR circular OR ecolabel* OR eco-label* OR eco-friendly OR "environmental sustainab*" OR "environmental practic*")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "re") OR LIMIT-TO (DOCTYPE , "ip")) AND (LIMIT-TO (LANGUAGE , "English"))

Query1. *Scopus Search with limitations.*

The research on Scopus returned 1396 results. Next step was to critically evaluate these results in order to select those papers focusing specifically on green practices in the hotel sector. In fact, from the analysis of query results only those specifically dealing with hotel, accommodation, lodging and that are focused on sustainability, intended in its broader definition, where further considered in the review. Starting from the 1,396 records initially extracted, we set aside 745 records that were not coherent with the scope of the research. Additionally, during the full text scan of the records further 51 records were deleted. Eventually, 600 records were employed to carry out the study.

3. Results and Discussion

The databases analysis shows that scholars' interest in green hotels research is constantly growing over the last years. Particularly, 89.33% of the paper were published over the last ten years (2010-2018). Moreover, during 2017 and 2018, 28% of the works were issued, showing a sharp increase of publications. Figure 1 illustrates the trend of the literature, showing the increasing interest in the topic.

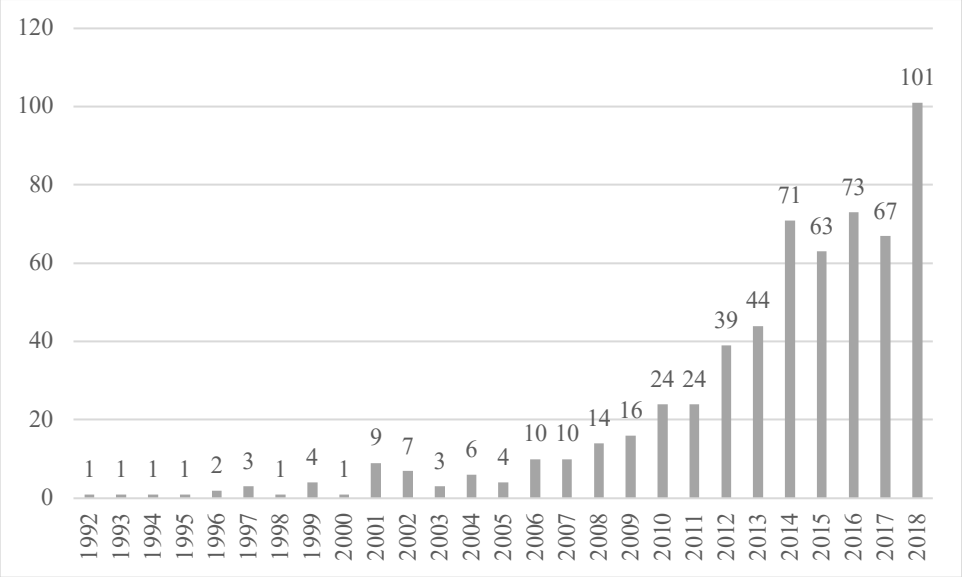

***Figure 1**. Distribution of publications per years.*

Figure 2 shows the journal that published more on the topics, with these journals accounting for the 44% of the publications selected for this study. The "International Journal of Hospitality Management" is the most prolific one with the 8.7% of the publications (52 papers), followed by the "International Journal of Contemporary Hospitality Management" (43 papers) and the "Journal of Sustainable Tourism" (39 papers). The journals "Cornell Hospitality Quarterly", "Journal of Cleaner Production", "Sustainability (Switzerland)" and "Tourism Management" follows this triad accounting together for the 13.33% of the total publications.

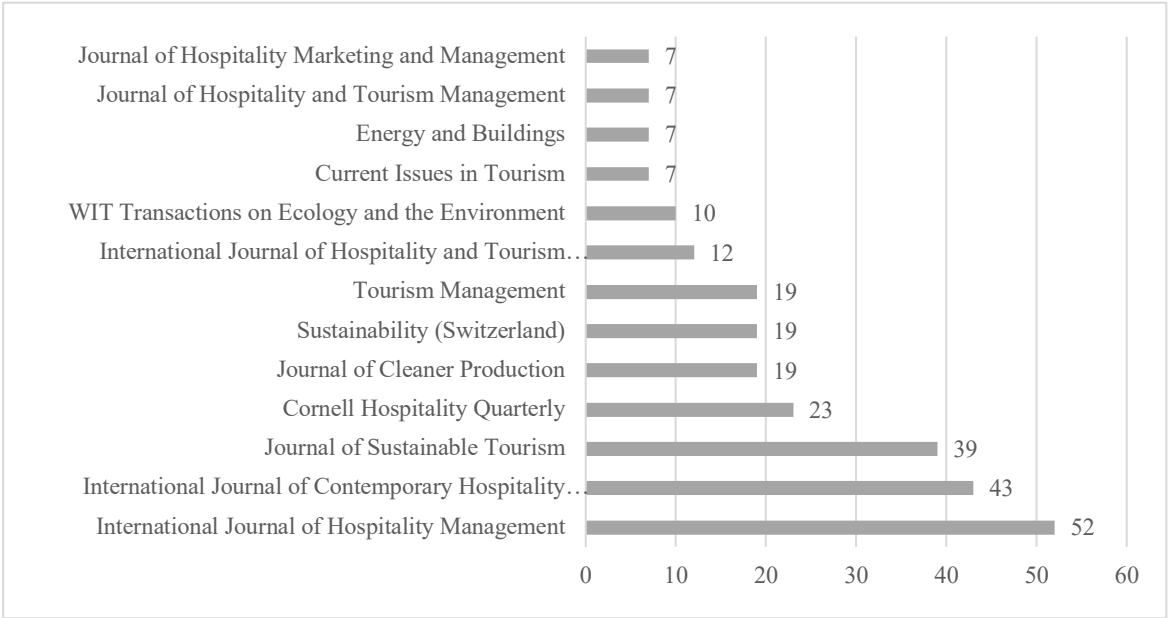

***Figure 2**. Journals with at least 7 publications.*

Considering the seven most prolific journals and the distribution of their publications per years the analysis shows that "International Journal of Hospitality Management" and the "International Journal of Contemporary Hospitality Management" and the "Journal of Sustainable Tourism" have constantly published on the topic since 1995-1996-1998 (Figure 3). The "Cornell Hospitality Quarterly" become interested in green hotels research only in the 2008 and the journal "Sustainability" in the 2015. Instead, the "Journal of Cleaner Production" intermittently published in the topic since 2005.

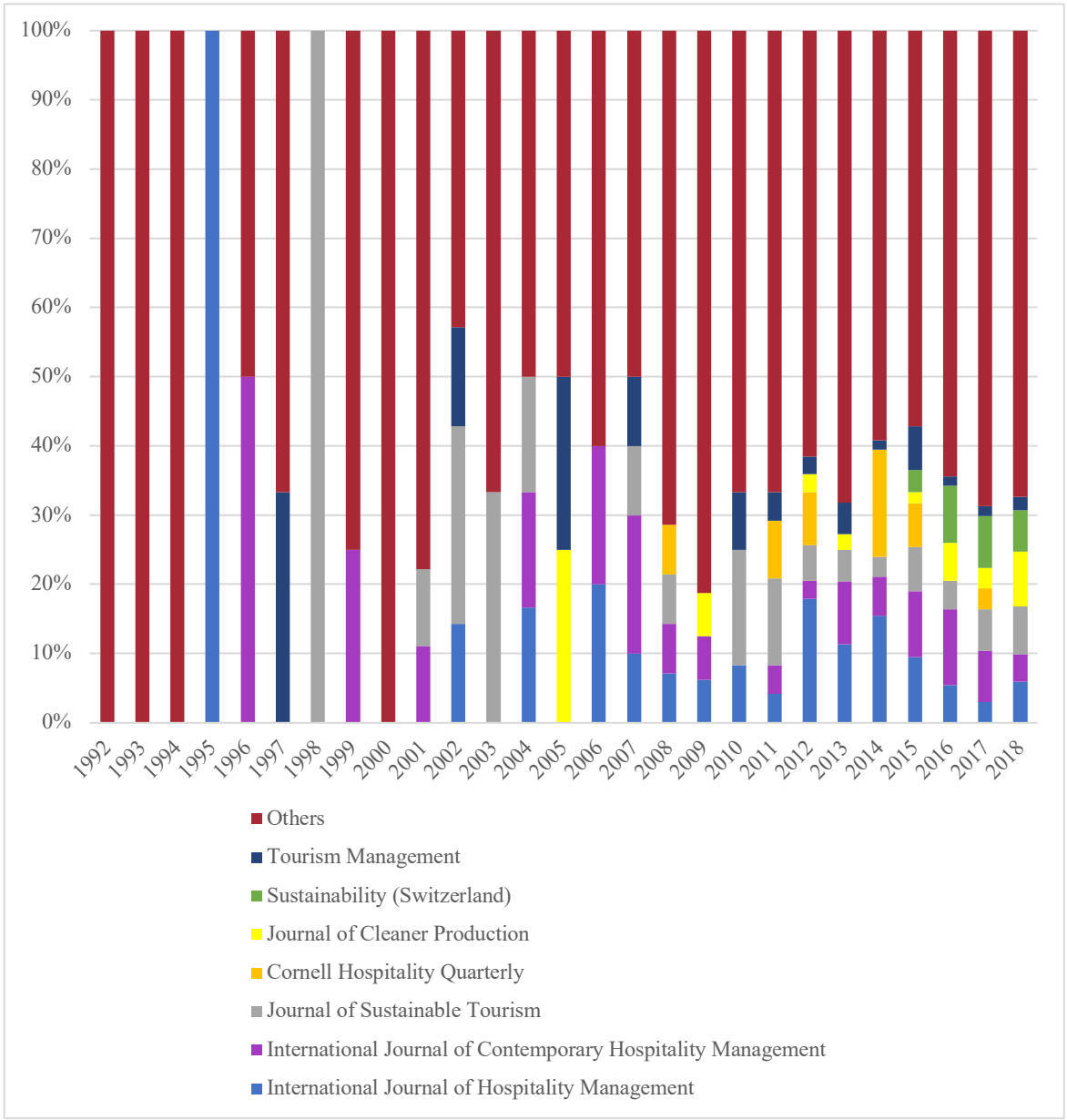

***Figure 3**. The seven journals with the highest share of publications per years.*

Next, the most cited papers, according to the Scopus count, were analysed to have an overview of the most impactful researcher on the theme (Table 1). Considering the ten most cited papers in green hotels

research the analysis shows that five out of ten papers have studied consumer's behaviour in the context of green hotels. Specifically, three of these used the "Theory of Planned Behaviour" (TPB) to understand consumers behavioural intentions formation (Chen and Tung, 2014; Han et al., 2010; Han and Kim, 2010). The most cited paper (431 citations) was written by Han et al. (2010), and studied the formation of hotel customers' intentions to visit a green hotel under the TPB theory using the Structural Equation Modelling (SEM) methodology to analyse survey results. In another study, Han & Kim (2010) enlarged the scope of their analysis extending the TPB incorporating also the role of service quality, customer satisfaction, overall image, and frequency of past behaviour to predict customer's intentions to visit green hotels. Additionally, also Chen & Tung (2014) works tries to develop an extended TPB model including environmental concern and perceived moral obligation to predict consumers' intention to visit green hotels. The study of Manaktola & Jauhari (2007) analysed through a mixed-methods approach the role of consumer's attitude and behaviour towards hotels green practices in influencing their willingness to pay for green practices. Moreover, Lee, Hsu, Han, & Kim (2010) studied how hotel green image can influence customers behavioural intentions intended as willingness to pay, intention to visit and intention to recommend. The role of hotel's image has been studied also by Han, Hsu, & Lee (2009). They tested a model that investigated the relationships among customers attitude toward green behaviours, overall image, visit intention, word-of-mouth intention, and willingness to pay more by considering the effects of gender and age in the hotel customers' eco-friendly decision-making process. However, only two articles explored the hoteliers' perception of hotel green practices (Bohdanowicz, 2006, 2005). In the work of Bohdanowicz (2005) the level of environmental knowledge and awareness among managers of European independent and chain-affiliated hotels were studied. Results from this work showed chain-affiliated hotels were more likely to adopt environmentally friendly solutions than were independent operators. This author also analysed the environmental awareness and initiatives in the Swedish and Polish hotel industries showing differences and similarities between these two countries (Bohdanowicz, 2006). Finally, just one paper focus the environmental aspect of green hotels performing a feasibility analysis of renewable energy supply (RES) for a stand-alone supply large-scale tourist operation in Australia (Dalton et al., 2008).

Table 1. *Most cited papers.*

N.	Authors	Article title	Year	Journal	Cited by
1	Han H., Hsu L.-T.(J.), Sheu C.	Application of the Theory of Planned Behavior to green hotel choice: Testing the effect of environmentally friendly activities	2010	Tourism Management	431

2	Manaktola K., Jauhari V.	Exploring consumer attitude and behaviour towards green practices in the lodging industry in India	2007	International Journal of Contemporary Hospitality Management	325
3	Lee J.-S., Hsu L.-T., Han H., Kim Y.	Understanding how consumers view green hotels: How a hotel's green image can influence behavioural intentions	2010	Journal of Sustainable Tourism	276
4	Bohdanowicz P.	European hoteliers' environmental attitudes: Greening the business	2005	Cornell Hotel and Restaurant Administration Quarterly	226
5	Holcomb J.L., Upchurch R.S., Okumus F.	Corporate social responsibility: What are top hotel companies reporting?	2007	International Journal of Contemporary Hospitality Management	224
6	Han H., Kim Y.	An investigation of green hotel customers' decision formation: Developing an extended model of the theory of planned behavior	2010	International Journal of Hospitality Management	207
7	Han H., Hsu L.-T.(J.), Lee J.-S.	Empirical investigation of the roles of attitudes toward green behaviors, overall image, gender, and age in hotel customers' eco-friendly decision-making process	2009	International Journal of Hospitality Management	207
8	Bohdanowicz P.	Environmental awareness and initiatives in the Swedish and Polish hotel industries-survey results	2006	International Journal of Hospitality Management	185
9	Chen M.-F., Tung P.-J.	Developing an extended Theory of Planned Behavior model to predict consumers' intention to visit green hotels	2014	International Journal of Hospitality Management	182

10	Dalton G.J., Lockington D.A., Baldock T.E.	Feasibility analysis of stand-alone renewable energy supply options for a large hotel	2008	Renewable Energy	172

To further analyse the database results a graphical mapping based on bibliographic material was performed. The bibliographic network analysis has been carried out through the VOS viewer software (version 1.6.11). This free software, developed at Leiden University by Nees Jan van Eck and Ludo Waltman (van Eck and Waltman, 2010), allows to make maps to visualize bibliometric network data based on the Visualisation Of Similarities (VOS) technique (Wong, 2018). In this study, co-authorship and co-occurrence were performed to create maps showing the network of: (1) the co-authorship among researchers and countries, (2) the co-occurrence of index and authors keywords. In co-authorship networks, researchers, research institutions, or countries are linked to each other based on the number of publications they have authored jointly (van Eck and Waltman, 2017). The items or nodes represent the objects of interest (e.g., publications, researchers, keywords, authors), in this case a node depicts an author in this network. The size of the node indicates the number of authors' co-authored publications. The distance between two nodes reflects the strength of the relation between them, i.e., shorter distance means a stronger relationship. A link between two nodes indicates a co-authorship relationship for one or more publications. Figures 4 and 5 show the co-authorship network obtained applying a threshold of a minimum of 1 article co-published per author. The analysis resulted in 33 authors selected divided into 6 clusters (Figure 4). In particular, in Figure 5 the nodes are coloured based on the average publication year of the author, using the colour scheme depicted in the legend.

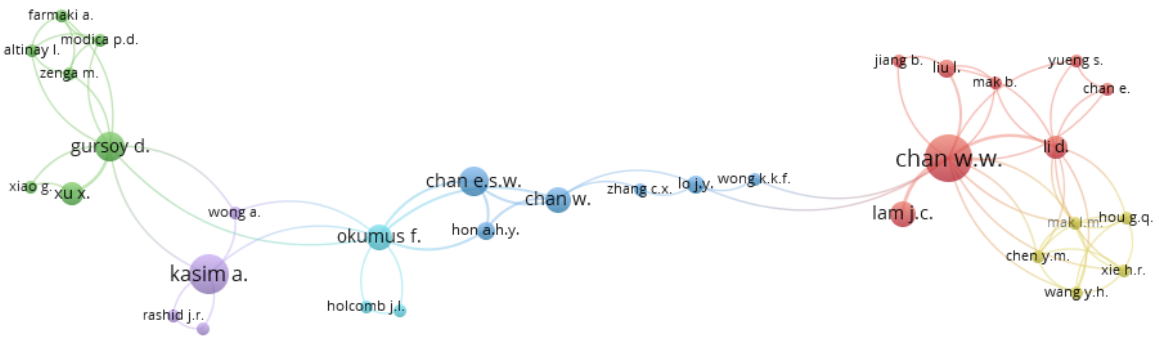

***Figure 4**. Co-authorship network map of authors publishing on green hotels.*

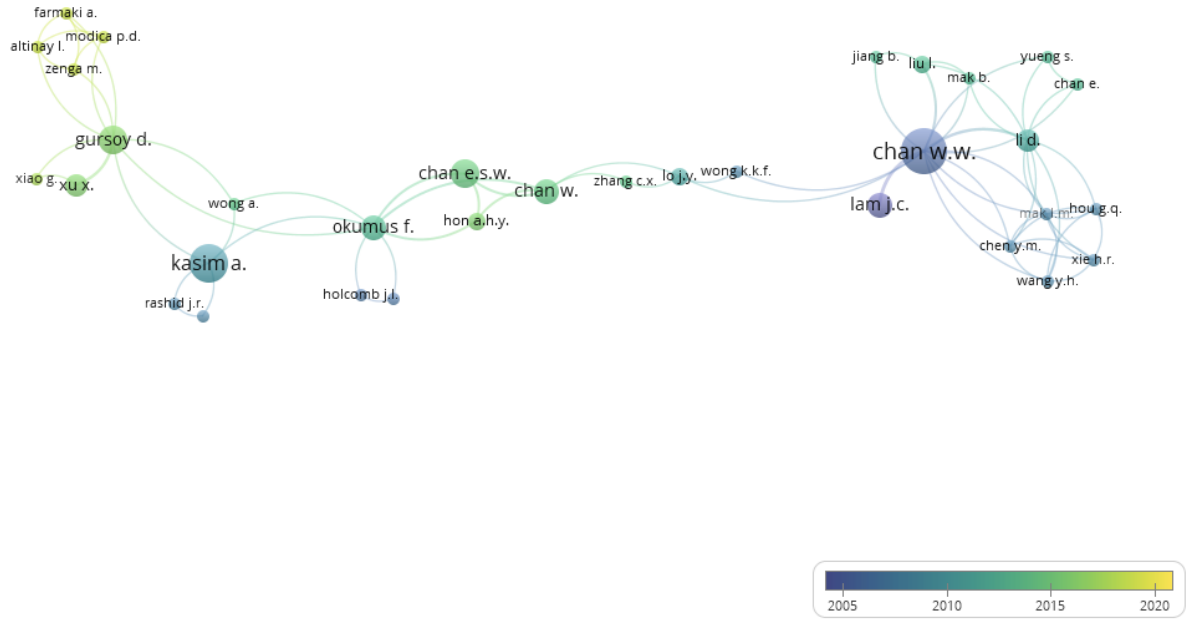

***Figure 5**. Co-authorship network map of authors publishing on green hotels with overlay visualization.*

Figure 4 shows that in the green cluster the most prolific authors are Xu X. from the College of Business Administration in the California State University and Gursoy D. from the School of Hospitality Business Management in the Washington State University. This cluster is connected to the purple one where the author with more co-authored publications is Kasim A. from the Faculty of Tourism, Hospitality and Environmental Management at the Universiti Utara Malaysia. The light-blue cluster, instead, is dominated by Okumus F. from the Rosen College of Hospitality of the University of Central Florida. Additionally, from the analysis emerges that in two clusters the blue and the red ones the most influential authors are Wilco W. Chan and Eric S.W. Chan from the School of Hotel and Tourism Management at Hong Kong Polytechnic University (Hong Kong). The last cluster, the yellow one, is populated by different authors that published an article with Wilco W. Chan and Danny H.W. Li from the City University of Hong Kong (Chan et al., 2008).

Figure 5 shows that the most recent collaboration is between Patrizia Daniela Modica, Levent Altinay, Anna Farmaki, Mariangela Zenga and Dogan Gursoy in one paper published in 2018 in the journal "Current Issues in Tourism" (Modica et al., 2018). Instead, one of the earliest was between Wilco W. Chan and Joseph C. Lam from the Department of Building and Construction of the City University of Hong Kong. Then the Co-authorship network of countries was analysed applying a threshold of a minimum of 6 documents published per country eventually 27 countries were selected divided into 6 clusters.

In Figure 6 the countries with the largest volume of publications are in the centre of the map, represented by the bigger circles: USA (144 papers), Spain (60 papers) and UK (51 papers). Each link between two circles of different countries indicates that there is a co-authorship between the organizations based in those countries.The purple cluster is formed by USA, South Korea and India. The blue one is formed mostly by European countries as UK, Italy, Greece and Cyprus. The light blue cluster is formed by United Arab Emirates (UAE) and Switzerland. The green is composed mainly by Asian countries as China, Taiwan, Hong Kong, Thailand plus Canada and Netherlands. Instead, the red one that is dominated by Spain comprises also Australia, Malaysia and some European countries as Germany, Austria, Slovenia and Romania. Finally, the yellow cluster includes Vietnam, New Zealand, South Africa and Sweden. Figure 7 helps to visualize the temporal evolution of these collaborations between countries. The temporal network, based on the average publications per year shows that United Kingdom, Hong Kong and Australia were the pioneers of the research on green hotels. In yellow, instead, are highlighted the most recent ones: Austria, UAE, South Africa, Turkey.

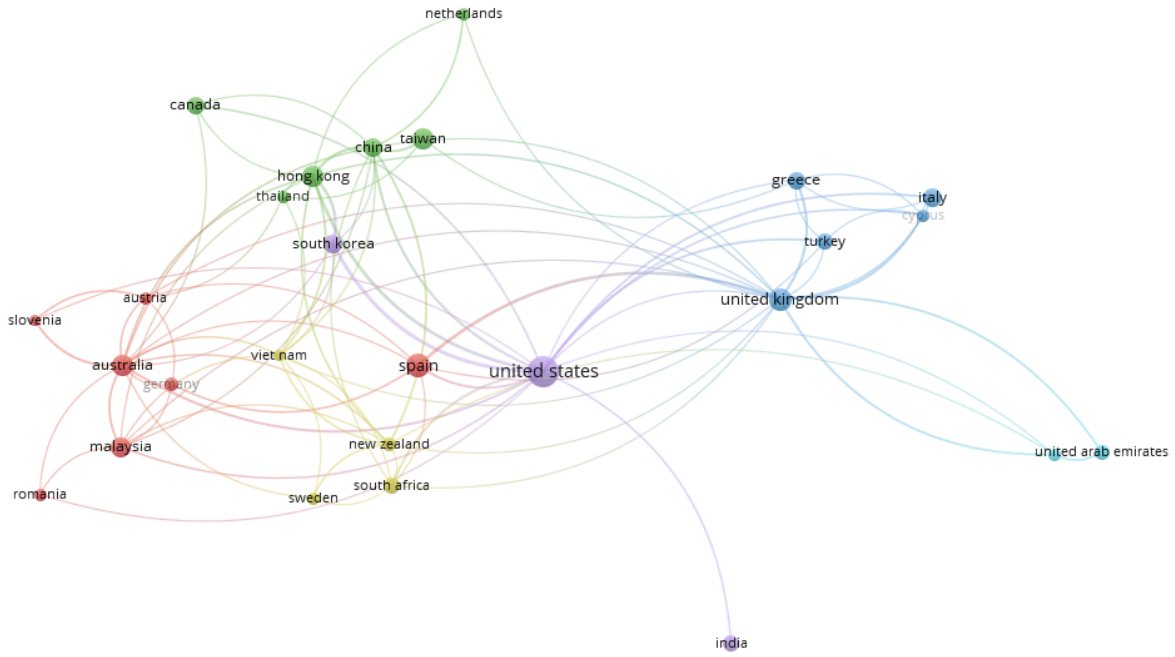

***Figure 6**. Co-authorship: Network of collaboration among countries.*

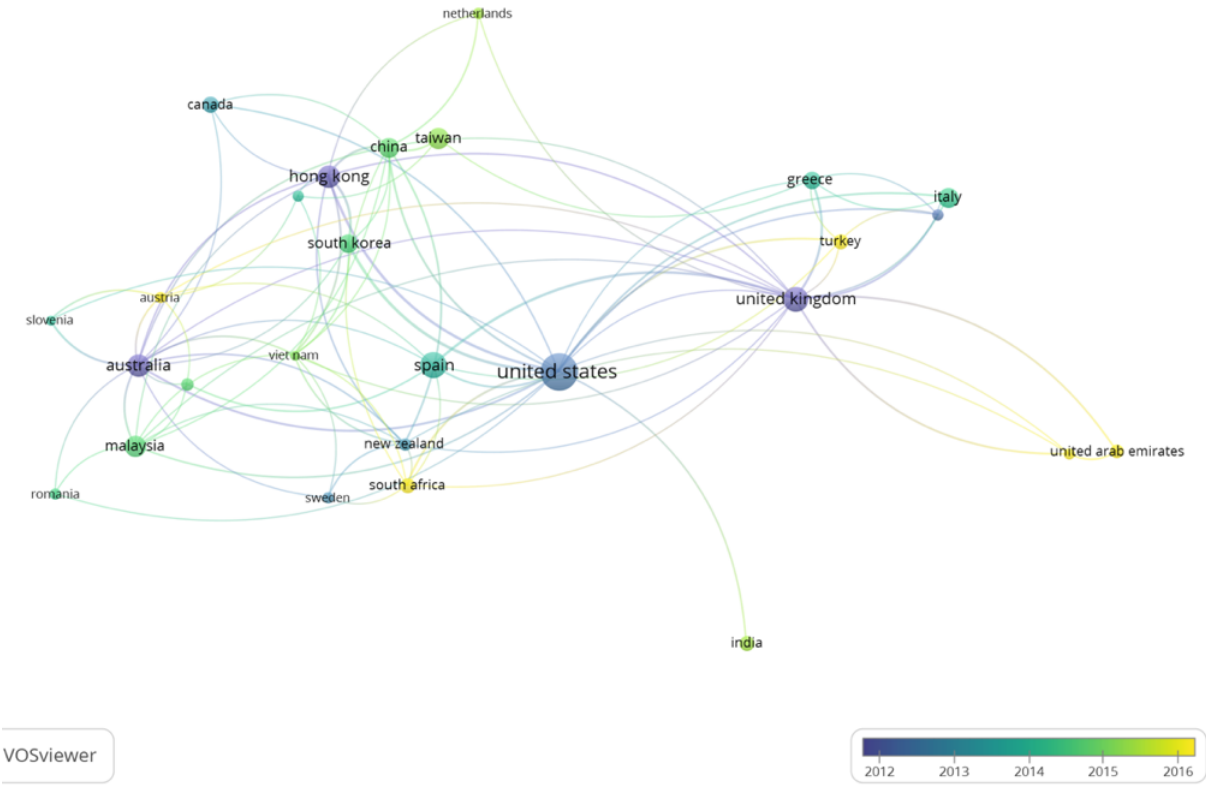

Figure 7. *Co-authorship: Network of collaboration among countries with overlay visualisation.*

Moreover, a co-occurrence analysis of authors' keywords has been performed. Co-occurrence analysis studies the relatedness of keywords considering the number of publications in which they occur together. Author keywords were used as unit of analysis with the full counting method. To create a clear and representative map of the network we required a minimum of five occurrences for each keyword. Eventually, 66 keywords have met the threshold.

The main keywords are presented in Figure 8. The most frequent keyword is sustainability with 94 occurrences. Seven keywords were employed more than 30 times: hotels (69), sustainable tourism (67), tourism (43), hotel industry (43), hospitality (39), sustainable development (37), and environmental management (36). Among the eight clusters identified, the strongest relationships in terms of keywords co-occurrences are among "sustainability" and "hotel industry", "green hotel" and "corporate social responsibility", and "sustainable tourism" and "hotel". Authors' keywords network analysis with overlay visualization is showed in Figure 9 shows the yellow nodes that highlight those keywords more employed in the last few years (e.g. innovation, food waste, competitive, towel reuse and attitudes). Conversely, the purple/blue nodes group highlights the keywords that were used mainly before (e.g. environmental awareness, accommodation, China, recycling and energy consumption).

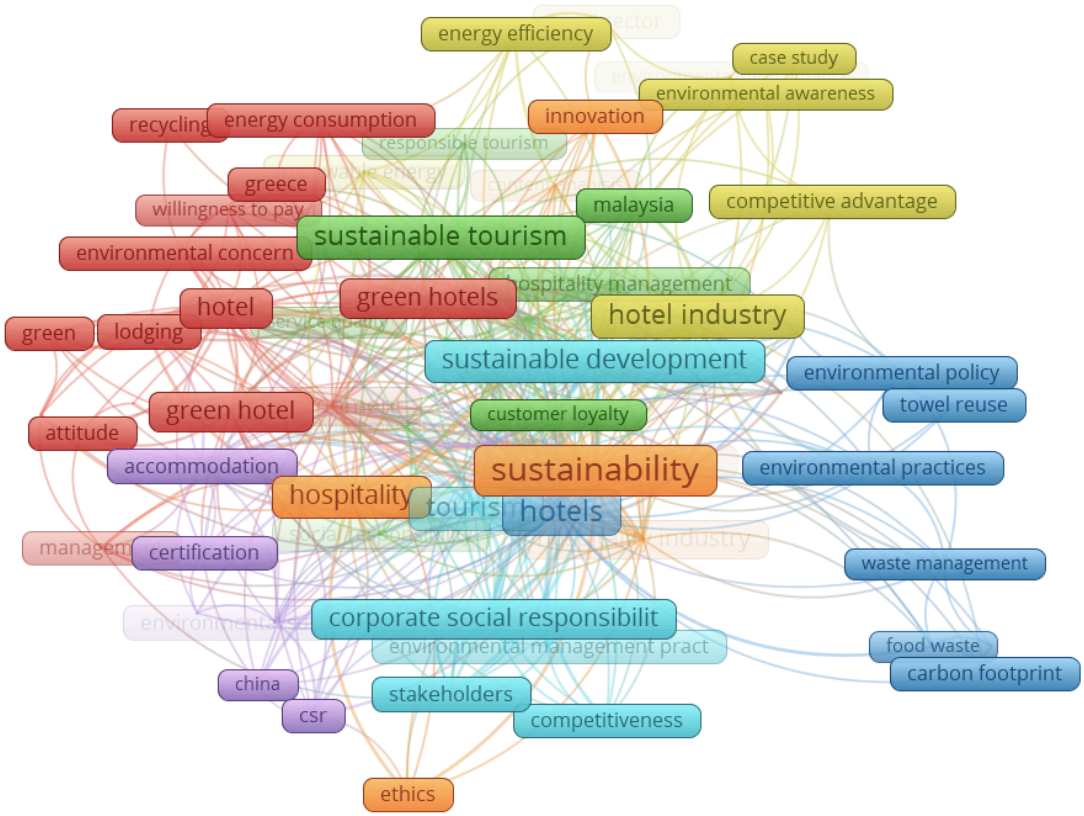

Figure 8. *Co-occurrence network map of authors' keywords.*

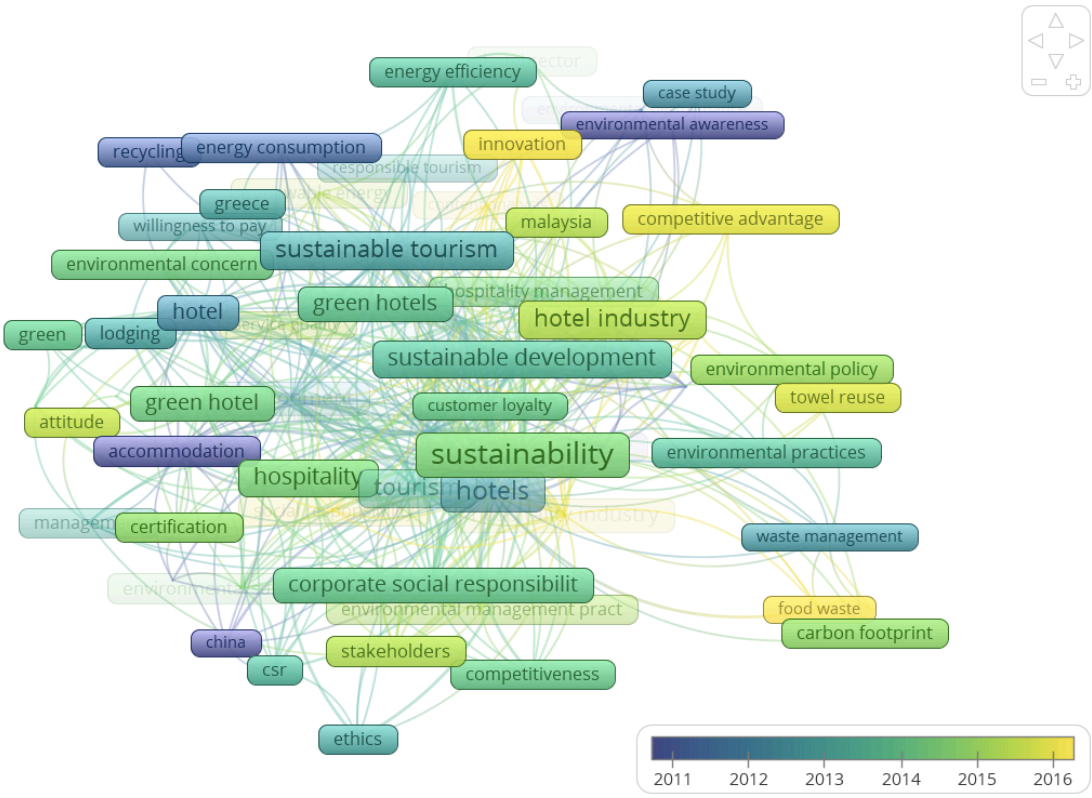

Figure 9. *Co-occurrence network map of authors' keywords with overlay visualization.*

4. Conclusions

This systematic literature review has highlighted past, present and future lines of research on sustainability research in the hotel industry. The analysis has shown as green hotels have been a hot topic over the last years. Scholars have dedicated growing attention to the topic and publications have grown constantly over the years. This topic has been mostly discussed in hospitality and tourism-related journals. However, also journals dealing with sustainability and cleaner production and consumption have been interested in green hotels research such as Sustainability and Journal of Cleaner Production. This aspect is particularly relevant as it represents the interdisciplinarity of the subject and the growing interest also beside hospitality and tourism researchers. Looking at articles published in non-hospitality and tourism journals, authors' affiliation is mainly from business studies and engineering departments all over the world. However, from the analysis emerged that most of the studies on green hotels are published by authors based in the United States, the United Kingdom, and Spain. Moreover, looking at the co-authorship network this research has shown as US scholars are in the centre of this network between Spanish and British scholars. Two other poles of collaboration are Australia and Hong Kong. Additionally, considering the co-authorship network map of authors publishing on Green hotels the main clusters are dominated by Gursoy D. from the School of Hospitality Business Management in the Washington State University, Azilah Kasim from the School of Tourism, Hospitality & Event Management (STHEM) at Universiti Utara Malaysia (Malaysia), Okumus F. from the Rosen College of Hospitality of the University of Central Florida, Wilco W. Chan and Eric S.W. Chan from the School of Hotel and Tourism Management at Hong Kong Polytechnic University (Hong Kong). Particularly, the Hong Kong Polytechnic University has the pride of place among the universities for what concern the number of published articles, almost 90 papers have been issued about sustainability in hospitality. Furthermore, the most prolific and impactful author is Heesup Han from the College of Hospitality and Tourism Management at Sejong University (Korea). He published 17 articles on the topic and 4 of his papers are among the 10 most cited documents on green hotels. Looking at the most cited documents we can have a look at the most influencing themes on green hotels research. Half of the papers on this list deal with the study of consumer's behaviour towards green hotels. These papers analysed consumers' attitudes, behaviour, perception, awareness and decision formation towards the green hotels. Indeed, scholars have investigated consumers' appreciation of green practices implemented by hotels. This is partially due to the need of hoteliers to understand if their efforts towards sustainability were rewarded through a better consumers' predisposition to pay a premium price for green hotels, a greater satisfaction, a better brand equity or a greater customer engagement.

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Review on models applied to Design for Sustainable Behaviour

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Abstract

This paper presents a literature review on models applied to Design for Sustainable Behaviour, aiming to identify similarities and gaps in this area of knowledge. Each model has its own structure to promote behavioural change. Models used in the scope of Product Design and Service Design will be presented. Some models have stages, as in the case of the Mindful Design model (Niedderer, 2014), Behavioural Intervention model (Bhamra et al., 2011), Design for Healthy Behaviour (Ludden and Hekkert, 2014), the NADI model (Bijl-Brouwer, 2017), Service Design model for Self-Care (Aly et al., 2017), the Cleaner Cooking Intervention model (Jürisoo et al., 2018) and the Channel Design model (Wünderlich et al., 2019). There are also models that do not have specific stages, but they point out elements to generate insights for behavioural change, as in the case of Fogg's Behaviour model (Fogg, 2009), the Design with Intent (Lockton et al., 2010), Design for Socially Responsible Behaviour (Trompt et al., 2011) and Design the Built Environment for Mental Health Services (Liddicoat et al., 2020). Despite this difference in structure, there are also similarities. For example, in the Behavioural Intervention model, the stage of behavioural elements analysis, there is a connection with the NADI model, which proposes the analysis of needs and aspirations; with the Channel Design model, that analysis internal and external aspects of the user; with the Design the Built Environment of Mental Health Services that presents principles and questions to generate insights at the individual, contextual and relational level; with the Mindful Design model that analysis the interactions and the individual's intention; with Fogg's Behaviour model and Cleaner Cooking Intervention model, where both emphasize the individual's motivations and skills. At the intervention level stage, elements of the Design for Healthy Behaviour to guide, maintain and ensure change are evident. And, in the intervention stage, it can be associated with the Design for Socially Responsible Behaviour that mentions restriction, coercion, seduction and persuasion, as well as Design with Intent with the strategies to activate, motivate or restrict a behaviour. However, each model has its own structure and details about the elements that are possibly not considered in another model. These details can connect and contribute to improve the behavioural change process for sustainability. There are studies that connect specific parts of models and build a unique structure (Cash et al., 2017; De Medeiros et al., 2018; Irizar-Arrieta et al., 2019), however, with predominance in models focused on the development of physical artefacts. Thus, there is a gap to connect models focused on physical artefacts with models focused on services. Another gap is there are few empirical researches on the application of these models. In this sense, bringing this mapping and

the specific characteristics of each model to improve the application, can effectively contribute to sustainable development in order to accelerate progress towards the SDGs in times of crisis. The study contributes to SDG 12, target 12.9.

Keywords: Models, Design for Sustainable Behaviour, Sustainable Development.

1. Introduction

Each step towards sustainability involve a systemic discontinuity with pre-existing situations (Manzini, 2007). Unsustainable behaviour is responsible for countless environmental, economic and social problems. The use of certain products and services can negatively affect the sustainability (Lockton, et, al. 2010; Santos et al., 2019). In this sense, stimulating behavioural change is a discontinuity of pre-existing patterns of unsustainable behaviour and a contribution to sustainable development.

Design can play a crucial role in the societal transformations towards sustainability. There is different level that Design can contribute: from materials to products, product – service systems, social organizations and socio - technical systems (Ceschin and Gaziulusoy, 2019). Design has a strategic role in the process of changing sustainability-oriented behaviours. Products or services can be designed intentionally for this purpose (Niedderer et al., 2014; Trompt et al., 2011). For this aim, there are significant contributions the field of Design for Sustainable Behaviour.

Design for Sustainable Behaviour is a fields integration: User-Centered Design, Psychology and Sustainability (Daee, 2014). It was create to influence behaviour for sustainable direction during the use of a product (Lilley, 2009). So, there is a gap, a fewer researches that focuses on services to promote sustainable behaviour.

In order to propose solutions for more sustainable behaviours, a diversity of models for behaviour change was created. The behaviour change models identified in the Design for Sustainable Behaviour literature is a scientific advance in this theme. These are models with their own characteristics, but which also have similarities.

2. Methods

To identify the similarities and gaps of models applied to Design for Sustainable Behaviour, a narrative review of the literature was adopting. This research method is comprehensive and aim to deepen about the subject, in a short period of time, through non-systematic criteria (Rother, 2007; Casarin et al., 2020). It is considered an unsystematic bibliographic review.

In this sense, was searched for models applied to Design for Sustainable Behaviour. Publications suggested by experts on the subject were also considered. So, for this study, the following models were analysed: Mindful Design model (Niedderer, 2014); Behavioural Intervention model

(Bhamra et al., 2011); Design for Healthy Behaviour (Ludden and Hekkert, 2014); NADI (Needs and Aspirations for Design and Innovation) model (Bijl-Brouwer, 2017); Service Design model for Self-Care (Aly et al., 2017); Cleaner Cooking Intervention model (Jürisoo et al., 2018); Channel Design model (Wünderlich et al., 2019); Fogg's Behaviour model (Fogg, 2009); Design with Intent (Lockton et al., 2010); Design for Socially Responsible Behaviour (Trompt et al., 2011); Design the Built Environment for Mental Health Services (Liddicoat et al., 2020).

3. Results and Discussion

The models aim to provide a general understanding of how design can be used it. They propose a theoretical framework to use for solve some problem of sustainability (Niedderer, et al., 2014).

Some models have stages, as in the case of the Mindful Design model (Niedderer et al., 2014), Behavioural Intervention model (Bhamra et al., 2011), Design for Healthy Behaviour (Ludden and Hekkert, 2014), the NADI model (Bijl-Brouwer, 2017), Service Design model for Self-Care (Aly et al., 2017), the Cleaner Cooking Intervention model (Jürisoo et al., 2018) and the Channel Design model (Wünderlich et al., 2019).

The Mindful Design model highlights the role of consciousness as an essential factor for behaviour change. It aims to elevate the individual's awareness, reflection and judgment process about behaviour. In this sense, contribute to make responsible choices. The lack of this awareness reinforces unsustainable unconscious behaviours (Niedderer, 2013; Niedderer et al., 2014). The stages of the Mindful Design model consist of: (1) identifying the Design problem; (2) identify the potential of a Design solution; and (3) identify different forms of implementation (Niedderer, 2007).

Design for Behavioural Intervention model was created with the objective of reducing the negative social and environmental impacts caused by human behaviour, usually during the use phase of a product. Aims to contribute through the following stages: (1) identify the elements for behavioural change; (2) identify the levels of intervention; and (3) identify design interventions (Bhamra, et al., 2011).

The Design for Healthy Behaviour model is an adaptation of the Thanstheoretical model by Prochaska and Di Clemente (1993) with the focuses on healthy behaviour. It involves five stages to change behaviour: (1) pre-contemplation; (2) contemplation; (3) preparation; (4) action; and (5) maintenance (Ludden and Hekkert, 2014).

Cleaner Cooking Intervention (CCI) model is a structure used in the stove sector that aims to change behaviour with benefits in the dimensions of health, economics and environmental sustainability. The stages in this model are: (1) identify the techniques for behavioural intervention; (2) identify interventions; (3) identify the behavioural determinants; (4) identify the results; (5) identify the impact on sustainability (Goodwin et al., 2015; Jürisoo, et., Al, 2018).

The Service Design model for Self-Care was created to improve the provision of services that meet the needs categorized as primary care. It includes the following stages: (1) identify engagement; (2) elaborate the planning; (3) establish governance; (4) pilot implementation; (5) monitor, review and evaluate (Aly et al., 2017).

The NADI model (Needs and Aspirations for Design and Innovation) is represented by a four-layer structure: (1) solutions; (2) scenarios; (3) objectives; and (4) themes. Each layer is a stage towards understanding two factors associated with behaviour: needs and aspirations. Based on these information, aim to assist in the Design and Innovation process (Bijl-Brouwer and Dorst, 2014; Bijl-Brouwer and Dorst, 2017; Bijl-Brouwer, 2017).

Channel Design model aims to minimize or prevent the individual's state of vulnerability in their experience with service. It includes the following stages: (1) identify the determinants of the vulnerability; (2) identify vulnerability states and perceptions; (3) identify the strategy for Channel Design; and (4) identify the results of vulnerability (Wünderlich, et al., 2019).

Table 1. *Stages of Models*

Models	Stages
Mindful Design	(1) identify the Design problem; (2) identify the potential of a Design solution; (3) identify different forms of implementation.
Design for Behavioural Intervention	(1) identifying the elements for behavioural change; (2) identify the levels of intervention; (3) identify Design interventions.
Design for Healthy Behaviour	(1) pre-contemplation; (2) contemplation; (3) preparation; (4) action; (5) maintenance.
Cleaner Cooking Intervention	(1) identify the techniques for behavioural intervention; (2) identify interventions; (3) identify the behavioural determinants; (4) identify the results; (5) identify the impact on sustainability.
Service Design model for Self-Care	(1) identify engagement;

	(2) elaborate the planning; (3) establish governance; (4) pilot implementation; (5) monitor, review and evaluate.
NADI model	(1) identify solutions; (2) identify scenarios; (3) identify objectives; (4) identify themes.
Channel Design model	(1) identify the determinants of vulnerability; (2) identifying vulnerability states and perceptions; (3) identify the strategy for Channel Design; (4) identify the results of vulnerability.

According to these phases of the models for behaviour change, it is noticed similarities in the first phase of each model. In the Design for Behavioural Intervention, Design for Healthy Behaviour and Channel Design model, they are associated with the elements of human behaviour. In the Cleaner Cooking Intervention model, this analysis is verified in other phase (3).

In the Mindful Design model, identifying the problem phase, the focus, at first, is specifically on Design, which, consequently, generates information about human behaviour. Also, in the NADI model, this first phase is not explicit, although it is understood that information about behaviour is collected.

Also, it should be noted that the Design for Behavioural Intervention, Cleaner Cooking Intervention and Channel Design model have brought specific behavioural intervention. In addition to raising information about human behaviour, these models point the strategies to intervention.

There are also models that do not have specific stages, but they point out elements to generate insights for behavioural change, as in the case of Fogg's Behaviour model (Fogg, 2009), Design with Intent (Lockton et al., 2010), Design for Socially Responsible Behaviour (Trompt et al., 2011) and Design the Built Environment for Mental Health Services (Liddicoat et al., 2020).

Fogg's Behavioural model focuses on two main elements associated with behaviour change: motivation and ability. About these elements, it is possible identify the most appropriate behavioural intervention, that usually occurs through persuasive technologies (Fogg, 2009; Niedderer et al., 2014).

The Design with Intent model aims to assist the creative process of Design through cards method that are categorized into eight lenses that represent different visions for behavioural change:

architectural, error proofing, interaction, perceptual, cognitive, security, ludic and machiavellian. They are lenses that are associated with both individual and contextual factors behaviours (Lockton et al., 2010; Lockton, 2017).

Design for Socially Responsible Behaviour model is based on individual motivation and collective interests as main factors associated with behaviour. The individual's motivation and collective interests can result in two situations: being aligned or in conflict. Based on this information, the model points out dimensions, categories and strategies that can be used as references by Design to behaviour change (Trompt et al., 2011).

Design the Built Environment for Mental Health Services model proposes six principles that are associated with evidence in mental health care and service delivery. It aims to promote a more resilient and sustainable society. The model presents evidence of architecture as a factor associated with physiological, cognitive, emotional and functional satisfactory experiences to the customer. To achieve the desired results, Service Design operates on three levels based on evidence: individual, interpersonal and community (Liddicoat et al., 2020).

Table 2. *Main elements of models*

Models	Main elements
Fogg's Behavioural model	Motivation Ability
Design for Socially Responsible Behaviour	Motivation Collective interests
Design with Intent	Architectural Lens Error proofing lens Interaction Lens Perceptual Lens Cognitive Lens Security Lens Ludic Lens Machiavellian Lens
Design the Built Environment for Mental Health Services	Provide evidence-based best practices Provide reception and facilitate access to services Training and empowerment Creation of collaborative services Collaborative work with other services that contribute to treatment

	Facilitate interaction

It is noticed that Fogg's Behavioural model, Design for Socially Responsible Behaviour, Design with Intent and Design the Built Environment for Mental Services points internal and external elements associated with behaviour, as a way to promote a change. In the Design with Intent model, there is a special contribution to the creation of alternatives for behaviour change. As well, contribute to understanding of which elements may be associated with behaviour change.

The Design the Built Environment for Mental Health Services model points to six principles that contribute to behaviour change. Most are associated with external factors, but with influence on internal elements: it facilitates reception and facilitates access to services; training and capacity building; creation of collaboration services; collaborative work with other services that contribute to treatment; and facilitate interaction. It is noticed that these elements are offered by a service organization to improve the well-being of users. It should be noted that the principle of providing evidence-based best practices can connect with the Design with Intent model.

Despite this difference in structure, the models have other similar elements. For example, in the Behavioural Intervention model, the stage of behavioural elements analysis, there is a connection with the NADI model, which proposes the analysis of needs and aspirations; with the Channel Design model, that analyses internal and external aspects of the user; with the Design the Built Environment for Mental Health Services that presents principles and questions to generate insights at the individual, interpersonal and community level; with the Mindful Design model that analyses the interactions and the individual's intention; with Fogg's Behaviour model and Cleaner Cooking Intervention model, where both emphasize the individual's motivations and skills.

At the intervention level stage, elements of the Design for Healthy Behaviour to guide, maintain and ensure change are evident. And, in the intervention stage, it can associate with the Design for Socially Responsible Behaviour that mentions restriction, coercion, seduction and persuasion, as well as Design with Intent with the strategies to activate, motivate or restrict a behaviour. The Figure 1 points out the similarities.

However, each model has its own structure and details about the elements that are possibly not considered in another model. When integrated, these details can contribute to improve the behavioural change process for sustainability.

There are studies that integrate specific parts of models and build a unique structure (Cash et al., 2017; De Medeiros et al., 2018; Irizar-Arrieta et al., 2019). However, models can be integrated in other ways as well, with a view to specific sustainability benefits.

It is important apply the models in different contexts of the sustainability. In this way, more empirical results can be obtained and contribute to scientifically progress with the theme. There are few empirical researches on the application of these models.

Also, they can be integrated to generate other specific results, as in the case of services, a theme underexplored. The predominance of the identified models is in the development of physical artefacts. Adapt the strategies for behaviour change for applied in services it can be an alternative to innovation to Design for Sustainable Behaviour.

4. Conclusions

There is a diversity of models for behaviour change oriented towards sustainability. However, all this diversity of models can make decision making difficult in the Design process. In this paper, it was possible to gather models that have similarities in their structures: models that have stages and models that emphasize certain elements. Both contribute to Design for Sustainable Behaviour.

Bringing this mapping and the specific characteristics of each model to improve the application, can effectively contribute to sustainable development in order to accelerate progress towards the SDGs in times of crisis. Design for Sustainable Behaviour contribute to SDG 12, target 12.a: Support developing countries to strengthen their scientific and technological capacities to move to more sustainable patterns of production and consumption.

For future studies, it is recommended to apply existing models for behaviour change to create solutions to specific problems related to sustainability. Also, it is recommended to propose a model that can integrate the strategies to behaviour change for application on services, theme underexplored. The adaptation of the knowledge existent in the models to the scope of services, as well, it is a possibility.

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Posters

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Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis
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Deposit collection and recycling system as an instrument supporting sustainable plastic packaging market. Polish case study.

Introduction

As a result of actions taken to implement the EU plastics strategy for packaging (100% recyclable by 2030), dynamic changes are visible primarily at the stage of designing and improving collection and recycling methods. In Poland the principle of extended producer responsibility (EPR) is planned, which in the case of beverage packaging waste will be implemented through the introduction of a general deposit system. The aim of the study is to present the way the deposit collection and recycling system can work in Poland and the benefits of its introduction.

Methods

The concept of an innovative comprehensive system of waste collection and recycling has been developed by EcoTech System start-up for Maspex Group and will be introduced as a pilot within a project implemented together with MEERI PAS with the support of the Polish Funding Agency. The system consists of a prototype network of connected devices and a system in the form of networks of VM and RMV type devices and central IT system „EcoTech System platform".

Results and conclusions

System characteristics: [1] Positive motivation of the users (by loyalty programs based on the analysis of data from the pilot) in comparison to the current system in Poland based on negative motivation (fees for segregated and unsorted waste) [2] Integration of RVM and VM devices [3] Creating a solution enabling the simultaneous collection of deposit and non-deposit packaging as well as damaged packaging / packaging without EAN code [4] Development of mechanisms responsible for identifying the producer of a given packaging / material fraction [5] Wide range of stakeholders (residents, local governments, recycling companies and business partners).

Potential benefits for producers:

Commer-cial	▪ additional vending points ▪ acquiring attractive locations ▪ activation of vending consumers
PR	▪ getting ahead of the administration's actions - incentive instead of deposit ▪ implementation of the project in accordance with social responsibility ▪ response to consumer trends and expectations ▪ possibility of practical use in social actions
Marketing	▪ possibility of pro-ecological involvement of brands ▪ identification and direct communication with consumers ▪ possibility of promoting the company, brands and products - branding, multimedia, promotion of new products, etc.

The project is at an early stage so there are no pilot results yet.

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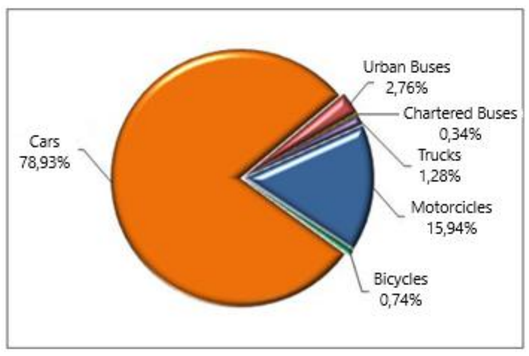
BEHAVIORAL THEORIES. PSYCHOLOGICAL FACTORS THAT INFLUENCE THE INTENTION TO REDUCE THE CAR USAGE

INTRODUCTION

From the incorporation of well-founded theories to the process of analysis of experimental studies of a predominantly empirical character, the theoretical basis was established to outline and base these studies' results (Bamberg & Schmidt, 2003). Based on the study carried out by Abrahanse (2009), this work used the constructs of the Theory of Planned Behavior of Ajzen (1985), the Norm Activated Model of Schwartz (1977) and the habit variable described in the work of Chen & Chao (2011), to establish as their main objective, which psychological factors are considered by the drivers of the city of São Paulo – Brazil, when opting for reducing the car usage in daily commuting.

As another world metropolis, São Paulo City has problems related to the amount of cars in circulation, such as pollution and daily huge traffic jams. The Inventory of Atmospheric Emissions from Road Passenger Transport of São Paulo (Institute of Energy and Environment [IEMA], 2018) indicated that the municipality of São Paulo systematically exceeds the limit established as a standard for air quality. In 2019 São Paulo was pointed as the 2nd most congested city of Brazil and the 5th in the world (Inrix, 2020). Picture 1 shows how was the distribution of the automobile fleet in 2018:



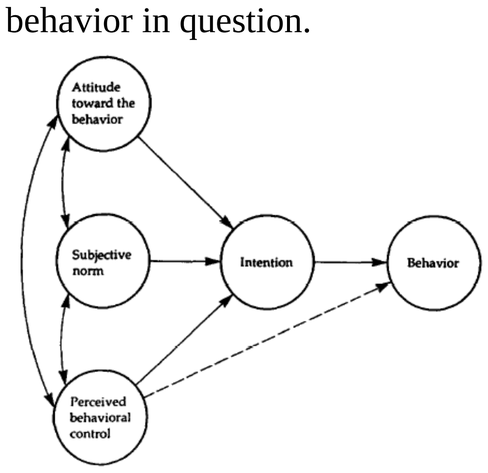
Picture 1 – Automobile fleet at SP em 2018
Source: Adapted from CETESB in http://www.cetsp.com.br/media/969813/relatorio-msvp-2018.pdf

Understanding the most relevant psychological factors that make drivers consider change their drive behavior to an alternative way, can help public administrators to incorporate these factors in the development of most efficient mobility plans.

THEORETICAL BACKGROUD

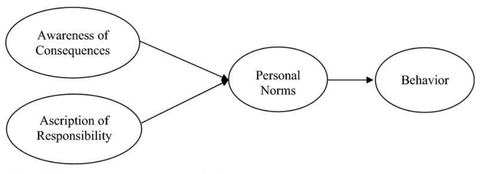
Since the 2000s the Theory of Planned Behavior from Ajzen - TPB (1985) and the Norm Activated Model - NAM from Schwartz (1977) became more usual in reaserches explaining behaviors related to car usage.

The theory of planned behavior uses three psychological mechanisms to explain the formation of the intention to assume a certain behavior (Olsson et al., 2018). The attitude is defined as the individual evaluation, positive or negative, about taking on a behavior. Subjective norm refers to the perception that the individual has about how his social environment - family, friends, society - evaluates the fact of assuming a behavior. The perceived behavior control is defined as the individual analysis of how much to assume or not a certain behavior is under his control (Ajzen, 1985) or in other words, how easy or difficult it is for the individual to carry out the behavior in question.



Picture 2 – Theory of Planned Behavior
Source: The theory of planned behavior. Ajzen, 1991. in: *Organizational Behavior and Human Decision Processes* 50 (2), 179–211. DOI: 10.1016/0749-5978(91)90020-t.

The NAM is characterized by explaining prosocial and altruistic behaviors (Bamberg & Schmidt, 2003) and like TCP, NAM is based on three psychological mechanisms: personal norms, knowledge of consequences and assignment of responsibility (Schwartz, 1977).



Picture 3 – Norm Activated Model
Fonte: adaptado de Interactions Between Perceived Behavioral Control and Personal-Normative Motives. Wall et al. (2008). Em: *Journal of Mixed Methods Research, 2*(1), 63-86. DOI: 10.1177/1558689807309967

HYPOTHESIS

H1 - There are positive relationships between TCP constructs towards the intention to reduce car usage;

H2 - There are positive relationships between NAM constructs towards the intention to reduce car usage;

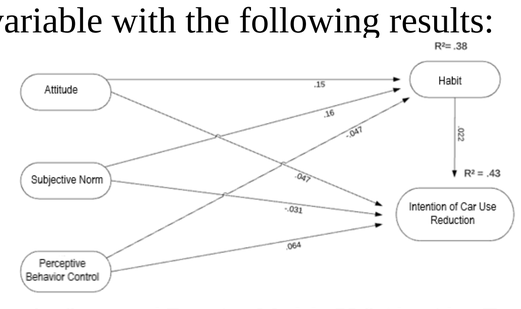
H3 - Habit presents a positive correlation with the variable attitude from TCP towards the intention to reduce car usage;

H4 - Habit presents a negative correlation with the variable perceived behavior control from TCP towards the intention to reduce car usage.

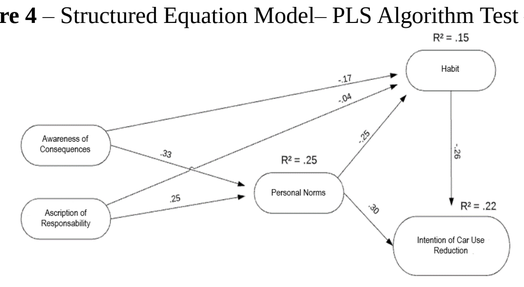
METODOLOGY AND RESULTS

With an exploratory quantitative analysis of primary data, the research instrument was built with 30 questions grouped into 21 questions elaborated in order to capture the perceptions of its respondents. With 640 hits, it was fully answered in 260 of them. The snowballing distribution model proved to be appropriate for data collection. The research instrument was accessible for 15 days and it went beyond the borders of the city of São Paulo. In addition to reaching several cities in the interior of the state, it reached other states of Brazil as well as countries in North America, Europe, Oceania and Asia

Data analysis was carried out through the structured equation model - SEM considering the variables of each theory and the addition of the habit variable with the following results:



Picture 4 – Structured Equation Model– PLS Algorithm Test – TPB



Picture 5 – Structured Equation Model– PLS Algorithm Test – NAM

CONCLUSION

The observed data related exclusively to the TCP constructs, presented high factor loadings in relation to their respective constructs, with the model explaining 42% of the variance. On the other hand, only the perception of behavioral control was statistically significant in relation to the intention to reduce. With this result, H1 was partially rejected once attitude and norm subjective presents negative correlation with intention of reduction.. The observations referring to NAM also presented high factor with the model explaining 21% of the variance, instead the result was lower than the TCP, all constructs, including the habit variable, were significant confirming this way H2. Habit has positive correlation with attitude and negative correlation with perceived behavior control from TCP confirming this way H3 and H4.

The NAM variables have a direct relationship with the individuals' internalized moral considerations and the TCP variables are more closely related to personal interests. In this way, for the elaboration of public policies that aim to reduce the usage of cars, is important to consider strategies that increase the individual's perception in relation to the control of the action. The perception of vantage is also fundamental for reducing the effect of the habit. With negative correlations regardless of the theory analyzed, it is possible to infer that car usage is seen as a shortcut. Finally, the constructs of NAM indicated that intensifying campaigns that emphasize the impacts of the car usage, as the level of air and noise pollution, congestion and its effects, in addition to the influence that each individual exerts on these effects, the level of activation of personal norms rises, thus increasing the propensity to reduce car usage.

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Janice Accioli Ramos Rodrigues
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Prosumer in the fashion context: implications for enabling a distributed economy in a pandemic scenario

The pandemic has shown that more distributed economies offer more resilience to global crises. Indeed, from a sustainable perspective, practices and strategies that foster local production of goods and provision of services, with units integrated into networks, do contribute to reduce transportation, valuing local knowledge and resources and contribute to achieve higher social cohesion. In this paper the authors explore the concept of prosumer as a strategy to achieve a more distributed economy in the fashion sector, with a focus on the social dimension of sustainability.

Prosumer can be defined as the individual that integrates the roles of the producer and consumer.

The study involved a systematic literature review and an evaluation of multiple case studies, using pattern matching analysis. The theoretical framework compares the practice of these prosumer cases against the heuristics associated with distributed economy and the impacts on sustainability identified in the literature.

In this study the authors have focused on the six types of prosumer archetypes proposed by Lang et al. (2020):

DIY prosumers;
self-service prosumers;
customizing prosumers;
collaborative prosumers,
monetized prosumers,
and economic prosumers.

The findings have demonstrated that prosumer experiences are aligned to distribute economy and do present direct win-win benefits on the social dimension of sustainability: a) it can foster a culture of mutual help and empowerment in the fashion sector, enhancing the system social resilience;

b) It is a viable strategy to promote higher socio-economic equity via the fashion products and services, offering more opportunity to marginalized people to get involved on the provision of their own needs, thus accepting diversity;

c) It encourages the sharing of knowledge and skills in the fashion sector, providing a better environment for wide competence building;

d) it values local culture, knowledge and capabilities on the Fashion sector, by using local skills and native knowledge, enabling higher customer involvement into the Design process;

And finally e) on an appropriate context, it can contribute to promote social cohesion among local stakeholders, with a better cultural fit of products/services, creating meaningful and long-lasting relationships with customers, promoting mutual trust at local level.

All multiple case studies have shown that in order to achieve these social impacts, particularly during a pandemic, it is critical the wide availability of communication and information technologies.

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"Please Reuse Your Towels": Guest Insights of Green Practices in the Hotel Industry

Introduction:

Starting with the analysis of literature, we propose a conceptual framework to investigate whether green practices implemented by the Italian "Legambiente Turismo" certified hotels contribute significantly to the formation of guest

positive behavioural intention toward green hotels. Even if little research has been conducted on this topic, understanding the role of hotels' environmental practices is pivotal in the hotel decision-making

process and strategy. To clarify this point, a survey was conducted with guests of two Italian hotels awarded with the ecolabel, and 335 questionnaires were usable and employed in the analysis, adopting

Partial Least Square Structural Equation Modelling (PLS-SEM) to test the hypotheses.

Hypotheses:

H1: Guest environmental concern influences guest perception of hotel green practices

H2: Guest environmental concern influences guest perception of hotel environmental communication

H3: Hotel environmental communication influences guest perception of hotel green practices

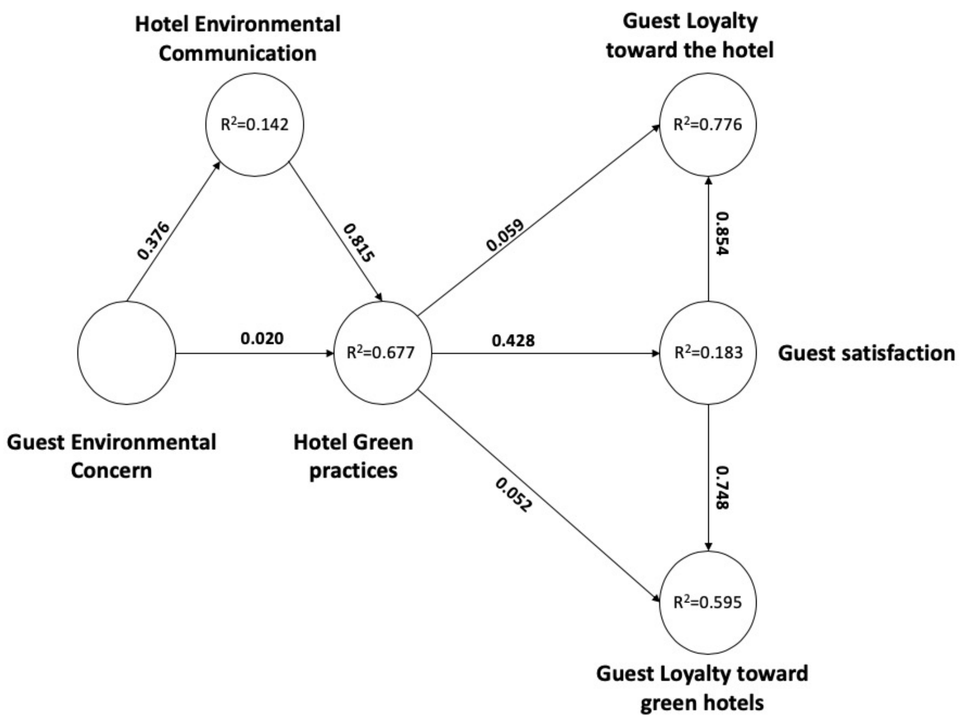
H4: Hotel environmental practices positively influence guest loyalty toward the hotel

H5: Hotel environmental practices positively influence guest loyalty toward green hotels

H6: Hotel environmental practices positively influence guest satisfaction with the hote

H7: Guest satisfaction is a significant antecedent of guest loyalty toward the hotel

H8: Guest satisfaction is a significant antecedent of guest loyalty toward green hotels



Hypotesis	Accepted/Rejected
H1	Rejected
H2	Accepted
H3	Accepted
H4	Rejected
H5	Rejected
H6	Accepted
H7	Accepted
H8	Accepted

Methods:

A survey was developed and administered to the guests of two hotels to collect data and measure the constructs in the research model. 500 questionnaires were sent to two Italian hotels awarded with the Legambiente

Turismo ecolabel. Eventually, 335 questionnaires were usable and employed for the subsequent analysis (210 from Hotel A and 125 from Hotel B). Partial least squares structural equation modelling (PLS-SEM) was used to test the proposed hypotheses. SmartPLS (V.3.2.8) software was employed to build models and assess their validity.

Discussion and conclusion:

The Partial Least Square Structural Equation Modelling (PLS-SEM) analysis leads to accept five out of the eight hypotheses tested. Results from the model testing show the role played by guest environmental concern in influencing guests' perception of hotels' green communication. Moreover, the model also confirms that guest perception of hotel environmental communication has a positive influence in guest perception of green practices implemented. The model does not confirm the direct relationship between guest environmental concern and green practices appreciation. Indeed, in order to be recognized, green practices need to be communicated. Additionally, results from the model testing suggest that the hotels environmental commitment is positively recognized by customers, influencing their satisfaction. However, this study found that there isn't a direct positive effect between hotels' green practices and loyalty towards the hotels and towards green hotels as customer satisfaction may fully mediates the relationship between green practices and loyalty towards the hotel and towards green hotels

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Sustainable practices in the hotel industry: A systematic literature review

Summary:

The paper explores the body of literature on sustainable practices in hotels, revisiting 600 articles, collected through the Scopus databases, and evaluating it using specific structural dimensions to group the selected literature into analytical categories. Several studies reviewed green and sustainability research in hospitality. With respect to past reviews produced by other scholars, this study contains various novelties that provide added value to better understand the topic under investigation. First, it explores the topic with a systematic approach to provide an exhaustive and comprehensive analysis of the phenomenon with rigorous and reproducible research criteria. Second, it includes a wide spectrum of scholars' publications (600 papers), in comparison with other reviews previously produced and it specifically explores the research about sustainable practices in hotels. Additionally, the investigations on the topic have considerably increased during the last years, and this work provides an updated overview on this research field. Finally, the paper presents the main limitations of the study and identifies opportunities for future research.

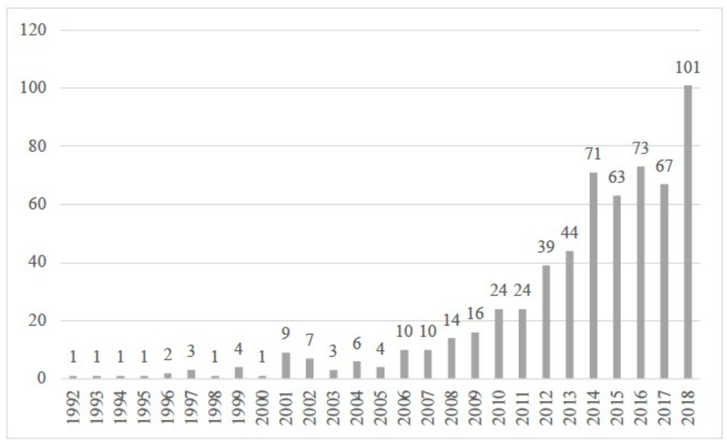

Figure 1. Distribution of publications per years.

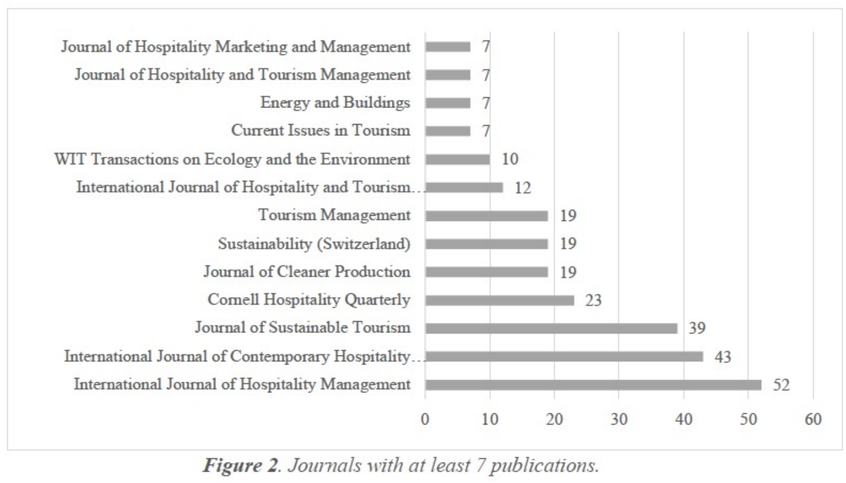

Figure 2. Journals with at least 7 publications.

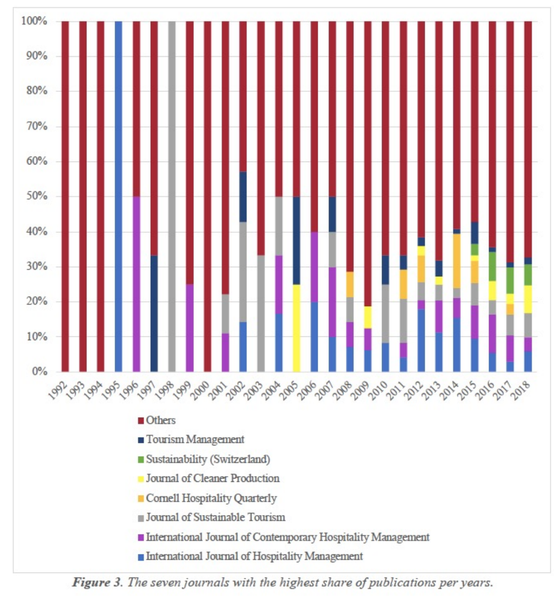

Figure 3. The seven journals with the highest share of publications per years.

Network analysis:

To further analyse the database results a graphical mapping based on bibliographic material was performed. The bibliographic network analysis has been carried out through the VOS viewer software (version 1.6.11). This free software, developed at Leiden University, allows to make maps to visualize bibliometric network data based on the Visualisation Of Similarities (VOS) technique.

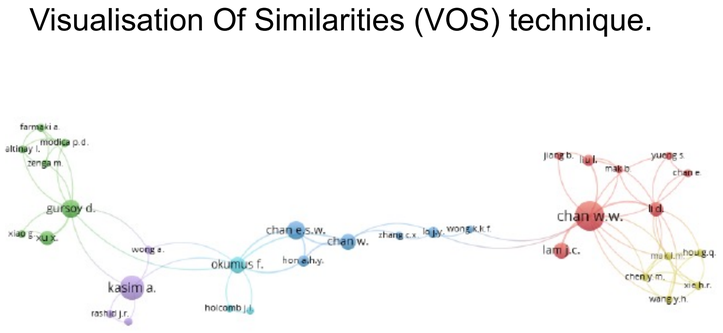

Figure 4. Co-authorship network map of authors publishing on green hotels.

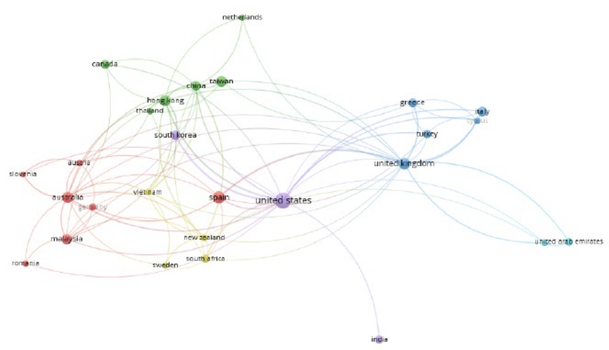

Figure 6. Co-authorship: Network of collaboration among countries.

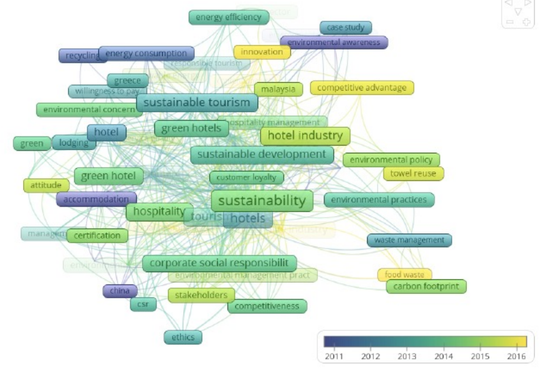

Figure 9. Co-occurrence network map of authors' keywords with overlay visualization.

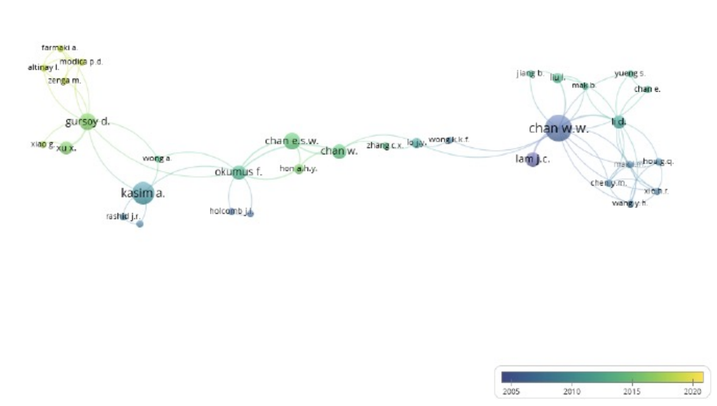

Figure 5. Co-authorship network map of authors publishing on green hotels with overlay visualization.

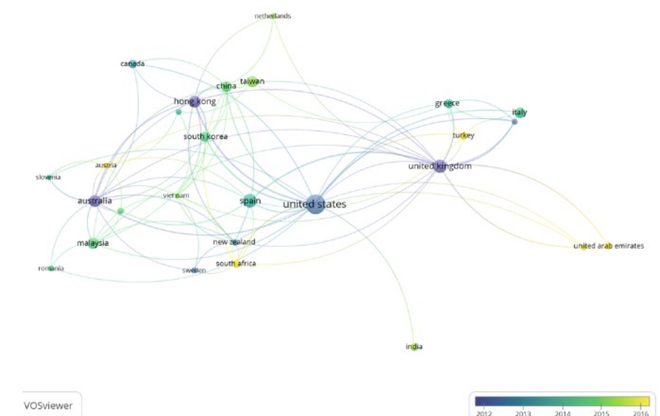

Figure 7. *Co-authorship: Network of collaboration among countries with overlay visualisation.*

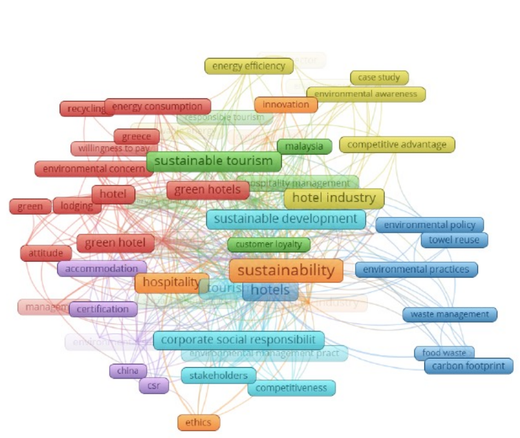

Figure 8. *Co-occurrence network map of authors' keywords.*

Discussion and conclusions:

This systematic literature review has highlighted past, present and future lines of research on sustainability research in the hotel industry. The analysis has shown as green hotels have been a hot topic over the last years. Scholars have dedicated growing attention to the topic and publications have grown constantly over the years. This topic has been mostly discussed in hospitality and tourism-related journals. However, also journals dealing with sustainability and cleaner production and consumption have been interested in green hotels research such as Sustainability and Journal of Cleaner Production. Looking at articles published in non-hospitality and tourism journals, authors' affiliation is mainly from business studies and engineering departments all over the world. However, from the analysis emerged that most of the studies on green hotels are published by authors based in the United States, the United Kingdom, and Spain. Moreover, looking at the co-authorship network this research has shown as US scholars are in the centre of this network between Spanish and British scholars.

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REVIEW ON MODELS APPLIED TO DESIGN FOR SUSTAINABLE BHEAVIOUR

INTRODUCTION

Each step towards sustainability involve a systemic discontinuity with pre-existing situations (Manzini, 2007). Unsustainable behaviour is responsible for countless environmental, economic and social problems. This research aims to analyze models applied on Design for Sustainability Behavior in order to identify gaps and similarities in these. In this sense, contribute to facilitate decision-making in the creative process of Design.

METHOD

To identify the similarities and gaps of models applied to Design for Sustainable Behaviour, a narrative review of the literature was adopting. This research method is comprehensive and aim to deepen about the subject, in a short period of time, through non-systematic criteria (Rother, 2007; Casarin et al., 2020).

RESULTS AND DISCUSSION

RESEARCH QUESTION:

What are the similarities and gaps of models applied on Design for Sustainable Behaviour?

REVIEW ON MODELS APPLIED TO DESIGN FOR SUSTAINABLE BEHAVIOUR

SIMILARITIES	FOGG'S BEHAVIOUR MODEL (FOGG, 2009)	DESIGN WITH INTENT (LOCKTON ET AL., 2010)	BEHAVIOURAL INTERVENTION MODEL (BHAMRA ET AL., 2011)	DESIGN FOR SOCIALLY RESPONSIBLE BEHAVIOUR (TROMPT ET AL., 2011)	MINDFUL DESIGN (NIEDDERER, 2014)	DESIGN FOR HEALTHY BEHAVIOUR (LUDDEN AND HEKKERT, 2014)	SERVICE DESIGN MODEL FOR SELF-CARE (ALY ET AL., 2017)	NADI MODEL (BIJL-BROUWER, 2017)	CLEANER COOKING INTERVENTION MODEL (JÜRISOO ET AL., 2018)	CHANNEL DESIGN MODEL (WÜNDERLICH ET AL., 2019)	DESIGN THE BUILT ENVIRONMENT FOR MENTAL HEALTH SERVICES (LIDDICOAT ET AL., 2020)
USE PHASES			✓		✓	✓	✓	✓	✓	✓	✓
POINT OUT MAIN ELEMENTS	✓	✓		✓							
BEHAVIOURAL INTERVENTION MODEL (BHAMRA ET AL., 2011) — PHASE OF BEHAVIOURAL ELEMENTS ANALYSIS	✓		✓		✓			✓	✓	✓	✓
BEHAVIOURAL INTERVENTION MODEL (BHAMRA ET AL., 2011) — INTERVENTION LEVEL PHASE			✓			✓					
BEHAVIOURAL INTERVENTION MODEL (BHAMRA ET AL., 2011) — INTERVENTION PHASE	✓	✓	✓	✓							

GAPS

MORE EMPIRICAL RESEARCHES APPLYING THE MODELS

EXPLORE THE SERVICES TO PROMOTE SUSTAINABLE BEHAVIOUR

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Paraná Federal University (UFPR), Curitiba, Brazil

CONCLUSION

- Propose a model that can integrate the strategies to behaviour change for application on services, theme underexplored;
- The adaptation of the knowledge existent in the models to the scope of services.

5. Production, Consumption and Innovation

5f. Food security and agriculture

Abstracts

11

ANALYZING THE INDICATORS OF THE HOUSEHOLDS FOOD INSECURITY IN FRANCIS BAARD DISTRICT MUNICIPALITY OF THE REPUBLIC OF SOUTH AFRICA.

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[1]Centre for Sustainable Agriculture, Free State University,, Bloemfontein, South Africa. [2]National Agricultural Marketing Council & Centre for Sustainable Agriculture, Free State University, Pretoria & Bloemfontein, South Africa

Abstract

Food insecurity is a growing concern worldwide. However, to ensure that the households are food secured, various tools to measure and evaluate food indicators should be developed using the food indicators measurement. Currently, minimal studies focus on the development of household food insecurity indicators. The purpose of this study is to evaluate and assess the indicators that are associated with food insecurity in Francis Baard district municipality. The study followed a quantitative research approach, where descriptive, correlational, and explanatory research design was used. A simple random sampling technique was utilized for this study, and 536 respondents constituted the sample size. Of the 536 households, 70.2 % and 89.2% of households are large with four members and more, are poorly educated. The results revealed that there is a positive and strong correlation between not having food at all [r= (534) = 0.452, p < 0.001], households members eating few meals [r= (534) = 0.439, p < 0.001] and lack of enough food for the households. These results imply that a higher number of households without food at all in this municipality could decrease food security by 11.6% (B = -0.499, p = 0.030). The household members who go to sleep hungry could decrease household food security by 11.2% (B = -0.547, p = 0.032). Households' food security indicators should be critical in assessing food insecurity in the Francis Baard municipality. The high number of dependents in households makes households' access to food very difficult. It is recommended that household agriculture be promoted and supported to reduce food insecurities.

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Gender-dynamics of Household Food Security under the changing climatic conditions in Nasarawa state, Nigeria.

Mr Abraham Akyala
Obafemi Awolowo University, Ile-ife, Nigeria

Abstract

Gender inequalities and climate change are disrupting global household food security systems. Although climate change and food insecurity affect everyone within the household system, their effects are being felt in gendered ways. North-central Nigeria has been experiencing a potential reduction and both plant and animal because of a decrease in rainfall and an increase in temperature. Men and women, boys and girls are both vulnerable to the present and future climate events disrupting the households' food security systems in north-central Nigeria. The study adopted a sequential-mixed method to investigate the underlying trajectories of power-relations in household food security under the changing climatic condition in Nasarawa State, Nigeria. The study examined the effects of climate change on the food security system,
examined the household levels of food security, and assessed the gender-differential household provisional and feeding practices to achieve its aim. The study employed both quantitative and qualitative data, which were being obtained from primary and secondary sources. It
included meteorological data which was being retrieved from the Nigeria Meteorological Agency (NiMet) archive and interview responses from respondents using an in-depth interview format. The study used
the meteorological data that are being obtained for the period of 35 years 1984 to 2019, also 40 households were being sampled respondents for the study using a purposive gender-analytical sampling technique. The study attached a spatial reference to the meteorological data and
showed the variation of rainfall and temperature over the study area using an Analysis of Variance (ANOVA) using the Statistical Package for Social Sciences (SPSS). Time series analysis was being done using R statistics, which showed the trend and pattern of climate events
from 1984 to 2019, while data obtained from interviews were being transcribed and analysed using thematic content analysis. Findings showed a significant effect of climate change on the household food security systems in the study area. It also found out that gender-norms are influencing household food security, and there is a low level of food security in the study area because of their low livelihood options. These livelihood options include education, health, income, and expenditure and are being influenced by gender. It further found out that female-headed households have lower levels of food security compared to male-headed households. Male-headed households have more access to food supply compared to female-headed households. More findings showed that female-headed households have better feeding practices compared to male-headed households. The study concludes that there is a significant gender gap in household food security under a changing climatic condition. The study recommends gender-integration in agriculture and climate policies and mainstreaming in projects and programs.

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Diagnosis and baseline refrigerant use in the Colombian meat, dairy, and fruit and vegetable industries

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Abstract

This paper presents the characteristics and baseline use of refrigerant gas in the meat, dairy, and fruit and vegetable sectors. The data are based on different sources of primary information starting from a survey of the companies that constitute the three chains in different departments of Colombia, a review of secondary information to identify the use of refrigerant gases, especially in the food sector, interviews with experts on refrigeration systems, consultations with companies that provide refrigeration services and a review of the importation of these gases into the country. The results show that the management, use and handling of refrigerants is similar among the three productive sectors and that the most commonly used refrigerant gases are R22, R404, R507, and R134A. Moreover, 80% of refrigerants are traditional and 20% are natural refrigerants, such as nitrogen and CO_2, especially in large companies that have managed to migrate to cleaner technologies that have less of an impact on the environment. The food sector with the highest consumption of refrigerant gas is the meat industry, followed by the dairy and fruit and vegetable industries. Except in the fruit and vegetable chain, the refrigerant charge for these sectors is less than 100 kilograms and refrigerant changes are performed in a period of six to twelve months. A consensus was reached that preventive maintenance and timely detection of leaks is essential for the efficient and rational use of refrigerant, and its reuse is not a practice that is evident in these sectors. The findings of this study are important for analysing how companies in the food sector, especially in the above three sectors, have implemented environmentally friendly practices related to vital refrigeration processes for the processing and conservation of products and for identifying controls and maintenance processes that generate refrigerant changes and reduce environmental impacts.

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India's Pursuit For Zero Hunger: Achievable Or A Distant Dream?

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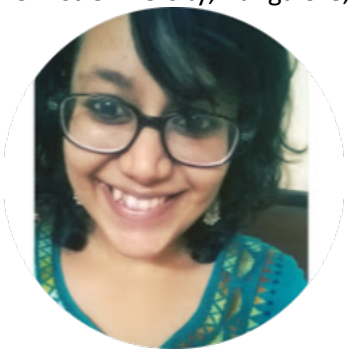

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Abstract

The existence of either stagnant or reversal on several child nutrition parameters is the cardinal observation from the recently released data (Phase I) by the National Family Health Survey (NFHS). The NFHS provides vast and diverse data that are useful for studying the parameters of child nutrition in the Indian states and provides an excellent empirical basis for further investigation for certain concerns such as accessibility of services, quality education, and the implementation of policies that have a direct effect on achieving zero hunger.

The two eyebrow-raising trends developed conclusions from phase I data are - Firstly, the fact that children born between 2014-2019 are more malnourished than the previous generation, with stunting representing acute malnutrition. Secondly, the fact that Phase II data was disrupted by the outbreak of the Covid-19 pandemic, considering which, the results can only be predicted to be worse or stagnant (best case scenario). The authors attempt to study India's chase and hurdles in achieving the "zero hunger" (Goal 2, SDGs). Majority of laws and policies in India, project literacy as the core theme for all human emancipation. Taking into account, which the authors would attempt to study the intersection between quality education and zero hunger, as a cause/action phenomenon.

For the purpose of the present study, the authors shall consider relevant data from two of the most and least literate states in India as per Goal 4 (Quality education) of SDGs. With India's average literacy rate at about 77.4% (as of 2020), states like Kerala, Himachal Pradesh and Andhra Pradesh, Bihar will form the focus of our study. Trends and preliminary observations show India's dream of zero hunger to be not only distant but also impossible to achieve by 2030 if the issue remains to be at the boundaries of law and policy.

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THE CARBON FOOTPRINT OF MEALWORMS AS AN ALTERNATIVE PROTEIN SOURCE: A DIETARY TRANSITION PERSPECTIVE

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Abstract

Eradicating hunger and achieving food security remains a challenge, more so in the wake of the COVID-19 crisis. At the global level, hunger and food insecurity have been on the rise. The situation is likely to get worse owing to economic slowdowns and disruptions caused by a pandemic-triggered recession.

Alternative food and feed sources are needed for the continually growing world population, which makes it necessary to produce ever greater quantities of food with negative effects on the environment

Food production processes, in fact, contribute consistently to global anthropogenic GHG emissions. Food choices, therefore, indirectly affect climate change. According to previous studies (Oonincx & De Boer, 2012; De Leo et al., 2015), mealworms show great potential as a sustainable choice for future food systems.

In this context, the present study, in order to verify the sustainable advantages of a hypothetical food dietary transition, evaluates the emissions deriving from the production process of mealworms and compares them with those deriving from other animal-derived protein sources.

The methodology adopted is the Carbon Footprint Assessment, which measures the direct and indirect GHG emissions across the whole life cycle of a product. The study is based on data extracted from Oonincx and de Boer (2012). The latter analyzed a Dutch company which produces two species of insects (*T. molitor L.* and *Z. morio L.*).

The research findings show that mealworms could represent a sustainable alternative to commonly used animal-derived proteins, potentially being a progress option towards SDGs in times of crisis. The sustainability aspects linked to the responsible production and consumption of edible insects also depend on other important factors. Mealworms are edible for 100% of their body mass, unlike other animals of which about 60% most of the mass is thrown away during slaughter (Vries & De Boer, 2010). Furthermore, CO_2 emissions from the production of feed for farm animals are much higher than those needed to feed mealworms. It has also been shown that mealworms do not produce CH_4, which is increasingly produced in the livestock sector. Further advantages are related to the fast growth and reproduction rate of edible insects.

The study is original because highlights the relevance of a transition to dietary models which could ensure both food security (SDG 2.4 target) and responsible production and consumption in a life cycle

perspective (SDG 12.2 target). Further research developments could provide insights into making the mealworms breeding more sustainable from a supply chain perspective or into proposing other options of sustainable dietary model addressed to defeat hunger.

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Local Public Policies for a Sustainable Food System: assessing the role of the Municipality of Viseu in Portugal

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Abstract

Food has always been present in our lives, however, only recently its impacts have been reflected and understood in terms of health, society, and the environment. The increasing population growth leads to a constant demand for food and, thus, a greater exploitation of raw materials, jeopardizing the sustainability of the planet. In this way, public policies play a fundamental role in ensuring a better quality of life for citizens and, at the same time, guaranteeing the sustainability of the food systems. This transition needs to be particularly promoted at the city level due to the benefits it can bring to change the way we produce, transform, distribute, consume, and waste food. To reverse our unsustainable trends it is critical to have strong institutions and policies at the local level to ensure better information and awareness systems, administrative and government capacity, integrated local government functions and particularly strong political commitment and strategies to shift towards healthy and sustainable diets. Through this research work, we intend to reflect on the role of local food policies in the promotion of more sustainable food systems in Portugal, with an in-depth case study of the Municipality of Viseu. In this way, we seek to understand the role of the municipality of Viseu in the design and implementation of sustainable food policies, to identify the initiatives developed and understand whether these involve different actors of the local food system. To this end, a qualitative case study method based on semi-structured interviews was used to understand the perception of local actors regarding the policies implemented by the municipality. Results show that the municipality has implemented some food policies, with the development of few initiatives with special prominence in recent years, but that this policy area is still not considered as a priority in the municipality, reflecting the lack of government structures and the articulation of the policies developed. This case study analysis allows us to understand major policy gaps and propose a set of recommendations for the Municipality of Viseu, as well as certainly other Municipalities in Portugal, so that local policies are reinforced to transform the food systems to more sustainable ones.

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Transformations towards sustainable food systems – levers of change from a stakeholder perspective in light of the Farm to Fork Strategy

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Abstract

The United Nations' 2030 Agenda calls for transformative change throughout all societal systems where transformations towards sustainable food systems is pointed out as one of the core challenges. At a European level, the need for more sustainable food systems has been recognised in the Farm to Fork Strategy, launched in 2020 as a part of the European Union's Green Deal. Furthermore, it is evident that the new Common Agricultural Policy (CAP) for the European Union needs to be aligned with the Farm to Fork Strategy and the Sustainable Development Goals.

The Swedish ambition to be one of the leading countries on the pathways towards reaching the United Nations' 2030 Agenda motivates that attention is directed towards food production and consumption. This study aims to identify features of potential food system transformations towards sustainability based on perspectives of Swedish food system stakeholders and analyses these in light of the European Union's Farm to Fork Strategy. Drawing on theories of complex systems transformations, different levers of change in food systems are identified, exploring drivers and barriers for transformations as well as associated roles, responsibilities and agency related to these changes. The study employs visualization supported focus groups with stakeholders that are engaged in farming, food production, as well as rural and agricultural development on the local and regional scale in Sweden. The results of this study indicate that there is a call for a new paradigm where food is valued in other terms than monetary and a shift of mindsets and understanding of food and food production. An identified key feature of societal transformations is Swedish food sovereignty and security and the associated values and concepts of local and sustainable food production and consumption. While significant focus relies on producers and consumers, the intermediate processes, such as retail, were assigned a more powerful role, which might be of importance for transformative changes. The study identifies levers of change for societal transformations towards sustainable food systems, discussing how these transformations could be facilitated or governed and what role the implementation of the Farm to Fork Strategy and the new CAP can play in a Swedish context.

This abstract relates to the following SDGs and SDG-targets:

SDG 2; all targets

SDG 8; 8.3, 8.4

SDG 12; 12.1-12.8, 12.A

SDG 13; 13.1, 13.3

SDG 14; 14.1

SDG 15; 15.1, 15.5, 15.A

SDG 17; 17.6, 17.8, 17.9, 17.14, 17.16-19

This contribution relates to the conference topic “Accelerating progress towards SDGs in time of crisis” as features for transforming food systems towards sustainability are identified in a Swedish and European context, highlighting perspectives on food security, food sovereignty as well as environmental and resource use challenges.

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Knowledge Management in the Food, Energy, Water Nexus: Accomplishments from the Food and Agriculture Organization's (FAO) Community of Practice on Food Loss Reduction

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Abstract

Approximately 690 million people worldwide experience chronic hunger. In 2019, the Food and Agriculture Organization (FAO) of the United Nations estimate 1.3 billion tons of food is lost or wasted each year. This level of food loss and food waste equates to one third of all the food produced for human consumption alone and translates to an annual loss of $680 billion US dollars. Issues of food insecurity and global food waste are directly connected. Consequences of food waste involves wasted land, labor, water, and energy used in the food production process. The food waste crisis is one reason the world is not on track to achieve Sustainable Development Goal (SDG) #2, zero hunger by 2030.

Complexities related to food loss require a comprehensive, global approach to identify and develop feasible solutions in various geographic areas and contexts. In response to the food loss crisis, the FAO developed a community of practice (CoP) on food loss reduction to serve as a global convener and an integrator of knowledge related to post-harvest loss (PHL) reduction. As a product of continuous interaction, CoP's expand knowledge and expertise through three identifiable communicative enactments of mutual engagement, negotiation of a joint enterprise, and shared repertoire. This CoP launched by the FAO offers a platform to facilitate linkages and information sharing amongst stakeholders, relevant networks, projects, and programs on post-harvest management. This case study examines the FAO's use of a CoP as an approach to generate knowledge related to the complexities involved in mitigating post-harvest food loss.

The researchers use a discourse analysis to collect and analyze data within the FAO's CoP on food loss reduction between 2014 and 2018. Data was collected from the FAO's CoP on food loss reduction from four forum discussions. The researchers were required to officially join the CoP to access dialogs from the open forums. Participation in the CoP forum posts represented 17 different countries and a total of 59 engagements in the CoP forums.

Two accomplishments of the CoP emerge from the discourse analysis are: a.) time-space distanciation and b.) co-creation of knowledge. The richness of information exchanged through this CoP offers practical implications and specific strategies for bridging knowledge and practice to achieve UN SDGs. This case study offers a discussion for how CoP approach fosters putting the ideas of SDGs into practice through communicatively constituting the group, leading to collective action.

This research directly relates to the following SDGs: #2.1 end hunger and ensure access by all people to safe, nutritious and sufficient food all year round, #17.16 Enhance global partnerships for sustainable development that mobilize and share knowledge, expertise, technology, and financial resources to support the achievement of SDGs in all countries, #17.17 Encourage and promote effective public - private and civil society partnerships, building on the experience and resourcing strategies of partnerships. Without communication, there will be no transformation. This research contributes to understanding how knowledge is moved to action through communicative engagement.

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The efficacy of chemo-preventive attributes of African nightshade leafy vegetable on cancer using mice model

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Abstract

Food insecurity and cancer is a relationship that has been overlooked by many in the oncological world. Population studies have shown that cancer risk is higher in households that are food insecure. In addition, prevalence of cancer increases as the severity of food insecurity increases. Human cancers are on the steady increase in the world yet, two-thirds of cancers are due to preventable causes. Diet is one major aspect that can be modified to lower the risk of cancer. The objective of this study was first, to assess the antioxidant potential of African nightshade vegetables and formulations in mice feed. Second, to evaluate the effect of consumption of vegetables on the expression of a tumor marker (urokinase plasminogen activator protein) in mice.

The antioxidant activity of African nightshade leafy vegetable, when cooked and raw was determined using Trolox standard. Using an experimental design, mice were divided into three groups. Group one was fed on a control diet. Group two was fed on a diet formulation containing cooked vegetables. Group three was fed on a diet formulation containing raw vegetables. Then the expression of urokinase plasminogen activator protein was determined by a quantitative polymerase chain reaction. The study was conducted at a 95% confidence interval. The results indicated that the antioxidant activity of African nightshade leafy vegetable increased with steam cooking. The statistical significance was established between cooked and raw vegetables.

The expression of urokinase plasminogen activator protein is reduced to 3% in mice fed with cooked vegetable formulation compared to the mice fed with control diet formulation. Expression of uPA is reduced to 61% in mice fed with raw vegetable formulation compared to the mice fed with the control diet formulation. The study concludes that steam cooking was effective in increasing the antioxidant activity of African nightshade leafy vegetables. The tumor marker urokinase plasminogen activator protein expression was shown to decrease with consumption of African nightshade vegetable.

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Is ecological intensification of agriculture really sustainable?

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Abstract

The intensification of agriculture, started in the late 60s, has led to a rapid increase of yields per unit of land and time. However, it has also dramatically expanded the ecological footprint of the agricultural systems to a point that the intensification process itself is threatening the current crop productivity. A number of scholars proposed the adoption of a more ecological approach to intensification, where the overall environmental burden of agriculture is minimized and the ecosystems services provided by the agroecosystems are enhanced, while ensuring high yields and food security. Reduced tillage or no-till practices, cover crops, intercropping, crop diversifications are some of the key elements of an ecological intensification of agriculture.

A series of field experiments carried out between 2016 and 2019 in the U.S. upper Midwest looked into the sustainability of some spatial and temporal ecological intensification practices, more specifically intercropping and relay-cropping, crop diversification and cover crops. A sustainability assessment of the dominant cropping system (maize-soybean) with and without ecological intensification practices was performed to evaluate the environmental and economic trade-offs. In the assessment, we analyzed and quantified the impacts of the agricultural systems investigated on a global (climate change), regional (eutrophication), and local (erosion and soil fertility) scale. Relay-cropping systems of maize and soybean with cover crops showed an overall reduction of the ecological footprint per hectare in comparison with the conventional cropping system. However, when the economic component was introduced in the assessment, the sequences with cover crops showed an overall lack of economic sustainability, due to a significant reduction of the main crop's yield. Another experiment where we assessed the environmental tradeoffs of diversifying crop rotation by introducing a perennial legume (alfalfa) into a maize cropping system, showed a better performance compared with a conventional system in economic terms. Despite the promising results of the research, there is still a very limited interest from farmers to introduce crop diversification into the dominant cropping system.

These findings suggest that 1) more research is needed to design and develop sustainable and reliable alternative cropping systems based on ecological intensification principles, and 2) it is essential to work directly with farmers to address their concerns and overcome the current barriers that are slowing down transition toward ecological intensification practices. To increase the adoption on such practices, it is also important to quantify the enhancement of the ecosystem services provided by an ecological intensification of agriculture. This is a key step to develop cost-share policies that might support farmers in making crop production more sustainable.

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Impact of Agricultural Health Training Programme on the Productivity of Crop Farmers: Evidence from Randomized Control Trial in Nigeria

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Abstract

Low labour productivity among farming households have been associated with farmers' exposures to chemical and musculoskeletal health risks among other factors. The extent of these health risks and effectiveness of interventions aim at reducing exposure to these health risks among farmers in Nigeria is yet to be addressed by research. In this study, a randomized control trial approach was used to assign 480 cassava farmers from 24 farming communities to the study. However, 200 farmers were randomly assigned to receive the treatment. The intervention component includes one-time village level agricultural health training and a three-month farm safety mobile text messaging follow up. A peer-developed module covering safe ergonomic practices and safe use of agrochemicals was used for the training. The intervention effects were evaluated in short-term (6 months) post treatment. Structured questionnaire, interviews and random farm visit were used for data collection. Exposure to health risks is measured by recurrent self-reported symptoms. Descriptive statistics, ordinary least square regression, and difference-in-difference estimator were used for data analysis.

Findings showed that during chemical application, 90% of cassava farmers reported exposure to chemical health risks and at least 40% reported exposure to musculoskeletal disorders at other stages of cassava production; farmers' sickness absence is driven by age, educational level, daily duration of chemical spray, care time and number of ergonomic exposure ($p<0.05$); every one day increase in sickness absence decreases labour productivity of cassava farmers' by 3% ($p<0.01$); the agricultural

health intervention reduced sickness absence in the season by 1.9 out of 6.5 days (29%) with significant improvement in farmers' agricultural health knowledge and attitude ($p<0.01$).

The study concluded that cassava farmers were engaged in unsafe farm practices exposing them to some health risks which negatively affect their well-being. Although, evidences from the study supports that the agricultural health training intervention enhanced farm safety knowledge, attitude and reduced sickness absence in short term, additional research is needed to establish the long-term intervention effects and explore issues of cost effectiveness.

Furthermore, there is a need for inclusive agricultural health policy addressing agricultural health information, agricultural health surveillance and agricultural health services for the farming population in Nigeria.

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Food Consumption Expenditure Inequality among Nigerian Households

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Abstract

Background and Objectives: Food is a basic human need for survival. Regardless of abundant human resources and interventions, food insecurity and malnutrition remains a great challenge. Therefore, this paper examined food expenditure inequality among Nigerian households.

Materials and Methods: Household survey-based secondary data of National Bureau of Statistics (NBS) was employed in the study. Gini decomposition was used in the decomposition of food consumption expenditure inequalities by sector as well as within- and between group inequality in rural and urban Nigeria.

Results: The estimated results showed high food consumption inequality in Nigeria. This reveals a wide gap between the per capita expenditure in urban and rural Nigeria. The overall food expenditure inequality index is 0.4098. The South-South geopolitical zone has the highest food expenditure inequality of 0.4799. The overall food expenditure inequality index is 0.4098. This implies that food consumption inequality is averagely high in Nigeria. The inequality in food consumption was higher in urban areas (0.4382) than rural (0.3992). The Southsouth geopolitical zone has the highest food expenditure inequality of 0.4799, followed by southwest (0.4359) and south east (0.3956) while the northwest has the lowest inequality of 0.3773. The gini coefficient of Northeast and North-central was 0.3793 and 0.3881 respectively. Aggregating the food items into plant and animal origin revealed lower food consumption inequality in plant source (0.4314) than animal source (0.5794). However the inequality differs in the different food items under these two groups. Disaggregating into different food basket reveals high inequality in the consumption of all the food items, even among the cereals which are expected to be staple food among Nigerian households.

Conclusion: The study concludes that food expenditure inequality is high among Nigerian households. Rural-urban divide exists in food expenditure inequality. Rice, poultry, fruits and non-alcoholic beverage were inequality increasing. Hence, these food items should be accorded priority in the national food policy as well as technology development in order to make them available and affordable.

Key words: Consumption, Diet, Inequality, Nigeria, Rural-urban divide, Welfare.

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Efficiency and Profitability of Women Cassava Farmers in Ondo State, Nigeria

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Abstract

The article examined the productivity of women cassava farmers in Ondo State, Nigeria. Eighty respondents were selected using a multi-stage sampling procedure. Data were collected from the respondents with the aid of a structured questionnaire and analyzed using a combination of descriptive statistics, gross margin analysis and the stochastic frontier production function. Results showed that the average age of respondents was 48 years and about 68.8% of the respondents were married. Most (37.5%) of the respondents had no formal education while the mean farm size was 1.8ha. Most (47.5%) of the respondents acquired land through lease. The results also revealed that cassava production by women farmers was a profitable enterprise with a mean Gross Margin per hectare of N40, 362.04 in the study area. Maximum Likelihood Estimates of the Stochastic Frontier Production Function results showed that quantity of labour, farm size and quantity of cassava stem cuttings were the major determinants of output of women cassava farmers in the study area. In addition, age, farming experience and level of education had significant effect on the technical efficiency of women cassava farmers in the study area. Age, farming experience and level of education were observed to have led to increase in technical efficiency of the farmers. The presence of technical inefficiency effects on the farmers studied, accounted for most output variations in cassava production. The estimated mean of technical efficiency was 0.86. Policies that facilitate increased production of cassava, increased level of education, increased farming experience, and increased use of available resources are essential to help improving the productivity of respondents in the study area.

Full papers

Mainstreaming sustainable seafood systems for harmonizing the use of marine natural capital and needs of indigenous coastal communities

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Abstract

There is a great deal of discussion on the sustainable fisheries that highlights the benefits of marine protected areas and ecosystem-based management, but little attention has been given to identifying pathways to mainstream effective interventions. Indigenous coastal communities continue to suffer as the fish catches decline and their concerns continue to grow about food security and livelihoods. Given the slow pace of implementation of Sustainable Development Goal (SDG) 14 and the setbacks caused by COVID-19, the achievement of targets by 2030 appears uncertain or unlikely. However, since sustainability is a journey, the momentum generated by SDGs should continue beyond the 2030 timeline into the UN 2050 Vision of "Living in Harmony with Nature". It is timely that the UN has proclaimed Decade of Ocean Science for Sustainable Development (2021-2030). This will help in mobilizing interest in science-based efforts for sustainable development of the ocean fisheries resources. Due to 'commons' status of the ocean and the ever-increasing concentration of economic activities in the coastal zone, it is imperative to safeguard the interests of coastal communities that have traditionally depended on the marine resources for sustenance. The fact that the species exploited in fisheries have different ecological thresholds and recruitment capacity and are faced with different levels of fishing pressures and ecosystem conditions, it makes sense to identify several indicators. This will enable managing stocks and their optimization based on vulnerability and management interventions by governance bodies informed by the indicators. The application of Big Data will be helpful in analysing and systematically extracting information that are too complex to be dealt with by traditional data processing methods. This study draws attention towards sustainability concerns for small pelagic species that are intensively exploited even as knowledge gaps remain in accurate assessment of critical thresholds. These species are link between their prey and natural predators and become particularly vulnerable to overfishing by the prevailing fishing methods and climate change. Population fluctuations and depletion in these fisheries resources can cause imbalance in the social-ecological systems of many regions. Living in harmony with nature provides the way forward in a long-term societal welfare. These issues are addressed in this paper.

Keywords: Ocean, Biodiversity, Sustainability, Seafood, Adaptive management

Introduction

Marine capture fisheries play a significant role in the well-being of coastal communities world-wide, providing employment, income, and food security. Globally, the harvest of capture fisheries from the ocean amounts to 84.4 million tonnes (SOFIA, 2020). The nutritional and economic contribution of fish is increasing. Fish provides 3.3 billion people with 20% of their average per capita consumption of animal protein (SOFIA, 2020). Currently, the per capita intake of fish is 20.5 Kg and this amount is likely to increase. Sustainability of marine fisheries resources is, therefore, of great socio-economic, political and ecological significance.

Harvesting fish from the ocean at a rate that spares enough stocks for effective recruitment, respects the ecosystem and ensures livelihoods of the people who depend on fishing is a fundamental condition that defines sustainable fisheries. How this regulated fishing delivers food security and nutrition for all in such a way that the activities related to seafood remain profitable, continue to provide benefits to the society and produce no adverse impacts to the ocean constitute a sustainable seafood system. This is consistent with the economic, social and environmental criteria of sustainable development. Seafood system, like any other food system, comprises sub-systems that include the actors and their value-adding activities involved in production, processing, distribution, consumption and disposal of food products originating from fisheries (FAO, 2018). Normalizing sustainable seafood perspectives that entails some form of conscious decision-making pertaining to all these sub-systems so that the sustainable practices become the default (Robinson, 2019) is challenging but imperative. When people buy seafood, their main considerations are preference, quality and price, but not the ocean ecosystem and the society, and this shows that there is a long way to go in normalizing sustainable seafood thinking into routine practice. Changing this kind of mindset is no easy task but cannot be ignored to protect the ocean's natural capital- the stock of natural resources, including geological as well as biological. These natural capital assets provide the society with the ecosystem services that help us live and derive benefits. Fishing industry borrows from the natural capital of the ocean (Quaas et al., 2012). At a low level of harvesting that can be compensated by recruitment, the harvested fish is just borrowed from the natural asset to be self-regenerated. A higher rate of exploitation beyond the sustainable limits, exceeds the reproductive capacity of the renewable resource.

Methods

This study involved an integrative review of relevant empirical and theoretical literature to extract a more comprehensive understanding of the problem. It was an inclusive method of comparing published data and ideas to present scientific information in an articulated way. Effort was made to relate the review to the objectives of the study through knowledge management and synthesis of information to

generate new perspectives and approaches of direct applicability to policy and practice related to the ocean ecosystem.

Sustainability issues in integrated context

Sustainable fisheries have been a topic of thorough discussion and publications. In capturing the essence of what constitutes sustainable fisheries, MSC (2020) has defined three main conditions: Sparing adequate number of fish in the ocean for stock continuity, protecting habitats, and ensuring people depending on fish harvest to maintain their means of livelihood. These principles provided can be further elaborated for the measuring sustainability (Figure 1). Considerable information exists regarding sustainable fisheries but since sustainability is an ongoing process, new scientific knowledge will continue to strengthen the management of fisheries resources for future generations. There are many adverse environmental consequences associated with fishing. It is one of the major threats facing the ocean and a primary cause of ecosystem disruption. Not just that the fishing exerts impacts on the target species, it disturbs the trophic webs and biodiversity, and changes the population dynamics. Where fishing pressure is high and interrelations of the exploited species are intense, it is necessary to holistically examine the implications through an ecosystem-based modelling approach (Porobic et al., 2019) for effective interventions. A knowledge-based action will envisage improving the ocean's natural ability to restore itself to be able to derive more benefits without diminishing the natural capital. Managing a complex ecosystem to balance delivery of all of its services is at the heart of ecosystem-based management. Ecosystem Approach to Fisheries Management (EAFM) introduced by Food and Agriculture Organization (FAO) has created a good general management framework that protects natural capital and builds sustainability in the capture fisheries system, but its implementation faces major constraints. There are knowledge gaps that need to be addressed to inform EAFM implementation measures. Regional differences in ocean conditions and anthropogenic pressures should be considered in tailoring the most practical and result-oriented strategies. Bastardie et al. (2021) have reviewed the scenario surrounding EAFM and identified the nonlinear response, confounding effects and direction of causality as among the factors that need data collection and research collaboration for understanding and monitoring changes in the marine environment for designing management systems.

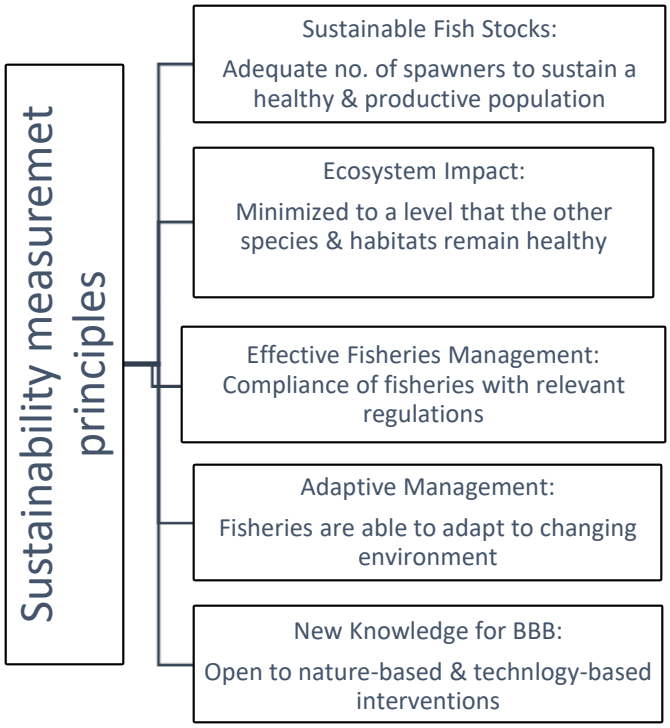

Figure 1. Principles for measuring fisheries sustainability

Seafood supplies from fisheries occupy a significant place in United Nations Sustainable Development Goals (SDGs 2015 – 2030). It is good initiative and is supplemented by the launching of Decade of Ocean Science for Sustainable Development (DOSSD, 2021-2030) for generating interest in marine ecosystem and the services it provides. However, sustainable development of the ocean is too complex a matter to be achieved by 2030 and it will go beyond this timeline to remain among the top priorities under the United Nations Vision 2050 'Living in Harmony with Nature'. Some of these complexities together with progress attained and potential solutions are highlighted in this paper.

Position of marine biodiversity in the natural capital and ecosystem services

Global consumption of the natural capital has exceeded its natural ability to regenerate (Vause et al., 2016). Although marine natural capital cannot be easily replenished but its renewable component can be enhanced to some extent by expanding the coverage of marine protected areas (MPAs) and their effective enforcement. An understanding of the following aspects is necessary to protect it for a sustainable ocean and sustainable society living in harmony with nature. Insights into at least three aspects (Figure 2) as outlined by MERP (2021) are necessary for informed actions and making transitions to sustainability.

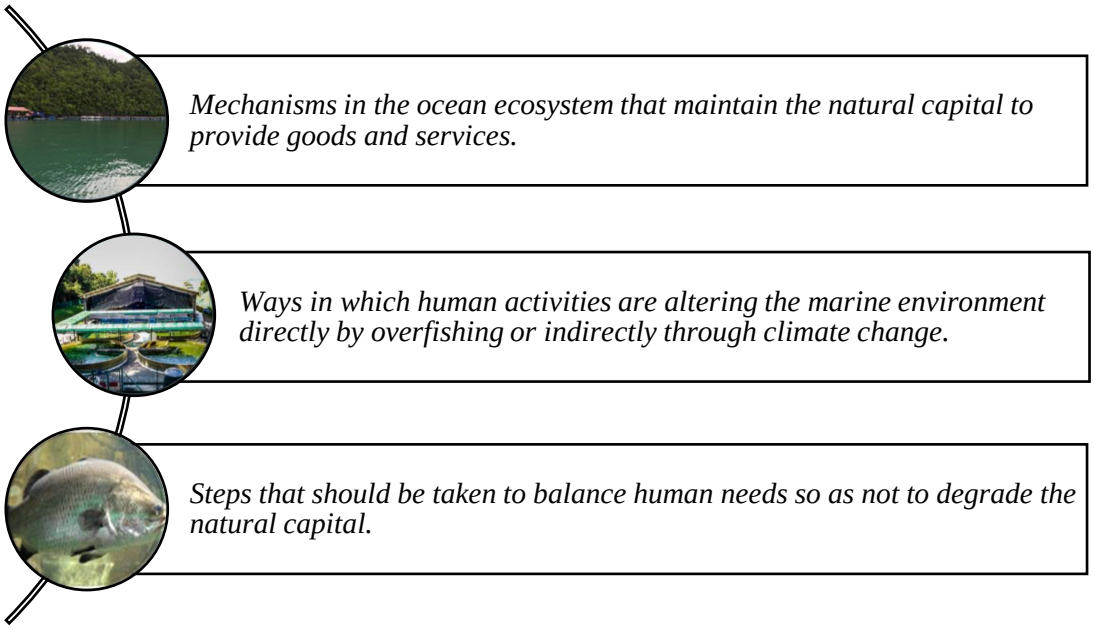

Figure 2. Knowledge required on natural capital of the ocean.

Biodiversity is a fundamental component of natural capital of the ocean. It plays a fundamentally important role in the functioning of the ocean and supports or influences almost all the ecosystem products or services in addition to having value in and of itself (Vause et al., 2016). Oceans are ideal for biodiversity **(**Costello and Chaudhary, 2017**)** and many areas such as coral reefs and coral triangle are biodiversity hotspots. The importance of diversity of life in the ocean is a topic of current research, after a long period of neglect. Still, some theories borrowed from terrestrial ecology are applied to marine biodiversity and mostly these are lacking in experimental verification **(**Heip, 2003). However, biodiversity is either missed or concealed in natural capital assessments even when the benefits flowing out of it are valued (Vause et al., 2016). In many environmental monitoring programs and environmental impact assessments biodiversity is listed among the areas of concern. In the latter, species are identified in localized areas but that is nowhere near the requirements of a marine biodiversity inventory. Therefore, it is necessary to highlight marine biodiversity in a more specific context and address the conflicting views that might constrain the enforcement measures. There are many published reports linking marine biodiversity to the environmental drivers (Mustafa et al., 2019; Arsenault, 2020; Bastardie et al., 2021; Mustafa and Saad, 2021). However, because of the multidimensionality of biodiversity there are constraints in quantitatively measuring these various linkages despite a growing number of ecological indicators. The difficulty is due

to the enormous numbers of species, genotypes and ecosystems interacting in different ways in the ocean. Ocean ecosystem is functionally diverse and adaptive. The dynamic nature of ocean equilibrium has evolved over time as human interaction changed and the ocean tended to resist the pressures or adapted to retain its ability to function. A topic of significant importance that emerges out of the many and which has implications for conservation is about the marine biodiversity redundancy and ecosystem redundancy. How this interface of the two shapes the dynamic equilibrium of the ocean remains an issue to be addressed by synthesis of new knowledge. Undoubtedly, ocean has ability to remain relatively stable while being subjected to pressures, and to recover equilibrium after the impact of factors that cause disturbances. This stable balance defines the ocean's dynamic equilibrium as against a static state. The marine ecosystem can be considered as having the tendency to remain stable in functioning despite the variability by virtue of resisting the effects of changing environmental conditions. Of course, this has limits. The ocean's resilience depends on how effectively it regains the original state following the perturbations. Species diversity is the most important feature of this dynamic equilibrium. Several hypotheses have been proposed to explain different aspects of the species biodiversity-ecosystem functioning but there is no doubt that this relationship is strong. The species redundancy hypothesis proposed by Walker (1992) is still among the main discussion topics in determining the ecological values of biodiversity (Kang et al., 2015). We believe that several strides have been made in the realm of marine science that provide a basis for reviewing some of these past concepts, including this one, in attempting to advance a more effective strategy for guiding conservation and sustainable management of the ocean. An effort has been made in this paper to address this issue. The term 'redundancy' has been used in the context of species as well as ecosystem, and both are features of community stability (Kang et al., 2015) but may have different connotations. However, all the marine species have a fundamental role to play in the ecosystem functioning is an undisputable fact. Coining the term "redundancy" which implies anything that is in surplus to requirements is problematic in assessment of the working of ocean ecosystem. The purpose of using this term seems to be to highlight the role of species within a community that performs similar ecosystem functions to compensate the functions of the species that has been deleted (Walker, 1992). Marine communities with more species performing similar functions will help impart temporal stability to the ecosystem in the event of loss of any given species (Naeem, 1998; Petchey et al., 2007). If that is indeed a sort of buffering role played by some species then the 'buffer species', rather than 'redundant species', could be a more appropriate characterization. Similarly, a subsequent attempt to characterize the so-called redundant

species as 'dormant species' (Mori et al., 2013) in the community that change to active mode to compensate the roles of deleted species deserves to be reconsidered. Dormancy is a period in the life history of an organism to minimize metabolic activity for conserving energy and this happens by a temporary cessation of physical activity, growth, and development. Obviously, dormancy is associated with environmental conditions. Predictive dormancy is synchronized according to seasons or it can consequential due to abrupt conditions. In any case, it is difficult to believe that this changeover of mode of life can be caused by deletion of species.

Furthermore, the assessment that some species have similar roles is based on the knowledge of the roles that are known. There may be roles that have not been discovered and remain largely unknown to science. Absence of evidence should not, therefore, be accepted as evidence of absence. Also, there is still no published data empirically establishing the relationship between functional redundancy and stability. Investigations have focused on the effect of biodiversity on production, resource use, and stability in response to environmental changes (Gascon et al., 2015). Biodiversity has been shown to impart resistance to disturbance but the mechanism to explain how this happens is still largely unknown since there is no evidence to show its role in resilience or returning to pre-disturbance levels of function (Isbell et al., 2015). While not oversimplifying the complexity of the ecosystem in interpreting the role of biodiversity in its resilience, Tschakert et al. (2020) used the metaphor of the 'house of cards'. The idea was to explain that if the card is essential for supporting the house structure, its removal will weaken the structure and deletion of more essential cards can lead to collapse of the structure. The authors have agreed that given the complexity of the ecosystem, removal of species has an impact, but how much it matters depends on the interactions between species and the role of that species in the overall functioning of the ecosystem. Marine species belonging to different categories in the community play unequal roles. Based on the analysis of the impact of species deletion presented earlier by Mustafa (2011), it is evident that the critical position of remaining species in the web of life in the sea increases with biodiversity loss as the system rests on their vital functions even as it transitions towards vulnerability. The author refrained from providing any quantitative measure of marine biodiversity loss to define ocean ecosystem condition in a generalized context due to geographical differences in nature of marine ecosystem and the modifications it is undergoing due to climate change.

Considering the species level of biodiversity, the species richness as well as species composition in a community, have implications for functional stability of the marine ecosystem. A general understanding is that species differ from one another in their ecological

roles, especially how they use environmental resources, level of tolerance to environmental fluctuations, and inter-specific interactions. That the species diversity contributes to marine ecosystem stability is not difficult to accept because when large numbers of species are present in a region such as the Coral Triangle, there is a higher chance of having more of those species that possess better tolerances to variations. Such species could be critically important in imparting stability to the ecosystem. Furthermore, the population size also deserves importance because the intraspecific diversity (genetic polymorphism) represents the evolutionary and adaptive potential of the species in changing environments. Currently, it is difficult to provide any quantitative metrics on the effect of marine genotypes and their variability on the population performance under different conditions due to paucity of studies on this specific aspect. Nevertheless, such topics assume significance due to pressures that are being brought to bear on the ocean ecosystem, especially by the climate change.

It is better to continue investing in research to strengthen the knowledge-data matrix in the interest of more effective conservation measures and outcomes. Believing that species deletions or extinctions are compensated by the 'dormant' or 'redundant' species implies that the ecosystem will be able to cope with the species extinction by way of replacement by the redundant or dormant species. Such views do not create a correct perspective and run contrary to conservation planning.

Marine natural capital and coastal communities

In more socio-economic terms, the natural capital of an area implies the value of the stock of natural resources which supports survival and development. The natural capital approach is comprehensive, requiring quality, quantity, functional roles, and value of environmental resources (assets) and goods and services they generate (Hooper et al., 2019). The key elements that can guide the implementation of this natural capital approach comprise identification of the main components of the target system, their measurement, assessment and appraisal (Figure 3). This is important for taking measures for sustainable use of natural resources for continued benefits to the society and examining how the natural environment is traded-off against societal needs. However, this approach entails evaluating the monetary value where questions remain about methodology and adoption as an instrument of policy. For these and possibly other reasons, the assessment and management of natural capital in most countries have either not started or are incomplete.

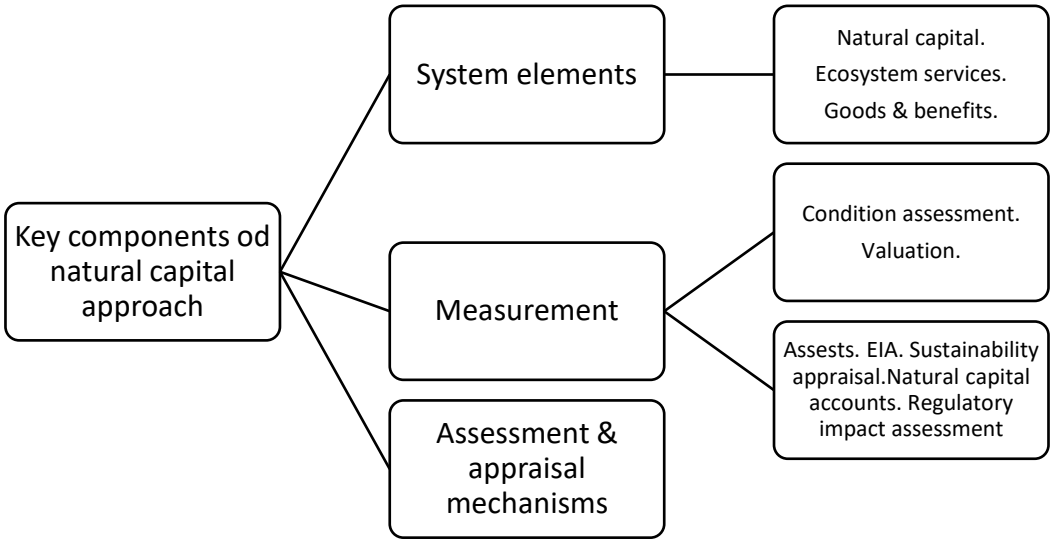

Figure 3. Implementation of natural capital approach Adapted from Hooper et al. (2019).

The challenging tasks are determination of the real values of marine fishery resources, carbon sequestration and conservation of marine biodiversity among others. There is scarcity of studies that can examine the full range of issues related multidimensional poverty and ecosystem services (Suich et al., 2015). However, so as not to delay action, some fundamental facts presented by ESCAP (2018) are good enough for policy support. A comprehensive survey conducted by ESCAP (2018) backed by empirical data reveals that the degradation of natural resources disproportionately affects the livelihoods and income of the poor sections of the community through the mechanism described in Figure 4. Dependence of low-income coastal communities traditionally harvesting marine resources for sustenance will, obviously suffer more with depletion of fisheries resources and this will widen the inequality within the society. For coastal communities, marine critical habitats occupy a frontline role in conserving capture fisheries resources, protecting from climatic disturbances and filtering many infectious diseases.

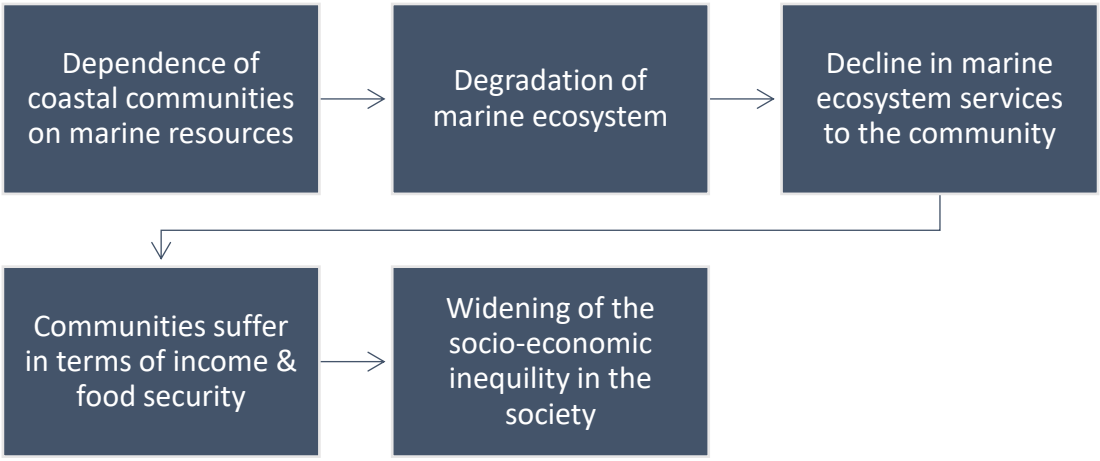

Figure 4. Chain of events resulting from degradation of natural capital of the sea.

Dependence of low-income coastal communities traditionally harvesting marine resources for sustenance will, obviously suffer more with depletion of fisheries resources and this will widen the inequality within the society. *For coastal communities, marine critical habitats occupy a frontline role in conserving capture fisheries resources, protecting from climatic disturbances and filtering many infectious diseases.* The small pelagic fisheries resources such as anchovies, scads, sardines and sergestid shrimps, play a significant role in livelihoods and food security of coastal communities. Their affordability and bulk landings have traditionally supported income-generating activities in developing countries around the world. They heavily depend on the natural capital in coastal-marine ecosystem. Despite being a catch of subsistence fisheries in many developing countries, these "unsung heroes of the ocean" (MSC, 2021) are treated as species of low economic value and consequently not given priority in management efforts (Kolding et al., 2019). Small pelagic species forage near the base of the food chain and are undoubtedly key components of the marine ecosystem and commercial fisheries worldwide (Queiros et al., 2019). Their ecological significance can be judged by the critical link that these species in their prey and predators in addition to making about 28% of the global capture fisheries production (MSC, 2021). Any setback to their populations impacts the wider ocean ecosystem as well as communities using this resource (Alheit, 2002). Currently, 46% of the pelagic fish stocks are reported to be overfished (IFFO, 2020). This includes direct human consumption as well as conversion of as much as 19% of the harvest into fish meal and oil which is mainly diverted to aquaculture industry (SOFIA, 2020).

Besides their contribution to food security the biological attributes of small pelagic species, including rapid growth, short life history, high fecundity, year-round spawning and fluctuations in abundance in response to environmental forcing (Alheit, 2002) make them a suitable candidate for studying the effects of climate change on marine ecosystem and fisheries. This is a topic worth pursuing.

Conclusions

This study contributes to articulating the linkage between sustainable seafood systems and natural capital of the ocean. Marine biodiversity should be given more attention as a fundamental pillar of the ocean's natural capital. Any conflicting perspectives constraining conservation of biodiversity should be addressed with strong scientific evidence and, common sense notions. Some pertinent issues in this area have been highlighted, and efforts made towards bridging the gaps in translating concerns into actions using compelling evidence from the available sources of knowledge. The relationships between human and natural systems are complex but evident through synthesis of scientific knowledge. Establishing a data metrics on the linked nature of natural capital (fisheries and habitat resources), human capital (people exploiting fisheries resources) and social capital (fisheries governance) within an appropriate social-ecological system requires more investment in analytical research. Follow-up investigations should give more attention to developing indictors for this purpose and practically feasible frameworks to increase their chances of acceptance as instruments of informed policies. Adaptive management planning can no longer presume linear thinking in matters related to the ocean. This is not to disregard the established relationship between ecological process that normally vary within a certain range but when a plurality of extrinsic factors is at play and effects of climate change are brought to bear in different forms, the outcomes are not always predictable. Ocean acidification, intensifying fishing pressure on vulnerable species and ecosystems, adaptive response of pelagic fisheries and their biological links, and specific evidence of tipping points necessitate a holistic consideration of non-stationarities and non-linearity in planning management for the ocean ecosystem.

Acknowledgements

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Knowledge, Attitude and Practices (KAP) of Farmers on Postharvest Aflatoxin Contamination of Maize in Makueni and Baringo counties, Kenya

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Abstract

Aflatoxin contaminated home grown maize has been a perennial problem in Kenya especially in the Eastern and North Rift parts of the country. This study focused on investigating the influence of knowledge, attitude and practices of farmers on aflatoxin contamination of maize in Makueni and Baringo counties in Kenya. A convergent mixed method study design combined quantitative and qualitative data collection techniques in maize producing areas of Baringo and Makueni Counties in Kenya. These methods included questionnaire administration, focus group discussions and key informant interviews. Of the 220 farmers who participated in the survey, 67.27% were male and 32.73% female in Baringo County whilst 45.45% male and 54.55% female in Makueni County. Majority of the farmers were in a marital union and were between the ages of 40-54 years. The average KAP score for knowledge was 57.6±11.79 % for both counties. The average knowledge score for Makueni was 37.70±11.36 % and 77.2±12.23 % for Baringo County. The average KAP attitude of the farmers in both counties was 77.1±9.32 %. There was a significant difference in the knowledge of factors contributing to aflatoxin in maize, as to the point where contamination begins, the signs of aflatoxin contamination and the consequences of aflatoxin exposure in both counties ($p<0.005$) The individual county scores were 76.5±9.24% and 77.7±9.41 % in Makueni and Baringo counties respectively. Socio-economic and demographic factors were linear predictors of knowledge ($R2=0.76$, $p<0.001$), whereas they had no effect ($R2=0.043$, $p=0.076$) on the attitude of the maize farmers. Farmers from Makueni County (Eastern Region of Kenya) were more likely (OR=1.24) to have higher knowledge scores on aflatoxin contamination than those from Baringo County (Rift Region of Kenya). On the contrary, with increasing age the maize farmers were less likely (OR=0.01) to have higher scores of knowledge. Farmers associated poorly dried maize and poor storage conditions as the maize cause of aflatoxin contamination. The study findings revealed a significant difference in knowledge and attitude between the two counties. This consequently had an effect on the practices of the farmers. There is need for increased awareness creation on dangers posed by consumption of

aflatoxin contaminated maize grain within the communities. Training of farmers on good agricultural and management practices is also of utmost importance. This coupled with regular surveillance and enhancement of laboratory capacities can also significantly reduce the occurrence of aflatoxicosis in Kenya.

Key words: Aflatoxin, maize, knowledge, attitude, practices

1. Introduction

The global production of maize is estimated to be 717 metric tons/year with United States, China and Brazil being the leading maize producing countries in the world with an estimated production of 563 metric tons/year *(Ranum et al., 2014*). It is also estimated that about 25% of this production is lost due to aflatoxin contamination *(WHO, 2018).* Maize is the most important food security crop in Kenya and plays a huge role in human nutrition with an estimated consumption of between 171g/person/day and 233g/person/day *(Ranum et al., 2014).* This data after extrapolation shows that a 60 kg adult on consumption of 233g of maize per day with a mean contamination of 17 ng/g (Arithmetic mean contamination of maize from four Agro-ecological Zones (AEZ) will translate to about 66 ng/kg of body weight *(Sirma et al., 2018).* Consumption of aflatoxin contaminated food in humans is associated with liver cancer, retarded growth and compromised immunity and aggravates infectious diseases such as tuberculosis, hepatitis and Human Immunodeficiency Syndrome (HIV)(EAC policy brief, 2018). Therefore, control of aflatoxin contamination in maize is of utmost importance. The control should be addressed both at the pre- and post- harvest levels. Understanding the farmers' perceptions, as the producer, is key to coming up with solutions. Several knowledge, attitude and practices (KAP) studies have been carried out in Kenya and Africa as a whole to document food safety scenario resulting from aflatoxin contamination *(Belayhun et al., 2019; Gichohi-Wainaina et al., 2020; Matumba et al., 2016; Udomkun et al., 2018).* In Congo for instance, farmers associated high levels of aflatoxin contamination to high humidity, improper storage practices and poor soils (Udomkun et al., 2018). This then led to discoloration of the grain and accompanied by unacceptable change in the organoleptic properties. This resulted in difficulty in selling the grain. In Ethiopia, majority of the respondents associated aflatoxin contamination to stomach related disorders, liver ailments including cancer *(Belayhun et al., 2019).* In Malawi, the farmers had relatively low knowledge scores on both pre- and post- harvest practices that lead to aflatoxin contamination *(Gichohi-Wainaina et al., 2020).* Higher knowledge scores were observed on issues related to income loss and less knowledge on the factors leading to occurrence of aflatoxins in produce. More educated households had higher knowledge scores as compared to those less educated. Pre- and post-harvest practices were recommended as a way of reducing cases of aflatoxin contamination in the produce. A similar study by Matumba et al. (2016) in Malawi, reported that about 33% of consumers bought mouldy maize despite the associated dangers of consuming aflatoxin contaminated foods. Aflatoxin

contamination is a very perennial problem in Kenya as well with many reported cases that have resulted in many reported cases and even deaths *(Lewis et al., 2005; Sirma et al., 2018).* The objective of this study was to investigate the factors that influence the knowledge, attitude and practices of farmers on aflatoxin contamination in Makueni and Baringo counties in Kenya.

Methods

a) Study sites

The survey was carried out in Baringo and Makueni counties. Baringo County is located in the Rift Valley region of Kenya. It borders eight counties geographically. To the North are Turkana and Samburu Counties and Laikipia County to the East. It also borders Elgeyo Marakwet and Pokot Counties to the West, Nakuru and Kericho Counties to the South and finally, Uasin Gishu County to the South West. It covers 11,015.3Km2 of which 165km2 is surface water. Agriculture is the main economic activity in the county with 80% proportion . Baringo County consists of three major ecological zones: Highlands, mid and lowlands. The soils in the highlands are basically well drained and fertile making these areas suitable for agriculture and improved livestock development. The lowlands are semi-arid in nature with complex soils where essentially pockets of rain-fed subsistence agriculture is practiced and also under irrigation in some areas. On the other hand, Makueni County is located in the Eastern part of Kenya. It borders Machakos County to the North, Taita Taveta County to the South, Kitui County to the East and Kajiado County to the West. Most of the 8.034.7km2 is either arid or semi-arid *(Ranum et al., 2014)*. The main income generating activity in the county is agriculture. The long rains are received in April and May while the short rains in November and December *(Sirma et al., 2018)*. The county is exposed to serious climatic challenges that include drought, heat stress, moisture stress, increased precipitation and temperatures (20.2^{o}C -35.8^{o}C). Due to these challenges, food insecurity is prevalent. Aflatoxicosis has been a big challenge as well since the first major recorded case in the 2004 in the county which resulted in 317 cases and 125 deaths *(Sirma et al., 2018)*. Since then, the county has recorded several major and minor incidences. The survey targeted these new hot spots to unearth the underlying issues contributing to the aflatoxicosis cases. The study sites were purposively selected due to the higher occurrence of aflatoxin-related cases compared to the other counties in Kenya. The specific sub-counties were chosen based on the fact that these areas where mixed farming is carried out and maize growing is an important economic activity therefore likelihood of finding maize in such homesteads. The survey was carried out in Baringo North, Baringo South, Baringo Central and Eldama Ravine sub-counties in Baringo County (Fig 1). In Makueni, the sub counties sampled were Makueni and Mbooni (Fig 1) which had recently registered some mild cases of aflatoxicosis.

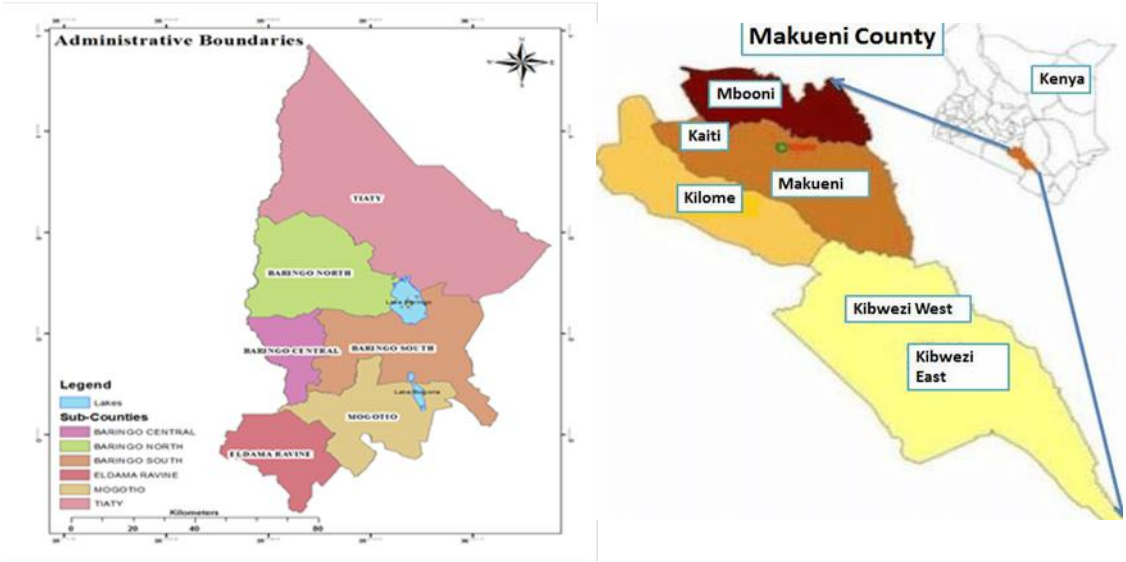

Figure 1: Map of the study areas (Makueni and Baringo Counties, Kenya)

b) Determination of sample size

The sample size was determined using the Fischer's formula (Fischer et al., 1991):

$$n = \frac{Z^2 pq}{d^2}$$

where n is the sample size, z is the normal deviation (1.96) corresponding to 95% confidence interval, p (0.5) is the estimated prevalence of aflatoxin in the county, q is 1-p and d is the degree of the desired accuracy (5%). This yielded a total of 196 households plus a 10% attrition giving a sample size of 216 households.

c) Sampling procedure

A mixed methods approach to data collection was used which included the use of semi-structured pre-tested questionnaires, focus group discussions and key informant interviews. Five enumerators in each county were selected and trained to aid in data collection. They were recruited based on their previous experience in similar research work and ability to understand and write in the local dialects, Kiswahili and English. Quantitative data was collected by administering a semi-structured questionnaire. A signed consent was sought from the farmers before the interview. A total of 220 questionnaires were randomly administered and shared equally between the two counties. The interviews were conducted in a combination of languages: local, Kiswahili and English. The semi-structured questionnaire was used to collect information on the farmer's demographics and knowledge, attitude and practices leading to aflatoxin contamination. A total of four focus group discussions were conducted with four farmer groups with each group consisting of 12 members divided equally between the two counties.

Key informants interviewed included senior ministry of agriculture officials, health officials and non-governmental organizations.

d) Study tools

The following study tools were used: A structured questionnaire, focus group discussion guide and key informant interview guide. Knowledge, attitude and practices were determined by questions in the questionnaire as follows:

i) **Knowledge**: It is the awareness of the community about aflatoxins. It was measured by calculating the mean score of 13 items and categorized as knowledgeable (if participants scored ≥ mean score of the correctly answered questions) or not knowledgeable (if participants score < mean score of the correctly answered questions).

ii) **Attitude**: The way a community thinks and behaves toward aflatoxin contaminated maize. It was measured by 13 questions with a five point like Likert's scale. All individual answers to attitudinal questions were computed to obtain total scores; then, mean score was calculated to categorize as having good attitude (if participants scored ≥ mean score) or poor attitude (if participants score < mean score).

iii) **Practice**: The behavior of a community that prevents or causes aflatoxin contamination. It was measured by 19 questions. All individual answers to practice questions were computed to obtain a total mean score and categorized as good practice (if participants scored ≥ mean score) or poor practice (if participants scored < mean score).

e) Quality control

Before administration of the questionnaire, farmers signed a consent form accepting to participate in the survey. The completed questionnaires were then checked for quality assurance before leaving the field.

f) Ethical considerations

Due to the corona virus pandemic, social distancing was maintained, masks and sanitizers were provided for all the study participants.

g) Data analysis

The data was then analysed using R software (version 4.0.3). A 5% level of significance was used throughout the study. Descriptive data on the socio-demographic and economic characteristics was generated. Moreover association tests to establish relationship of the socio-demographic on KAP scores was also undertaken.

2. Results and Discussion

Socio-demographic characteristics of farmers

Of the farmers who participated in Baringo County, 67.27% were male and 32.73% female whilst in Makueni, the proportion of male and female respondents was 45.45% and 54.55% respectively. Those below the ages of 24 years were less than 2% in all the counties. Majority of the farmers were between the ages of 40-54 years and most were married, 82.73% and 81.82% in Makueni County and Baringo County, respectively (Table 1). Most of the farmers engaged in farming as well as business in both counties (Table 1). A small proportion was also in formal employment. Most of the farmers had inherited land on which they were farming with a proportion of 59.09% and 90% in Baringo and Makueni counties respectively. There was a similar trend in the sizes of land owned in both counties with majority owning 1-5 ha of land. This stood at 87.27% in Makueni and 81.82% in Baringo counties. A larger proportion of the farmers in both counties had a family size of between 1 and 5 family members. There was a significant difference in the gender, education, source of income, housing and land ownership between Makueni and Baringo counties.

Table 1: Socio-demographic characteristics of farmers (N=220)

Farmer characteristics	Makueni (%)	Baringo (%)	p-value (X^2, df)
Gender			
Male	45.45	67.27	0.002 (9.78,1)
Female	54.55	32.73	
Age			
≤24	1.82	1.82	0.785(46.52, 55)
25-39	28.18	33.64	
40-54	40.00	37.27	
≥55	30.00	27.27	
Marital status			
Married	82.73	81.82	0.466 (2.55, 3)
Separated	0.91	1.82	
Single	6.36	2.73	

Widowed	10.00	13.64	
Education			
Adult education	1.82	1.82	<0.001 (46.65, 6)
College/University	14.55	37.27	
Completed primary	6.36	12.73	
Completed secondary	27.27	29.09	
Dropped from primary	12.73	3.64	
Dropped from secondary	36.36	7.27	
Illiterate	0.91	8.18	
Income source			
Farming	65.45	72.73	0.010 (13.37, 4)
Farming & Business	32.73	19.09	
Farming, Business & formal employment	1.82	8.18	
Land ownership			
Freehold title (inherited)	90.00	59.09	<0.001 (34.17, 6)
Freehold title (purchased)	10.00	21.82	
Community land	0.00	8.18	
Leased	0.00	6.36	
Rented	0.00	4.55	
Farm size (ha)			
≤1	1.82	3.64	0.066 (35.15, 24)
1 – 5	87.27	81.82	
6 – 10	8.18	13.64	
≥ 11	2.73	0.91	
Family size			
1 – 5	47.27	50.91	0.099 (22.36, 15)

6 – 10	44.55	38.18	
≥ 11	8.18	10.91	
Housing (Floor/Wall/Roof)			
Cemented/Iron sheets/Iron sheets	32.73	0.00	<0.001(101.41, 5)
Cemented/Stone/Iron sheets	24.55	85.45	
Cemented/Stone/Tiles	2.73	2.73	
Cemented/Timber/Iron sheets	8.18	0.00	
Earth/Mud/Iron Sheets	17.27	0.00	
Earth/Mud/Thatch	14.55	11.82	

Similarly, there was a significant difference on the asset ownership of some assets between the two counties. These were the television and private wells. No farmer in Baringo County had a private well but 10.91% of farmers in Makueni County did. On the other hand more farmers in Baringo (65.45%) owned a television as compared to Makueni County (43.64%) (Table 2).

Table 2: Asset ownership of maize farmers in Makueni and Baringo counties (N=220)

Item	**Baringo (%)**	**Makueni (%)**	**p-value (X^2, df)**
Motor vehicle (commercial)	0.91	5.45	0.124 (2.36, 1)
Motor vehicle (Private)	19.09	18.18	1 (0, 1)
Tuk tuk	0.00	0.91	1 (0, 1)
Bicycle	21.82	27.27	0.433 (0.61, 1)
Radio	93.64	87.27	0.167 (1.90, 1)
TV	65.45	43.64	0.002 (9.70, 1)
Mobile phone	88.18	94.55	0.150 (2.07, 1)
Fixed phone	1.82	0.91	1 (0, 1)
Generator	12.73	7.27	0.261 (1.26, 1)

Well (Private)	0.00	10.91	0.001 (10.67, 1)
Water pump	6.36	8.18	0.795 (0.07, 1)
Bore hole	2.73	8.18	1 (0, 1)
Water tanks	55.45	52.73	0.787 (0.07, 1)
Livestock	82.73	75.45	0.246 (1.35, 1)

The most commonly accessed farm tool was the bull/donkey drawn plough which was highly significant with 84.55% and 14.55% in Makueni and Baringo counties respectively. The plough was mainly used for land preparation. Owning a wheel barrow was common in both counties. (Table 3)

Table 3: Accessibility of farming tools among maize farmers in Makueni and Baringo counties (N=220)

Item	**Baringo (%)**	**Makueni (%)**	**p-value (X^2, df)**
Trailer (Tractor)	1.82	0.91	1 (0, 1)
Harrow (Tractor)	1.82	0.00	0.4775 (0.51, 1)
Plough (Tractor)	7.27	7.27	1 (0, 1)
Trailer (bull/donkey)	0.91	0.00	1 (0, 1)
Harrow (bull/donkey)	0.91	2.73	0.6138 (0.25, 1)
Plough (bull/donkey)	14.55	84.55	<0.001 (105.03, 1)
Wheel barrow	40.00	20.91	0.0034 (8.58, 1)

Knowledge assessment

There was a significant difference in the knowledge of factors contributing to aflatoxin in maize, as to the point where contamination begins, the signs of aflatoxin contamination and the consequences of aflatoxin exposure in both counties ($p<0.05$) (Table 4). Makueni County had relatively higher frequency of farmers knowledgeable on aflatoxin contamination and the precipitating effects of such contamination.

Table 4: Households' Knowledge about aflatoxin (N=220)

Parameter	Makueni			Baringo			p-value (X2, df)
	Yes (%)	No(%)	Don't Know (%)	Yes (%)	No (%)	Don't Know (%)	
Causes of aflatoxin in maize:							
Poorly dried or wet maize	100	0.00	0.00	95.45	2.73	1.82	0.078 (5.12, 2)
Poor storage of maize	95.45	4.55	0.00	36.36	61.82	1.82	<0.001 (85.508, 2)
Drying maize on the ground	63.64	36.66	0.00	6.36	91.82	1.82	<0.001 (79.94. 2)
Shelling wet maize	83.64	16.36	0.00	21.82	76.36	1.82	<0.001 (84.57, 2)
Contamination begins:							
In the field when growing	4.55	95.45	0.00	13.64	85.45	0.91	0.037 (6.61, 2)
During harvest	91.82	8.18	0.00	27.27	71.82	0.91	<0.001 (95.16, 2)
After harvest	95.45	4.55	0.00	56.36	42.73	0.91	<0.001 (45.99, 2)
In-storage	94.55	5.45	0.00	9.09	90.00	0.91	<0.001 (86.11, 2)
Improper drying	91.82	8.18	0.00	30.91	68.18	0.91	<0.001 (160.88, 2)
Not grading maize	53.64	46.36	0.00	0.00	99.09	0.91	<0.001 (81.03, 2)
Wet storage conditions	70.91	29.09	0.00	1.82	92.27	0.91	<0.001 (113.67, 2)

Signs of aflatoxin contamination:							
Discolouration	99.09	0.91	0.00	76.36	22.73	0.91	<0.001 (26.39, 2)
Mouldiness and wetness	98.18	1.82	0.00	38.18	60.91	0.91	<0.001 (91.27, 2)
Presence of insects	56.36	43.64	0.00	2.73	96.36	0.91	<0.001 (76.40, 2)
Mouldy smell	90.00	10.00	0.00	30.00	69.09	0.91	<0.001 (82.56, 2)
Aflatoxin exposure leads to:							
Stunting in children	49.09	50.91	0.00	1.82	96.36	1.82	<0.001 (65.72, 2)
Immunity suppression	76.36	23.64	0.00	17.27	80.91	1.82	<0.001 (77.53, 2)
Low productivity in livestock	71.82	28.18	0.00	8.18	90.00	1.82	<0.001 (93.25, 2)
Liver cirrhosis (Liver cancer)	73.64	26.36	0.00	23.64	74.55	1.82	<0.001 (55.58, 2)
Loss of income	57.27	42.73	0.00	86.36	11.82	1.82	<0.001 (102.21, 2)
Death	100.00	0.00	0.00	95.45	2.73	1.82	<0.001 (27.75, 2)

The average KAP score for knowledge of maize producing farmers in the two arid counties was 57.6±11.79 %. The average knowledge score for Makueni was 37.70±11.36 % and 77.2±12.23 % for Baringo County. At the sub-county level, there was a very significant difference in both counties. In Makueni County, Mbooni sub-county had a larger proportion of farmers with knowledge scores of between 26-50%, followed by Makueni sub-county (Figure 2).

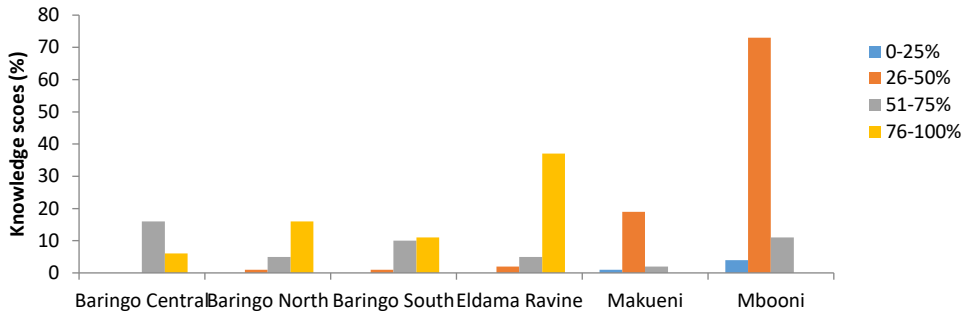

Figure 2: Knowledge scores of farmers in Makueni and Baringo counties

Wote (Makueni sub-county) can be considered a more peri-urban area as compared to Kisau Kiteta and Kako Woiya (Mbooni sub-county) which are remotely located. Outreach programs and projects by the Ministry and non-governmental organizations (NGO's) that train farmers on best practices mainly choose to work with farmers who are near the centres. This can explain the lower knowledge scores in Mbooni as compared to Makueni sub-county. Despite farmers in Baringo County having higher knowledge scores as compared to Makueni County, there was a variance at the sub-county level. Eldama Ravine sub-county had the highest number of farmers with between 76-100% knowledge scores. This can be explained by the fact that maize farming in Eldama Ravine sub-county is done is under large scale production and under irrigation. There are over 30 irrigation schemes in Eldama Ravine under contract farming. Seed companies usually contract farmers and undertake very close monitoring and supervision of the crop to ensure high quality seeds are produced. Additionally, they also train farmers on the best practices which could have led to the huge variation compared to the other sub-counties in Baringo ($p<0.001$).

Socio-economic and demographic factors were linear predictors of knowledge ($R^2=0.76$, $p<0.001$) (Table 5). Farmers from Baringo County (Rift Region of Kenya) were more likely (OR=1.24) to have higher knowledge scores on aflatoxin contamination than those from Makueni County (Eastern

region of Kenya). On the contrary, with increasing age the maize farmers were less likely (OR=0.01) to have higher scores of knowledge.

Table 5: Linear model of predictor factors of knowledge scores of farmers on aflatoxin contamination of maize (N=220)

Variable category	Beta	Std error	P value	Odds ratios
(Intercept)	0.63	1.79	<0.001	1.88
Gender Male	-0.18	0.07	0.726	0.84
Age	-5.26	6.74	0.015	0.01
Marital status Separated	-4.78	3.90	0.436	0.01
Marital status Single	1.84	2.82	0.221	6.32
Marital status Widowed	-8.96	6.27	0.514	0.00
Education College/University	-9.65	6.35	0.155	0.00
Education Completed primary	-10.02	6.11	0.130	0.00
Education Completed secondary	-12.66	6.45	0.102	0.00
Education Dropped from primary	-11.79	6.09	0.051	0.00
Education Dropped from secondary	-0.84	6.80	0.054	0.43
Education Illiterate	2.99	1.96	0.901	19.93
Source of income Farming & Business	2.24	4.46	0.128	9.36
Source of income Farming & Employment	1.11	11.77	0.616	3.04
Source of income Farming, Business, Employed	0.23	0.34	0.092	1.26
Farm size	-37.78	1.81	0.491	0.00
County Makueni	0.21	0.32	<0.001	1.24

Family size	0.63	1.79	0.505	1.88

Adjusted R^2=0.760, p<0.001

Attitude assessment

The average KAP attitude of the farmers in both counties was 77.1±9.32 %. The individual county scores were 76.5±9.24% and 77.7±9.41 % in Makueni and Baringo counties respectively. Farmers in Mbooni sub-county had a better attitude on control of aflatoxin compared to Makueni sub-county. Eldama Ravine sub-county also had a higher proportion of farmers with a good attitude on control of aflatoxins compared to other sub-counties in Baringo County (Figure 3). The knowledge of the farmers on aflatoxin had a similar effect on his/her attitude with the exception of Makueni County (Figure 3). In Makueni, farmers with lower knowledge scores had a higher attitude scores which could be due to the high number of cases that have occurred in the county some of which have led to many fatalities (*Daniel et al., 2011; IFPRI, 2020; Lewis et al., 2005; Mwihia et al., 2008*). There was a significant difference in the attitude scores in both counties (p<0.003).

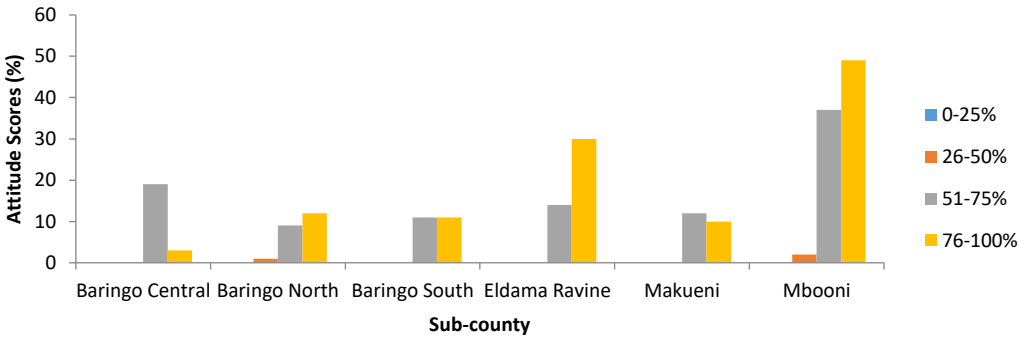

Figure 3: Attitude scores of respondents in Makueni and Baringo counties

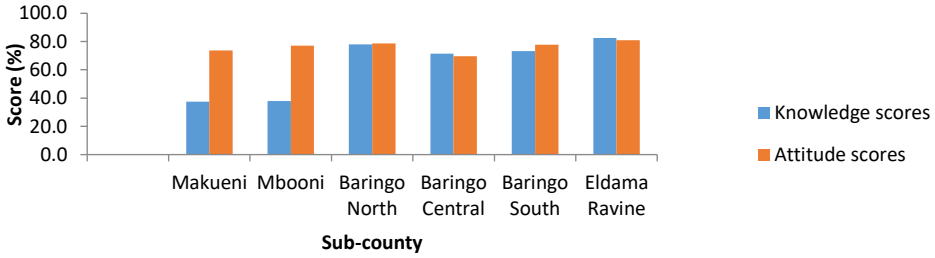

Figure 4: Relationship between knowledge and attitude of farmers in Makueni and Baringo counties (N=220)

Socio-economic and demographic factors had no effect on attitude of the maize farmers (R2=0.043, p=0.076) (Tables 6).

Table 6: Linear model of predictor factors of attitude scores of farmers on aflatoxin contamination of maize (N=220)

Variable category	Beta	Std error	P value	Odds ratios
(Intercept)	76.54	5.86	<0.001	<0.001
Gender Male	1.98	1.45	0.172	7.260
Age	0.00	0.06	0.943	1.000
Marital status Separated	1.24	5.44	0.821	3.440
Marital status Single	-2.83	3.15	0.371	0.006
Marital status Widowed	-0.04	2.28	0.986	0.961
Education College/University	2.13	5.07	0.675	8.370
Education Completed primary	3.59	5.13	0.484	36.40
Education Completed secondary	2.59	4.93	0.599	13.40
Education Dropped from primary	3.96	5.21	0.448	52.60
Education Dropped from secondary	2.29	4.92	0.641	9.920
Education Illiterate	6.12	5.49	0.267	456.00
Source of income Farming & Business	-1.89	1.58	0.232	0.150
Source of income Farming & Employment	4.26	3.60	0.238	70.90
Source of income Farming & Family support	14.49	9.51	0.129	>1000
Source of income Farming, Business, Employed	8.38	6.66	0.210	>1000
Farm size	-0.83	0.27	0.003	0.436
County Makueni	0.35	1.46	0.811	1.420
Family size	-0.06	0.26	0.808	0.939

Adjusted R^2=0.043, p=0.076

Practices assessment

Harvesting was exclusively done manually by farmers in Makueni County and 95.45% in Baringo County. Manual use of labour in production of maize and use of artisanal tool were the most dominant practices (Table 7). Manual harvesting is not only labour intensive but also time consuming. However, over 80% of farmers in both counties had an average farm size of between 1-5ha, thus harvesting would not take such a long time. There was significant difference in the mode of handling, drying, shelling and storage of maize in both counties.

Table 7: Summary of practices of respondents in Makueni and Baringo counties (N=220)

Practice	Baringo (%)	Makueni (%)	p-value (X^2, df)
Mode of harvesting			
Hand	95.45	100.00	0.070 (3.27, 1)
Machine	4.55	0.00	
Mode of handling			
Maize stovers stacked in heaps	3.64	27.27	<0.001 (21.74, 1)
Maize cob removed while stovers standing	96.36	72.73	
Drying			
On ground with canvas	51.82	39.09	<0.001 (71.60, 10)
On ground without canvas	28.18	60.91	
Left to dry in field	19.09	0.00	
In an open store	0.91	0.00	
Shelling			
By hand	13.64	49.09	<0.001 (157.43, 11)
Use of machine	81.82	10.91	
Pounding manually in gunny bags	4.55	40.00	
Storage			
Gunny bags	38.18	63.64	0.0003 (13.26, 1)

Pics bags	51.82	40.00	0.105 (2.64, 1)
Granary/Thatch	24.55	7.27	0.0009 (11.01, 1)
Granary/ Iron sheets	30.91	31.82	0 (1, 1)
Air tight bins	0.00	0.91	0 (1, 1)
Hermetic storage	33.64	0.00	8.633 (42.11, 1)
Mode of preservation			
Insecticides (Actellic)	82.73	76.36	0.251 (5.38, 4)
Ash	0.00	4.55	
None	17.27	19.09	

Focus group discussions

The farmers had a wealth of knowledge on the different methods that were used to control aflatoxin in maize from time in memorial. Aflatoxin, also known as *'mbuuka'* in Kamba language in the Eastern part of Kenya was a term that was initially used to refer to maize that was not fit for human consumption. Due to discolouration, the maize, locally known as *'mbemba'* would be set aside as it had a bitter taste and would be fed to chicken. The farmers did not know that this was also poisonous but chose to set it aside due to organoleptic challenges. Farmers were also still using the traditional methods of preservation such as smoking and use of ash. Maize meant for seed or *'mbeu ya mbemba'* would be hung on the kitchen roof where it would be smoked gradually (Figure 5). This kept the maize intact free of insect attack as well as aflatoxin contamination until the next season.

Figure 5: Seed maize hung on ceiling of kitchen

Figure 6: Traditional thatch granary

Figure 7: Pics bags (hermetic bags)

Figure 8: Modern iron sheet roofed granary

Figure 9: Air tight bins (hermetic storage)

Figure 10: Aflatoxin contaminated maize/*'maozo'*

Maize meant for household consumption was on the other hand mixed with ash, also known as *'mouu'* and kept in the traditional granary (Figure 6), also known as *'ikumbi'* or *'ndaali'*. Modern methods are also used currently such as use of insecticides such as *actellic* to prevent insect attack especially weevils or *'ngulu'*. Maize in the *'keinga'* would dry fast within the store as they left spaces in between the walls to allow for free air flow. Farmers attributed the high cases of aflatoxin contamination to early harvesting, labour challenges due to too much work when airing the maize, poor onset of rains caused by climate change, ignorance of the communities on dangers of consuming contaminated maize, poverty, insecurity, interference by wildlife and differences in varieties. Maize is exposed to unfavourable conditions in the house due human and animal interference such as wild pigs also known as *'nguuwe'*. Farmers associated diseases to aflatoxin contamination in the community. These were linked to liver cancer, swelling of legs, joint pains and early child mortality. In children, farmers associate aflatoxin contamination with jaundice, also referred to as *'muuku'* which also clinically presents with vomiting and diarrhoea. It has also been associated with *'kwashiokor'* in children as children would be very skinny and swollen abdomen. Farmers were aware of the issue of bio-transfer of aflatoxin from contaminated chicken meat and even mothers milk. Maize stalks are usually left in the farm and start rotting when in the field. This contaminated feed is then fed to dairy cows and this ends up in the cow's milk. Their concern was that the community need more sensitization on the dangers of continued exposure to aflatoxin as a result of consumption of aflatoxin

contaminated food and feed. Farmers suggested use of community health workers to educate the communities and also use of posters in schools, churches and health facilities.

The farmers have been advised by the ministry of agriculture to harvest and heap in the farm for 2-3 weeks to allow for complete drying. However, they still find it had to practice this due to seasonality challenges. Early onset of rains sometimes makes them harvest the maize prematurely and this has led to an influx of cases of aflatoxin contamination in maize. Attack by army worm attack and birds whilst still on the farm are also associated with contamination. Indigenous varieties locally known as *'kikamba'* or *'kinyanya'* were not susceptible to attack by fungi compared to the modern varieties. Hand harvesting is widely practiced while threshing is sometimes mechanized. The most common is use of gunny bags. Hermetic bags, which are locally referred to as *'kinga njaa'* are regarded as expensive and has challenges as they are not able to test the moisture content at the point of storage. If maize is not continually aired, this has led to cases of poisoning. Since most farmers are not able to afford a moisture meter, they have been taught by extension officers on how to use salt in a glass to assess whether the maize is adequately dried. Drying is done on tarpaulins (10%) and the other 90% of the population dries their maize on the ground due to lack of resources to buy and dependence on donations through outreach programs.

In Baringo County on the other hand, farmers had a wealth of traditional knowledge on preservation of maize. Similarly as in Makueni County, maize meant for seed *'sixtabut'or 'keswek'* was smoked in order to extend its shelflife till the next planting season. The maize which is locally referred by the Kalenjin community as *'bantek'* to as was hung on the central pillar/ *'tolkta* or *saina'* of the kitchen. The traditional store also known as *'choke'* is still widely used by farmers to store their maize. Ash is also added to the maize before storage to discourage attack by weevils and other insects. This is not widely practiced as compared to use of insecticides such as actellic. The farmers also feed contaminated grain to livestock as is the case in Makueni County.

Key informant interviews

Interviews with key informants in the county revealed many underlying issues. They pointed out that about two thirds of Baringo County receives erratic rains and cereals do not do well. Grains are thus imported from neighbouring counties such as Keiyo, Kericho, Bomet, Nandi, Nzoia,Trans Nzoia, Uasin Gishu and Nakuru. Maize from the neighbouring counties is often of very poor quality as they sell what has been rejected by National Cereals and Produce Board. Trucks lie in wait for buyers in markets under wet conditions at times due to erratic rains. Maize flour from these markets is bitter in

taste due to aflatoxin contamination but is still widely consumed. Some of the markets include: Eldama Ravine, Mogotio, Kabarnet town, Barrwessa, Koloa, Chemalingot, Nginyang, Marigat, Mochongoi, Kabel, Kaptara, Kabartonjo and Kipsaraman. At Kaptara, there is barter trade of maize grain and livestock. Baringo county is also one of the tourist destinations due to some of its remarkable land and lake features such as Lake Bogoria, Lake Baringo, hot springs, flamingo's, lake 94 which is since sub-merged. There are many others. Maize is grown all across the six sub-counties; however, in large scale, this is in: Eldama Ravine, Baringo South – under irrigation and Mochongoi which is an island in Baringo South Sub-county. There are over 30 irrigation schemes in Baringo South under contract farming. These schemes are under the management of seed companies, who undertake very close monitoring and supervision of the crop to ensure high quality seeds are produced. Hence, aflatoxin is not such a big issue in these areas. However, this is a very serious issue for domestic subsistence farmers. The areas of concern are: Eldama Ravine, Marigat and Mochongoi. The current season was harvesting time for the lowlands where maize takes a very short time to grow as compared to the highlands. Maize in the low lands (Marigat) takes 3-4 months to mature whilst that in the highlands (Mochongoi) takes approximately 9 months to mature. Due to the climatic conditions, excessive heat in the lowlands hastens germination as compared to the highlands.

In Baringo County, the aflatoxin issue is very serious. This has been attributed to the rising cases of cancer in the county. This is due to lack of knowledge among the population. Maize is mainly consumed in form of *'ugali'* and fermented milk, commonly referred to as *'mursik'*. Another dangerous trend is the use of the rotten maize by farmers, locally known as '*maozo*' to make livestock feed or *'dairy meal'* .It is estimated to have approximately 90% aflatoxin and is bitter when used in cooked form or '*ugali'.* It is also used to prepare traditional fermented brews such as '*busaa* 'and '*chang'aa*' so when farmers get a lot of '*maozo*' after harvest they are usually very excited. Interestingly, in some cases, domestic animals like chicken, goats and cows refuse to consume it as it is unpalatable. Farmers often mill the '*maozo*' and mix with bran to improve its taste converting it to feed. There has been a lot of disconnect between government agencies such as the county agricultural extension officers and the public health department. This is because mothers are advised to consume whole grains which are often contaminated with aflatoxins. This in turn finds its way into the breast milk and this has been shown to cause serious side effects to the offspring. This include but not limited to reduced immunity, stunted growth, liver cancer and in more severe cases, death occurs.

Aflatoxicosis had been a big problem in Makueni County dating back to the year 2004 when some major cases were reported in Makindu and surrounding areas. Generally, whenever the area experienced long rainy seasons, they also experienced high levels of aflatoxin in maize. Since then, a

number of development partners had come in to intervene and offer solutions. Some interventions have involved introduction of a strain to the soil to deter the growth of the Aspergillus strain. The carrier material used is sorghum which is broadcasted in the maize field during the growth stage. Other programs have been promoting postharvest practices among the farmers through various interventions: Farmers have often been encouraged to use tarpaulin to dry their maize and not on the soil as well as use of hermetic storage (bags/ containers). At times, the arrangement also includes cost sharing purchase of inputs – seeds, fertilizer, agro-chemicals, tarpaulin and hermetic bags. At the time of the survey, the current season activity was land preparation.

Conclusions

The average knowledge score is higher in Baringo County compared to Makueni County. This does not directly have an effect on the attitude and practices of the farmers. Despite the knowledge on the dangers associated with consumption of contaminated grain and the bio-transfer effect of aflatoxin such as to meat, poultry and even breast milk, some farmers still consume the maize. However, a large percentage of the farmers practice good agricultural practices such as drying maize adequately before storage, storing maize on a raised surface and even using hermetic bags to store the maize. Training of farmers on the good agricultural practices is therefore not enough to curb the recurrence of aflatoxicosis in these counties. It is imperative to also give recommendations on the methods that the farmers can use that are simple and affordable. Use of hermetic bags has been largely promoted in these counties but still remains a hurdle for most farmers due to affordability of the bags. There is also the challenge of ensuring the maize is at the right moisture content. Methods such as use of salt in a glass or bottle are simple and can be used by the farmers without difficulty. Farmers should also be encouraged to store their grain in aerated stores that are built on raised surfaces. Sensitization of farmers through community forums, posters in health centres and even schools can be useful in raising awareness on the dangers of consumption of contaminated grain.

Recommendations

Aflatoxin control and reduction in maize in Kenya requires a concerted effort by all the key players across the value chain. More importantly is to begin right from the production stage and this primarily revolves around the farmer. Hence, training of farmers on good agricultural and management practices is of utmost importance. There is need for increased awareness creation on dangers posed by consumption of aflatoxin contaminated maize grain within the communities. This coupled with regular surveillance and enhancement of laboratory capacities can also significantly reduce the occurrence of aflatoxicosis in Kenya.

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Effects of Enhanced Honey Bee Brood And Pearl Millet Consumption In Enhancing Food Security In Arid And Semi-Arid Livelihoods In Kenya

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ABSTRACT

Drylands cover approximately 40% of the world's land area, supporting two billion people, of whom 90% live in developing countries. Malnutrition, a common outcome of food insecurity in the ASALS remain a major threat to development with immediate and long-term consequences on health, social and economic status in the livelihoods. As such, timely, effective, sustainable measures are required to prevent, and manage malnutrition especially among children below five years in the ASAL specific context. With recommendations of supplementary foods for children with moderate wasting, the commonly used supplements, though able to modulate malnutrition, have limited potential in its prevention and offer minimal effect on the ASAL livelihoods since they have no target to reduction of food insecurity and poverty which are major underlying cause. Nevertheless, the pearl millet and bee keeping in the ASALS previously demonstrated evidence of potential in tackling malnutrition and promoting livelihoods stability. However, barely any innovation attempt involving combination of pearl millet and Honey Bee brood for use in prevention and management of acute malnutrition has been done. Consequently, this study seeks to develop a honey bee brood-based blend ($PeMH^+$) and assess its efficacy in modulating wasting among children 12-36 months living in ASALS of Meu County. Changes in weight, height, MUAC, WHZ, serum zinc, HB and iron ferritin assessed at baseline, and two weekly for three months among participants randomized to $PeMH^+$ (intervention group) or CSB (comparator group) will be compared. Positive findings from this study, will contribute in nutrition by providing an alternative blend for supplementary feeding program, provide data linking Honey Bee brood to treatment of acute malnutrition hence guiding policy for treatment of malnutrition in ASALS. The study also anticipates increased acceptability and utilization of pearl millet and honey bee brood for food, contributing to social-economic stability and resilience in the livelihoods.

Key words: Moderate Acute Malnutrition, Honey Bee Brood, pearl Millet, Livelihoods

INTRODUCTION

1.1 Background:

Everyone has a right to food and health and nutrition security. However, the cyclic drought situation, climate change impacts and the growing population in the ASALs cause worsening food

insecurity situation, warranting use of supplementary food for treatment of moderate acute malnutrition. As such, timely, effective, sustainable measures are required to prevent, and manage malnutrition especially among children below five years. The widely used Corn Soy Blend (CSB^{+}), Ready to use therapeutic food (RUTF), and Ready to use supplementary food (RUSF), though able to modulate malnutrition, have limited potential in its prevention and offer minimal effect on the ASAL livelihoods since they have no target to reduction of food insecurity and poverty, which are the major underlying cause. Nevertheless, pearl millet and bee keeping in the ASALS previously demonstrated evidence of potential in tackling malnutrition and promoting livelihoods stability. However, the honey bee brood and pearl millet are under produced, under processed and underutilized for food, both in the ASALs and other regions. Additionally, there is limited evidence proving efficacy of use of pearl millet and/or honey bee brood in treatment and prevention of malnutrition. There is no previous attempt made to develop pearl millet and honey bee brood blend for prevention and management of childhood malnutrition. This study therefore reviewed previous literature regarding efficacy of pearl millet and honey bee brood in treatment of malnutrition

Statement of the problem

While the overall implementation of the SDGs in Kenya has an enormous benefit to celebrate, vulnerable places and people in in the ASALS are left behind. Kenya is struggling to address undernutrition which is compounded by food insecurity in the ASALs which warrants use of supplementary food for treatment of moderate acute malnutrition. Approved supplementary foods for use in such programs are few mainly soy and corn based, which are unavailable locally at the most affected communities. Though honey bee brood, are demonstrated to have a potential to positively contribute to solving food insecurity in the ASALs, they are under produced, under processed and underutilized for food, both in the ASALs and other regions. Additionally, though it is documented that honey bee brood is consumed throughout lifespan, there are no records of its use as complimentary food or for supplementary feeding.

Justification of the study

This study provides evidence of possibility for use of HBB and PM in malnutrition interventional feeding program. It also provides an alternative commercial use for HBB and PM, Could further contribute to job creation, achievement of the projected production and further, social-economic stability, resilience and poverty reduction in the livelihoods. The results also inform policy

maker, and points to further research which may open avenues for increased acceptability, processing and utilization of pearl millet and honey bee brood for food and as a supplement.

Aim of the study

The main objective of the study was to assess possibility of combination of honey bee brood and pearl millet in prevention and treatment of moderate acute malnutrition in children of ages 12-36 months in Kenya

Objectives:

General Objective

1) The main objective of the study was to review literature regarding efficacy of pearl millet and honey bee brood in treatment of malnutrition

Specific objectives:

The study aimed at:

1. To determine the knowledge, attitude and practices related to bee keeping, and honey bee brood adoption, processing and use of HBB and PM as food
2. To determine the nutritional value of honey bee brood, and pearl millet
3. To determine possibility of use of PM and HBB in development of blend for use in modulating child growth, iron, zinc and inflammation among children 12-36 months
4. To determine strengths and threats for use of HBB and PM in prevention and treatment of MAM

Research questions or hypothesis

1 .6 Hypothesis

The study was based on the following hypothesis;

1. Negative believes, attitude and practices about bee keeping and honey bee brood are associated with poor adoption, processing, consumption of Honey bee brood, among households with children 12-36 months in ASALS in Kenya.

2. Honey bee brood and pearl millet blend can be formulated to acceptable nutritive supplement for children 12-36 months with MAM.
3. Supplementation with PM and HBB can induce growth, treat iron and zinc deficiency and reduce inflammation in children 12-36 months with MAM.
4. There are more benefits for use of PM and HBB in ASALs than the handles in their use

1.7 Significance of the study

Findings from this study provides Alternatives in solving malnutrition in the ASALs, introduces honey bee brood as a realistic addition to more sustainable food industry for child complimentary feeding, and evidence of for use in treatment of malnutrition, Guide policy makers regarding priority cereals in ASALs, Provide additional evidence on use of honey bee brood as human food

Methodology

All studies recorded in google scholar were identified as searched using the main words in each objective. Results for each objective were then recorded

Results and Discussion

Malnutrition refers to two broad groups of conditions caused by deficiencies (undernutrition) or overnutrition. This study is focused on undernutrition and specifically wasting, which is a major health problem associated with risks for morbidity and mortality. Wasting is defined as Z-Scores less than −2 Standard Deviations (SD) of median weight for height (WHZ) or MUAC less than 12.5 cm. (WHO, 2012). This is further subdivided to severe wasting (severe acute malnutrition) (WHZ -3 or MUAC below 11.5 cm) and moderate wasting (Moderate acute malnutrition (WHZ -2 or MUAC 11.5-12.5 cm). The two levels of wasting require different approaches of treatment (The Mother and Child Health and Education Trust, 2020; WHO, 2020c).

Undernutrition develops from an interplay of complex factors (UNICEF 2013), with interconnection of immediate (inadequate food intake and diseases), basic (poverty, including food insecurity, poor water, sanitation and health services) and underlying (conflict, climate change, scarce natural resources, high food prices, poor governance and population growth) causes of undernutrition. Undernutrition is a vicious cycle of nutrient deficiency and recurrent infections mainly attributable to impaired immune function (Robert, 2008), defective metabolism (Spoelstra,

2012, Bandsman, 2010, Jahoor, 2005), inflammation and impaired gut integrity (Martinsen, 2005, Peterson, 2014).

From several studies, Inadequate dietary intake, Poverty, Economic, and environmental instability have been cited as major causes of malnutrition in the ASALs.

Negative alteration of anthropometric indicators of malnutrition is almost always associated with poor immunity and increase risk to death (Evans, 2013, Gordon, 2012, Kau, 2011, Sayed-Mohsen 2014). Prolonged malnutrition often results to devastating effects such as permanent physical, social and emotional development, resulting to brain impairment, Poor performance at school, reduction in motor skills and activity, anxiety or depression, and behavioral problems (UNICEF 2017). However, evidence show that timely, adequate nutrition interventions would effectively eliminate the immediate symptoms, reducing global burden of disease and death and also and prevent the long-term sequelae (Black 2008). Growth faltering is attributable to the vicious cycle of nutrient deficiency and recurrent infections (inflammation) (Martinsen, 2005, Peterson, 2014) and often coupled with micronutrient deficiencies especially iron, zinc and calcium

Commonly children who develop MAM are treated with supplementary foods (commonly ready to use supplementary foods or corn soy blend) in the ASALS or food insecure regions. However, these foods are foreign in the ASALS and do not make any impact to the underlying causes of malnutrition. Using supplements developed from the locally produced, processed foods would most likely impact on food security, increasing adoption, productivity, processing, market and utilization hence producing resilience and stability in the ASAL livelihoods.

Potential in pearl millet

Pearl millet is cultivated mainly in the semiarid tropics, almost exclusively by subsistence and

may improve food and nutrition security in semi-arid zones globally, especially Sub-Saharan Africa (Yadav, 2011, Saleh, 2013, Amadou, 2016, Kumara, 2016). It thrives in harsh climatic conditions, grows well in acidic and infertile soils, and is nutritious (Awadelkareem, 2015, Suma, & Urooj, 2012, Amadou, 2016, Pattanashetti, 2016, Kavitha and Parimalavalli, 2014, Kavitha, 2014, Ahmed, 2014).

Nutritive value of pearl millet

Pearl millet is a high potein, high calory cereal. It provides 361 Kcal as compared to 365 in wheat, 125 in maize, 345 in rice and 349 in sorghum (NNI,2017). The total lipids estimated to be 4.2 % - 4.5 % (Ragaee, 2006, Nani, 2015), higher than in rice (1.7% and wheat (0.7%)), high in polyunsaturated fatty acids (Nani, 2016) with aProtein content of 42% (NNI,2017). It also contains high levels of essential amino acids lysine, threonine, valine, Sulphur containing amino (Mibithi-mwikya 2000), with a high chemical score (biological value of protein).

Threats to pearl millet use

There exists knowledge, beliefs, attitude, practices, policy, and systems which have negatively impacted semi-arid population as they toil to acquire other cereal (Mbugua, 2006). Additionally. bio accessibility of iron calcium and zinc is reduced, by presence of inhibitory factors (phytic acid, polyphenols and fibers). Localization of minerals and type of inhibitory factors helps to increase mineral bio accessibility- Decortication, soaking, Blanching, Acid treatment, Germination, and fermentation and roasting. Germination followed by fermentation and roasting significantly improved the chemical composition and nutritive value of pearl millet especially ash, fibre, fat, protein, minerals (iron and zinc) as well as colour, taste, aroma, texture and general acceptability foods which can be blended with pearl millet (Kindiki, 2016).

Effects of pearl millet on malnutrition indicators

Pearl millet plays a role in blood glucose homeostasis, (Ren 2018, Cisse, 2018), delaying gastric emptying, and improving immunity (Cisse, 2018, Mehta, 2017). It is also shown to Modulate gut microbiota(Ganmaa, 2017, Dewey, 2017, Roberts, 2017). Its also able to prevent malnutrition (Seetha, 2019). Evidence show that it is able to Reduce iron and zinc deficiency (Finkelstein, 2015, Rati, 2014). It also induces weight gain (Finkelstein, 2015, Rati, 2014), and is a Potential prebiotic component (Rao,2020). It is also vital in generation of vitamins, fatty acids and other vital nutrients that improve the body's defense system (FAO/WHO, 2001), and has Anti-inflammatory property (Rao, 2020)

Potential in honey bee brood

Honey bee (Apis mellifera), is among the insects which are commonly used for food worldwide (Rangacharyulu, 2003, Finke, 2005, Longvah, 2011). Adults and children alike often consume the entire contents of the hive including the bee brood (Crittenden, 2011). Removal strategically done

to manage bee populations or to reduce the varroa mite (*Varroa destructor*), (Dietemann 2013). The global insect's consumption launched by FAO in 2012, considered honey bee the insects to be promoted as a strategy for global gains in provision of essential nutrients (Premalatha, 2011; FAO, 2012), and as a functional food (Wattanathorn 2012). Honey bee brood is highly nutritious(Finke, 2005, Alvarez- Suarez, 2010, Ghosh, 2020b, Ghosh, 2020c).

Threats for Honey Bee Brood

The HBB is produced in certain seasons, and Processing it for food is and it esasily become lancin at room temperature (Premalatha, 2011).

Nutritive value of Honey Bee Brood

It contain protein content higher than that contained from conventional animal sources (pork: 27.7%, beef: 40.5%, chicken: 54.7%, egg: 52.7%) (USADA 2017), Protein contents with ranges of 40–75 g/100 g dry weight (Verkerk, 2007 Ghosh, 2016, Ghosh 2020). It is high in Lysine which is limited in many cereal-based diets (Kent, 1994, WHO/FAO/UNU 2002). The honey bee brood is a good source of balanced fatty acids with a composition of MUFAs (54%), SFAs (41%) and PUFAs (3%) (Chakravorty 2011, Małgorzata 2015).it is a rich source of Calcium, Magnesium, Sodium, Potassium, Phosphorus, Iron, Zinc, Copper, and Manganese (Chakravorty 2011, Małgorzata 2015). The high potassium to sodium ratio (350:1) useful for the malnourished population (Finke, 2005). It is healthy, consumers would like to consume it (Finke 2005).

Effects of Honey Bee Brood on malnutrition indicators

No literature was identified indicating previous use of HBB in prevention and treatment of malnutrition.

Conclusion

Both Honey bee brood and earl millet are widely used as human food in and out of ASALs. Pearl Millet can be processed through Germination followed by fermentation and roasting to significantly improve the chemical composition and nutritive value especially ash, fibre, fat, protein, minerals (iron and zinc) as well as colour, taste, aroma, texture and general acceptability. Further studies are required to determine effects of HBB on various outcomes of Malnutrition. A combination of Honey bee brood and pearl millet would produce a high calorie, high protein diet, with balanced amino acids, fats and micronutrients to meet the recommendations for supplementary foods as stipulated by Who. Use of PM and HBB for supplement may create stability and resilience in ASALs

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6. Sustainable Cities and Communities

6a. Urban and regional transformations

Abstracts

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Smart Villages: A review of the state of the art

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Abstract

Over the last two decades, communities have faced many challenges. Together with environmental concerns, above all the climate change phenomenon, and the economic recession, since the beginning of the 2020 the Covid-19 pandemic crisis is threatening both urban and rural societies. There is an ongoing debate among policy makers, scholars and economic operators on how to cope with these pressures and technological innovation/ICT is often seen as a mean for helping local communities by making "smarter" societies.

If, on the one hand, the notion of "smartness" has fuelled the debate when referring to urban areas, and has led to a recognized definition of smart city, on the other hand there is not a universally accepted paradigm for translating it into rural areas, yet. The "Smart Villages" concept, in fact, is quite new; in the European Union, the Smart Village Initiative was launched by the European Parliament in 2017, and, in the same year, the EU Action for Smart Villages document was published by the European Commission together with the European Parliament. This was the starting point in Europe in order to define the conceptual framework for speculating on how to apply smart solutions in rural areas at different levels, from the general policies to the operational applications. This contribution aims at providing a state of the art of the literature review inherent to the topic. For reaching this goal, a bibliometric study has been carried out by questioning the two main scientific databases, i.e. Scopus and Web of Science, using "smart village" as a keyword (20th January 2021). 316 papers containing the wording "smart village" in the title and/or keywords and/or abstract have been detected. After checking the results for avoiding overlapping, a total of 219 has been selected to be examined. 87% of the total was published from 2017 onwards; with 55 publications moreover, 2020 represents the year with the highest number of manuscripts related to the topic, showing and increasing interest in the issue. Furthermore, as regards the type of publication, the survey lists 104 articles, 33 book chapters and 82 conference papers. This study will contribute on the accelerating progress towards SDG's in times of crisis by providing an in-depth overview of this topic for defining potential research gaps as well as possible avenues of research, and it has to be seen particularly related to the "SDG 11: *Make cities and human settlements inclusive, safe, resilient and sustainable", t*argets 11.a and 11.b.

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Perspectives of Sustainable Circular Economy in Regional Innovation Policies

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Abstract

Circular economy (CE) is a trending concept that aims to increase the potential productivity of the economy while using fewer resources. In a CE, natural resources are used and recycled effectively; however, despite the circularity, the input in a circular system should not exceed the limits of planetary environmental constraints. If properly implemented, the CE supports the sustainable use of natural resources while at the same time contributing to solving climate crises and supporting biodiversity. Currently, the transition towards the CE is widely promoted through policymakers and governance, although this popular concept may have different meanings and origins depending on the region.

Through interviews with CE policy developers in 12 European regions, this paper explores how the CE has been defined in the context of regional innovation policies. The selected regions, along with their regional stakeholders, have defined the CE as a priority in their research and innovation strategies for smart specialisation (S3), which involves the European innovation policy approach of channelling research and innovation resources to selected priority areas. The paper presents S3 priorities related to the CE and to environmental themes that lie in the background of the transformation of regional CE policies.

The analysis showed that the regional CE context originates from environmental awareness, clean technologies and energy and waste management. Findings also showed that national policies, such as bioeconomy strategies, affect some regional priorities. In four regions, one reason behind prioritising the CE was because it was seen as a current trend in EU policies. The findings indicate that, as the CE becomes mainstream in regional policy, the importance of a holistic sustainable approach emerges. However, it seems that the term holistic can be understood in different ways in the CE context. Regions and regional authorities are challenged by the pressure to achieve concrete circular actions.

Sustainable development should guide the transformation of CE policies. To manage the transition towards the CE on a global scale, its implementation on the regional level is crucial. However, the proper understanding of all CE dimensions among regional actors might challenge the regions' capabilities to achieve sustainable change.

This research contributes to increasing the understanding of sustainability aspects of the CE in regional innovation policies by exploring its implications for Sustainable Development Goal targets 11.6 and 12.2. Target 11.6 involves how CE relates to developing waste management in the regions. Target 12.2 refers to the transformation of regional CE policy to achieve sustainable management and efficient use of natural resources. This paper relates to the ISDRS Conference topic, as it enhances the importance of a sustainable, proactive and transformative regional CE policy that involves relevant stakeholders in strengthening the regions' abilities to overcome the crisis.

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Building Stock Energy Renovation 2050 Pathways: A Cost-Effectiveness Analysis for Portugal

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Mr. Pedro Palma

Abstract

Buildings are a cornerstone of society, representing a crucial sector for the achievement of various Sustainable Development Goals (SDG), especially SDG11. In Europe, this sector is responsible for 40% of energy consumption and 36% of carbon dioxide emissions. About 35% of the EU building stock is over 50 years old and 75% has low energy performance. It is also one of the main causes of energy poverty, which negatively impacts the population wellbeing, further highlighting the need for increased energy efficiency. The European Commission has recently adopted the “Renovation Wave” strategy, as a part of the EU Green Deal, to address barriers and boost building stock renovation. This effort to enhance buildings’ energy performance has become even more relevant with the burst of the COVID-19 pandemic and the subsequent economic crisis, as buildings renovations can significantly support the economic recovery, as well as simultaneously improving thermal comfort inside homes and promoting the decarbonization of the sector. In Portugal, the residential building stock is old (70% were built prior to 1990) and has low energy performance - over 70% of all the energy certified residential dwellings have an energy performance rating equal or lower than C. Estimated deep renovation rate of buildings in the last 10 years is only around 0.06%/year, below the EU average of 1%, despite the implementation of several renovation schemes. Moreover, energy poverty affects approximately between 2.0 and 3.7 million inhabitants, potentially being exacerbated by the ongoing pandemic. A national Plan for Recovery and Resilience, stemming from a European debt issuance mechanism to face the crisis, will unlock €620M for improving energy efficiency of buildings. It is paramount to evaluate the potential impact of these funds and the necessary investment to significantly transform the building stock. Therefore, in this study, the cost effectiveness of energy retrofit scenarios for space heating and cooling energy needs reduction of the whole Portuguese dwelling stock is assessed, considering different outside walls, roof and window retrofit measures. The cost and impact of these scenarios is evaluated for three pathways up to 2050, considering: 1) the current Portuguese renovation rate; 2) the European average renovation rate; and 3) the target renovation rate for total building stock retrofit. This analysis is supported by a bottom-up building typology method to estimate energy needs of the building stock and a survey of market retrofit measures characteristics and costs. This study sheds light on the

potential effectiveness and cost evolution of retrofit measures, for different national renovation rates over the next 30 years, quantifying the necessary efforts to achieve the aimed transformation in 2050. It unfolds new knowledge that could be used in the process of designing a national-level comprehensive policy strategy for deep building stock renovation with improved use of public funding. Therefore, at larger scale, this work connects with SDG targets 11.1, 11.a, 11.b, as it supports national planning and policy towards accelerating the provision of more adequate and energy efficient housing at lower costs, a pressing need in this time of crisis.

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Periurban landscape transformation around Central Europe's middle-sized cities

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Abstract

One of the most important territorial processes in the highly urbanized continent of Europe is suburbanization, urban sprawl which occurs in a gradual manner over long periods and is not perceived as dramatic. Nevertheless, the built-up urban areas and the urban lifestyle occupy step by step the periurban territories. Urban sprawl affects the essential environmental, economic, and social functions of the impacted settlements. In the last decades, these processes reached the less urbanized Central European region, leading to very fast and less planned changes in our settlement system. Our research deals with these processes in four Central European (Slovak, Hungarian and Romanian) non-metropolitan areas, around economically growing regional centers, and with its environmental impacts: in the case of Nitra (SK), Győr, Kecskemét (HU), and Cluj-Napoca (RO) Functional Urban Area. These cities and their area feature high enlargement dynamics looking at the past decades, compared to other FUAs in Central Europe. The areas surrounding these cities have become a rapidly changing periurban area from traditional rural life.

The aim of this presentation is to point out spatial patterns of urban sprawl and suburbanization in these functional urban areas (FUA) and to characterize the differences among countries. We can detect suburbanization from the core city to the periurban areas in each country and at the same time a very dynamic inflow of migrants from the other parts of these countries. These processes provoke a relatively fast real estate market growth with some typical regional features. The research is based on standard geographical methods including field research. Desktop and field empirical researches were conducted, with different methods such as GIS analysis of land-use change. Our analysis shows to what extent cities and urban areas grow, from which one can conclude how the landscape surrounding the urban residential areas has changed. Our data demonstrate, moreover, how artificial patches and barriers fragment landscape more and more, endangering thereby biodiversity and decreasing green surfaces. Our examination covers the 2000-2018 period, using the CORINE CLC 2000, 2006, 2012, and 2018 databases. Thereby we are able to examine changes in a longer period of almost two decades and three internal periods. All this is compared to the economic and social changes of these countries as well, in order to see to what extent the change in these features contributes to the transformation of the periurban landscape and thereby to its environmental and social sustainability.

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Analysing Obstacles for Climate Change Mitigation using System Dynamics

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Abstract

Concerning ongoing climate change, numerous mitigation and adaptation measures were developed in the last decades, most focussing technological change but also addressing ecological and social transformation processes. However, to avoid a global warming above 2 °C the dynamics of these changes are far too slow and do often not consider the required holistic dimension of the complex transformation processes.

To gain a comprehensive understanding which drivers, obstacles and patterns affect the transformation to a sustainable, carbon neutral society the methodology of system dynamics can be helpful in two ways. First, to reveal the different mental models of various stakeholders involved in such transformation processes and collect resistances and contradictions in stakeholders mind set. Second, to simulate the dynamics of the system including interconnections and feedback loops with the aim of detecting effective leverage points to transform the system.

In the present contribution system dynamics was used to understand the process dynamics of transforming the building sector from high energy demand to low carbon by means of energetic renovation for the case of Germany. To meet climate change a renovation rate of 2 % of the building stock is required. However, the actual renovation rate is in the range of 1 % and shows a rigid behaviour in the last two decades without any significant increase. As a first step we collected mental models of different stakeholders involved in the process to determine which mind set and obstacles are present regarding such transformation of the building sector. Building on this the dynamics of the renovation decision process was simulated including several feedback loops. The model is able to explaining the rigid behaviour of the energetic renovation process and points out different leverage points.

In the developed model, the motivation to perform energetic renovation is a central element to change the intensity of energetic renovation considering certain implementation delays. These motivation is influenced by several reinforcing and balancing feedback loops leading to a non-linear impact on motivation and thus energetic renovation. However, the detailed information about the weight of the different motivating factors is an essential question of the model and needs to be analysed in more detail.

Concluding, applying system dynamics to the subsystem of energetic renovation in the building sector revealed several leverage points to transform the system from its rigid behaviour to a sustainable one with lower carbon emissions. With the central element of change in motivation achieve the desired transformation, these findings might be transferable to other system changes required to achieve a sustainable society. However, this is still an outlook and must be evaluated and examined in greater detail in future.

This work relates to the SDG 11 “sustainable cities and communities” with the SDG target 11.3 as well as SDG 13 “climate action” with the SDG target 13.3.

This article corresponds to the Track 6a key topic “Transformative strategies, policies, initiatives and actions” and examines “Longer term or emerging future pathways”.

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Transformations toward sustainable urban settlements in Poland before and after the COVID-19 pandemic

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Abstract

Cities are hubs for the advancement of humankind, innovation, culture, finance, science, and technology. In 2008, the world's urban population outnumbered the rural population, and by 2050, it is expected that more than 65% of the world population will inhabit cities. To make the urban areas more inclusive, secure, and resilient, the United Nations (UN) introduced global indicators of sustainable urban development under Sustainable Development Goal (SDG) 11 in the 2030 Agenda for Sustainable Development, instructing its members to collect complementary sets of national and regional indicators. In reference to the UN SDG 11 and building upon the proposed by Poland indicators and available data, this study develops a measurement framework for comparing 66 most prominent polish cities (with powiat status). By measuring the degree of sustainability for the cities based on the integrated technique for order performance by similarity to ideal solution (TOPSIS) and data envelopment analysis (DEA) model, this research aims to reveal which municipalities are closer and which further from reaching the SDG 11. Employing the advantages of both methods, it also defines the distance to the ideal solution to rank the urban settlements and to identify cities needing immediate attention by regional and local governments. Additionally, this study examines to what extend the transformations toward achieving targets of SDG 11 were affected by or resisted the disruptions of COVID-19 pandemic. To do so, it investigates the pace of change in five years preceding the global health crisis (2015-2019) and collates it with the sustainability performance for the cities in 2020. Considering the severity of turmoil caused by current pandemic, we assume that, among other factors, it was a prominent contributor to any setback for the progress of achieving sustainability targets. The empirical results are expected to indicate the substantial disparities among the municipalities in Poland and the scale of retardation. Finally, the guidelines to correct the imbalance between cities and to accelerate the progress toward achieving SDG 11 will be offered.

This research relates to SDG 11 targets 11.1-11.7.

In reference to the ISDRS Conference's topic "Accelerating the progress towards the SDGs in times of crisis", this study examines the progress toward achieving SDG 11 in Polish cities during the COVID-19 pandemic crisis, comparing it with the pre-pandemic time. The outcomes of comparison enable identifying the targets lagging behind and the feasibility of accelerating the progress so the urban development goal, as defined by the UN, can be attained by 2030.

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Place-based identites in coal phase-out regions as an obstacle to sustainable transitions – the case of Lusatia

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Abstract

Considering the necessity of far-reaching structural changes against the background of sustainable transitions, traditional lignite-mining regions with carbon intensive industries play a key role in these processes. One prominent example of such a region that is faced with massive economical and societal upheavals is Lusatia in the East of Germany. Formerly an important energy supplier for the GDR, the region is faced with extensive transformation since the early 1990s and is now confronted with a coal phase-out not later than 2038 by the German government. Evidence from regional monitoring shows that within that process not only economic and political factors are relevant to the people, but also aspects of place-based identity and place attachment. The study sheds light on the questions, how these aspects are an issue in the negotiation of the transition in Lusatia and what the implications for further research are.

To address these issues, the study focusses on proponents of transformative ideas within their social contexts. Therefore, guided interviews with change-agents and especially with external people that are relevant to their projects are conducted. The study is designed as a multiple-case approach with initiatives from the fields of administration, economy, and grassroots movements to capture a certain range of different social contexts. An analysis of the interviews implicates a relation between biographical experiences of loss and an unsettling of place attachment that leads to moments of resistance to further transition. The study argues that individuals are disembedded and to some extent deterritorialized from their accustomed environment and that this circumstance is a hindrance for transformation endeavours. The research suggests that biographical fractions must be acknowledged as a major part in the social construction of space and furthermore, the formation of place-based identity within transition processes.

The study contributes to SDGs 8.3 and 9.4 by emphasizing obstacles to the retrofitting of industries and the promoting of creative and innovative activities that foster sustainable development. It is especially relevant to SDG 10.2, because it exposes the importance of different place-based identities and the need to recognize them to include all people – particularly those with bad transformation experiences – in the negotiation of transition processes. The contribution relates to the topic of the conference because it makes clear the need of identifying obstacles on a socio-cultural level to reach SDGs more efficiently.

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Making visible the “invisible” environmental impact of consumption: using Ecological Footprint to challenge the role of local policies

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Abstract

The Ecological Footprint and biocapacity of Portuguese Municipalities project gathered six Portuguese cities in a strategic partnership with one university and two environmental non-governmental organizations to collect new information and generate capacity for local decision-making towards sustainability and innovation of territorial systems. An assessment of the Ecological Footprint and biocapacity of those municipalities was performed in 2018 and 2020, and individual calculators were developed and set up in the website of each local government to inform about the greatest individual pressure from the citizens’ consumption activites that threaten not only local ecosystems but also the stability of the planet itself. The goals for these calculators was not only to make visible for citizens the “invisible” environmental impact of their consumption options, but mainly to educate them about the necessary changes in terms of both individual consumption action and collective behavior. Mobilizing local leaders and structuring innovative local policies are key to achieve these goals. One workshop was conducted in 2019 in each of these six municipalities to train local associations, educators, administrators and citizens regarding the implications of the Ecological Footprint and biocapacity results for the city and the value of using personal Footprint calculators to identify the main drivers of the pressure local residents and economic activities place on ecological assets. A survey was conducted with the workshop attendees regarding the usefulness the Ecological Footprint calculator and questioning the role of local policies to tackle the challenges of fighting ecological deficits, gathering answers from 81 attendees. This paper therefore intends to discuss the survey’s results and the use of the online individual calculator in each municipality, collected by the project team, to challenge the role of local policies for reducing Ecological Footprint. The Ecological Footprint calculator presents results in a user-friendly way, to help assessing individual impact on the environment, and provides a platform for citizens to actively participate in the development of unique sustainable actions that are specific to each community needs. It then enables an informed debate on the challenges of local leaders and citizens to invert the current unwanted trajectory of excessive use of natural resources, to define opportunities to protect and safeguard the natural heritage of municipal territories and to the realization of the Sustainable Development Goals (SDG), which are enforced by the UN Agenda 2030, particularly SDG11 (sustainable communities) and SDG12 (sustainable consumption and production).

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Designing strategies for SDG localization and human flourishing at local level: The case of Florence metropolitan city

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Abstract

In the Covid19 era, the capacity of local and national systems to face the intersection between vulnerability, inequalities, and unsustainability will define the future course of development (UNDP, 2020). In this regard, the real playground for action to accelerate solutions towards the Agenda 2030 for Sustainable Development is not just the global and national level, but also the local level (Biggeri and Ferrannini, 2014; UNDG, 2014; GTF, 2016; Bentz et al., 2019; Granados & Noferini, 2019; UNDP, 2019).

In this view, the SDGs cannot be effectively implemented without considering the specific characteristics of each place and its actors, with their vision, values and identities, as well as the strict inter-linkages among the three dimensions of sustainability at local level. Moreover, local and regional governments (LRGs) play a fundamental role for SDG implementation concerning access to basic social services, the promotion of economic development, and the exercise of civic rights. Nowadays, this is reinforced by the territorially differentiated impact of the pandemic, which calls for a place-based approach to policy responses along with a strong inter-governmental coordination (OECD, 2020; UCLG, 2020). Indeed, LRGs are at the frontline of the crisis management (UCLG, 2020; UNDP, 2020), not only to implement nation-wide measures, but also to provide laboratories for bottom-up and innovative recovery strategies (OECD, 2020). In the long-term, LRGs have today the opportunity to plan for life after Covid19 with a range of strategic investments to pair economic recovery with social inclusiveness and environmental sustainability. For these reasons, the localization of SDGs becomes even more relevant in the Covid19

era, helping to frame priorities, align levels of governance, setting targets and monitoring real progress towards sustainable development.

The objective of our paper is twofold. First, we present a theoretical and interpretative framework to analyse how SDG localization can be pursued through strategic planning at local level centred on a vision of sustainable human development. Second, we make our framework operational by applying it to the case-study of Florence Metropolitan City (Italy), whose territory is composed by 41 municipalities spanning from small towns in rural and marginal areas (with less than 5000 inhabitants) to the city of Florence (with more than 370.000 inhabitants) representing its core and main urban environment.

This case-study is particularly interesting not only due to the structural socio-economic features of Florence Metropolitan City, but also to the efforts devoted by local authorities in recent years to plan strategies for sustainable human development through the current design of the Metropolitan Territorial Plan and the Metropolitan Agenda 2030.

Our research design combines i) the qualitative analysis of data and information gathered within the policy-making processes through semi-structured interviews and structured focus group discussions with local actors, with ii) the quantitative analysis of secondary data aggregated into five composite indices of sustainability.

This allows understanding to what extent transformative resilience, social cohesion and environmental consciousness have been firmly placed at the centre stage of decision-making processes, drawing wider insights for the international development on SDG localization in the pandemic era.

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Transformative climate urbanism: Attempting to overcome sacred cows through public participation in urban policy development

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Abstract

Before the global economy was suspended into paralysis in March 2020 in response to a mysterious viral pathogen, 2019 was arguably the most significant year of grassroots climate activism in a generation, capturing society's attention. The voices of campaigners from the youth climate striker Greta Thunberg to the direct-action protest group Extinction Rebellion captivated media attention throughout the year, primarily calling for national and international action. Despite outsized attention on these civic pressures aimed at the highest levels of politics, novel forms of public engagement also impacted urban climate policy development processes during this period.

From September 2017 through March 2019, the city-region of Greater Manchester, UK developed a landmark carbon neutrality strategy – the 5 Year Environment Plan – utilising innovative forms of citizen engagement. Through these new 'co-productive' pathways for civic involvement in urban climate policy development, policymakers were challenged to grapple with highly politicised policy issues that had previously avoided. To meaningfully confront these concerns would require local government decision-makers to engage in policy contestation of so-called sensitive issues, demanding governance capacity for transformation. Despite the participative co-productive pathways and clear perspectives articulated by factions of the public on these sensitive issues, Greater Manchester's 5 Year Environment Plan largely avoided taking any firm action on these policy areas.

As cities seek to respond to and recover from the Covid-19 pandemic whilst simultaneously addressing the climate crisis, there is an urgent need for local government organisations to develop the capabilities required to facilitate transformation. This study used a participative embedded research approach to investigate how Greater Manchester attempted to develop a transformative local climate policy through a publicly inclusive, co-productive process. Through this embedded research approach and key stakeholder interviews, the paper finds that facilitating robust local climate policy development that may address highly politicised challenges requires local government organisations to cultivate particular organisational cultures needed for dynamic transformation. This finding has broader implications for SDG+Target 11.3, demonstrating that for participatory and inclusive urban policy and planning processes to produce sustainable urbanisation policies, local government organisations must support organisational cultures conducive to integrating diverse forms of knowledge that may be needed for transformative urban climate action.

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Exploring the power of art and cultural initiative as drivers in urban transformation towards social and cultural sustainable development.

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Abstract

Art and cultural activities have been part of human lives and communities in diverse forms throughout time. On the one hand, art and culture relates to the essence of human interaction in which people interprets and understand our selves and the world we are living in (Fornäs,2012). On the other hand, art and culture relates to material artifacts that can be put on display as public art as well as valuable commodities. But it is not a simple dichotomy. Instead Pier Luigi Sacco (2019) emphasize art and culture's aesthetic modus of elevation, engagement and connections which sets focus on art and culture as crucial for creation and community development that is, for cultural sustainability (Soini et.al. 2014, 2016).

In cities around the world art and culture are obvious elements through theatres, operas, sculptures and other art work. But the space for and access to art and cultural activities differs. Power over resources and right to exhibit, tolerance or intolerance to ideas and/or expressions, and the sense of agency to participate, are just some aspects that deserves to be highlighted. In more marginalized parts of cities, art and culture seems to take other forms, at times more as protests or activism against predominate stratas.

The aim of this paper is to develop a framework for systematic understanding of the power of art and cultural initiatives as drivers in urban transformation towards an inclusive social and cultural sustainable urban development.

This paper is based on analysis of urban planning policy documents in Stockholm Sweden out of an art and cultural perspective and a special focus on marginalized suburban settings. It is furthermore based on case studies of cultural initiatives in diverse types of organisations such as civil society and so called alternative organizations in Stockholm Sweden, Sheffield UK and Warsaw Poland.

Art and culture are highlighted as important for growth and wellbeing in the major regional urban planning document (RUFS,2050). It does not however provide explicit policy measures or explicit means.

Case studies show how art and cultural initiatives contribute to individual and collective empowerment, active participation, strive towards decent livelihoods. These processes relate to several aspects of the UN SDGs and cultural vitality for potential future benefits. The case studies also reveal a vulnerability due to unsupportive structures including possibilities of longterm funding and livelihood for marginalized groups of participants.

There is a danger of instrumentalization and thereby violating the arm's length distance between artistic freedom of expression and political interference (Grinell,2020; Löfgren,2016; Sacco&Ferilli,2018; Valjakka,2021). The artistic and cultural initiatives we have studied, stand in the middle of a multitude of stakeholders and different power systems navigating between them in their ambition to contribute to an inclusive social and cultural sustainable urban development.

This study relates to SDG11, Sustainable cities, in particular the participatory subtarget 11.3.2, and Unesco's framework of cultural sustainability with the four dimensions: Environment & Resilience; Prosperity & Livelihood; Knowledge & Skills; Inclusion & Participation (UNESCO 2019), including connections to twelve SDGs (and 25 subtargets).

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Indicator system based on the goals of the Sustainable Development Goals at the local level: the case of urban sustainability in the city of Rio de Janeiro

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Abstract

Introduction

The growing phenomenon of urbanization poses permanent challenges for public administrators and for the civil society. Urban ecosystems have been increasingly under pressure as a result of the still dominant development model that favors economic growth to the detriment of social and environmental demands, causing unsustainable imbalances and affecting the quality of life in cities in the long run.

Special attention must be given on monitoring the progress made in relation to the Sustainable Development Goals (SDGs), transposed to the local scale through indicators capable of measuring urban sustainability in a continuous way.

Then, developing a system of indicators to assess the urban sustainability of the city of Rio de Janeiro, capable of capturing in depth the reality of the city as a case study, marked by profound social inequalities and the deterioration of its environmental, economic conditions and the quality of life of the population is an effort of urgent and utmost importance.

This context demonstrates the need to move forward, as existing initiatives in the city of Rio de Janeiro to monitor the city's progress towards achieving the SDGs of Agenda 2030 are not enough.

Methodology

The methodology is based on documentary research about systems of indicators for assessing sustainability at different scales (global, regional and local) that already exist, not restricted to the Global Indicator Framework for the SDGs, and related to several cities in Brazil and other countries. They're useful references for the development of an initial list of material and non-material indicators for assessing urban sustainability.

Interviews and focus groups will be conducted with experts and representatives of civil society entities from different segments of the population in order to identify new relevant indicators to measure the urban sustainability of the city of Rio de Janeiro. By doing so this will capture the data and local priorities that the official statistics fail to capture and thus expand popular participation in this research methodology, representing a new approach to the theme.

Finally, the Delphi method will be used to obtain consensus and validation by experts around the indicators that should be part of the indicator system under development.

Findings

The partial results already obtained show the insufficiency of the SDGs for assessing sustainability on a local scale. The numerous systems of indicators identified demonstrate the importance of developing specific indicators that respect the urban dynamics of each city, taking into account technical, methodological and local governance constraints.

Conclusions

The participation of specialists and members of civil society in the next stages of the study represents the innovative approach adopted. This is the method proposed to build a system of indicators that valorize people who live in the city and what is important to them. This is also the way to set up an effective system of indicators to measure the progress of the city of Rio de Janeiro towards a sustainable development model.

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Perspectives of Urban Agricultural Wastes Management towards Achieving Green Economy in Ondo State, Southwest Nigeria

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Dr David Awolala

Abstract

This study focused on perspectives of urban agricultural wastes management toward achieving a green economy in Ondo State, Nigeria. It identified agricultural wastes with likely environmental and health risks in the metropolitan cities areas by investigating the prevailing urban agricultural waste collection and disposal systems, and urban residents preferences for a voluntary agricultural waste collection system with estimated premium they are willing to pay for improved agricultural waste collection. Primary data were collected with a well-structured questionnaire from seventy-six respondents using a multistage sampling technique.

Descriptive results indicated that 77.6% of the respondents alluded that waste from livestock (fish, poultry and pig) farming constituted the dominant agro-waste polluting the environment. About 98% are closer to nearest agro-waste centers within 2km. 60% of the respondents had access to environmental education but 49% perceived their environment to be average, but not that they are satisfied with the situation. Within the agro-processors, about 90% do not dispose their agricultural waste weekly. Further, it was observed that 72% of the respondents perceived air pollution as major effect from agricultural wastes on their environment.

Majority were cognizant of cleaner and safer environmental transformation, and environmental condition of their areas tolerable, but not satisfied. The study concluded that most of the respondents

which are not willing to pay for improved urban agricultural waste collection because it was viewed as agro-processors responsibility. It is recommended that agro-processors contributing to urban environmental pollution should be willing to pay towards improved environmental transformation that would lead to green economy in the metropolitan area.

Keywords: Agricultural wastes, Urban environment, Health risk, Environmental transformation, Green economy, Nigeria

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Social values and public preferences on energy futures in Asian cities: Insights from a comparative study of online deliberative pollings in Tokyo and Hong Kong

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Abstract

Smart energy transition studies have drawn attention to the limits of government-led top-down approaches and have been calling for citizen-centric transitions that explore the roles of citizens in contributing to delivering deep decarbonisation goals. The literature has however remained limited in addressing social aspects of energy transitions from the perspectives of citizens. This paper explored social values as a factor in influencing public preferences on energy futures. Based on a combined used of quantitative and qualitative data from two online deliberative pollings conducted in Tokyo (n=136) and Hong Kong (n=174), this study found that public preferences on more ambitious solar futures scenarios were associated with social values in particular one's perception of energy autonomy, one's willingness to be engaged in energy transitions, and one's perceived capabilities to act. Our findings have policy implications in relation to innovation in participatory energy transitions and empowerment.

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City Love and Place Quality: A Study on Liveable and Loveable Neighbourhoods in Rotterdam

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Abstract

The Sustainable Development Goals (SDGs) and the *New Urban Agenda* (for 2030) contain an actionable message on sustainable cities and human settlements, with clear statements and insights demanding '*urban empires*' commitment and work together to tackle urgent global complex challenges and to create a better place quality and future for all. Restructuring local governance and reframing responsive and local actions for meeting SDGs creates new opportunities, innovative approaches and original directions for urban planners and public institutions with the focus on ensuring lovable and resilient places in order to make the future city '*a place4all*'. A necessary condition for coping with challenges and threats to the resilience of cities is not only to address indigenous vulnerabilities in urban structure and functioning, but also to support human well-being, satisfaction and activities in space. Understanding the local strengths and weaknesses that contribute to urban contentment – the so-called City Love - has in recent years attracted much interest from policy-makers, urban planners and scientists. The differences between neighbourhoods, in terms of their natural and built environment and their varied social-economic situation calls for local customized development strategies, actions and policies for a better future for all.

The driving forces behind the residents' appreciation for their neighbourhood are the focus of this study, where both the neighbourhood's 'body' and 'soul' are considered. Building on previous studies, the 'body' refers to the material and physical aspects of a neighbourhood, while the 'soul' refers to its immaterial and emotional aspects. However, previous studies are often based on databases regarding either residential perceptions or geographical information or official statistics. In this study, we approach the issue by combining all these types of information.

The overall aim is to develop and test a new city love concept – inspired by the soul and body conceptualisation of the 'city love' – based on a '*feelgood*' and *human habitat* index (HHI) aiming to map out the citizens' contentment or appreciation of city life at a district or neighbourhood scale. This study utilizes data from a quantitative survey of 63 neighbourhoods in the city of Rotterdam. The data contains survey information from residents and also register data e.g., real-estate values, crime statistics, and socio-demographics. Geographical information from Open Street Map was added as a complement.

In addition to multivariate analysis, the paper incorporates quantile regressions with spatial econometric methods. The results show that the coefficients of the *feelgood* index decrease slightly as we move up along the distribution of the Neighbourhood Love Index, whereas the *HHI* shows an

increasing trend for higher quantiles of the dependent variables. This means that access to amenities such as public transportation, sport facilities, diverse attractions and also to bikeable and walkable road networks, become more decisive for the upper end of the distribution of Neighbourhood Love Index. One contribution of this paper is the suggested conceptual *City Love* model. Furthermore, the paper pays considerable attention to the physical nature of places in combination with register and survey data, enabling a holistic analysis of local urban qualities.

Full papers

Emergy-based Sustainable Performance Evaluation of Green-Blue Infrastructure

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Abstract

The Green-Blue infrastructures (GBI), as key infrastructures in Sponge city construction, have important ecological benefits but are still lack of systematic evaluation methods. This study proposes an emergy-based classification and evaluation method to show their sustainable performance for four types of GBIs including forest type, wetland type, grassland type and special type, which is crucial for city and region transformation. The results show that forest type can provide the highest ecological benefit per unit area to promote the sustainability of a city, followed by wetland type infrastructure and grassland type, and the smallest is special type. The comprehensive benefits and the spatial heterogeneity are also quantitatively compared in the study. The results show that there is an interaction between the ecological, economic and social benefits, and the GBIs in the southern communities play a better comprehensive benefit. The donor-side method can provide new ideas and references for the sustainable transformation in cities and regions.

Keywords: Emergy method, Green-Blue infrastructure, Ecological benefits, Sustainable performance

1. Introduction

Stormwater management has become the key to relieve urban water crisis in order to improve the sustainable development of the city, and then the Sponge City, as a regional plan to comprehensively solve this problem, has attracted much attention since it was proposed in 2013 formally (Yang and Dong, 2019). Sponge City Construction is an important measure of urban and regional transformation in China in recent years, and has been promoted in many cities. The United Nations World Water Development Report 2018 also mentioned that China's sponge city concept and national actions are excellent examples of addressing water resources challenges (Uhlenbrook et al., 2018), which is a key step to improve sustainable urban development, achieving a huge leap in urban ecological environment, especially in urban resilience (Folke et al., 2002).

The green and blue infrastructure (GBI) is the most critical basic component in Sponge City construction. GBI is a natural, semi-natural and artificial ecological network system made of green vegetation and water (Tzoulas et al., 2007; IOJIC et al., 2018; Silva, 2017). The scientific application of urban blue-green infrastructure can greatly improve the ecological environment and contribute to

pursuing sustainable and resilient planning and designing of cities (Hysa, 2021). Completely and correctly identifying and caculating the ecological services provided by various GBIs is the top priority, which is of significance for the planning of GBIs and the evaluation of Sponge Cities, so as to provide a guarantee for the sustainable transformation of cities and regions.

There have been currently models and methods that can be used to evaluate GBI's ecological benefits, such as InVEST, EcoMetrix, The National Green Value Calculator(GVC) and i-Tree (Jayasooriya et al., 2014; Nemec and Raudsepp-Hearne., 2013). However, these methods all have problems such as high data requirements, single ecological services studied and lack of comparability of ecological services due to the disunity of units, which are fail to carry out an overall assessment of diversified blue-green infrastructure. Previous studies have confirmed that the emergy method has strong applicability in the accounting of GBIs (Law et al., 2017; Pulselli et al., 2014). The key advantage of emergy is that it accounts the donor-type value, which is determined by the production process and not by human's preferences or willingness to pay. However, the application of emergy method still lacks a framework in its application to GBI ecosystem services valuation, which is aimed at achieving an integrated comparison of various GBIs and their relevant ecological services.

This study focuses on the methodology of GBIs' ecological services accounting based on emergy method, and applies it to the case of Chineses residential community for verification, aiming to provide foundations and suggestions for urban sustainable development from the perspective of residential community transformation.

2. Methods

Modeled on the principle of natural ecosystem classification, this study divides Green-Blue infrastructures into wetland type (Type-A), grassland type (Type-B), special type (Type-C) and forest type (Type-D) based on the construction requirements and the ecosystem services that produced. For better analysis and comparison, the typical infrastructures are classified as A1-biological retention pond, A2-rainwater garden, B1-sunken green space, B2- planting grassland, B3-green roof, C1-permeable pavement, C2-seepage well, C3-water storage tank, D1-urban forest and D2-street tree with permeable pavers.

Table 1. *Ecosystem services and disservices provided by GBIs*

Type	Ecosystem services										Disservices
	Biomass increase	Carbon sequestration	Ground water recharge	Surface Water regulation	Microclimate regulation	Ecosystem services and disservices related to environmental benefits					Mosquitoes increase
						Water purification	Air purification	Noise reduction	Green garbage	VOC release	

A1	○	○	○	○	○	○	○	○	○	/	○
A2	○	○	×	○	○	○	○	○	○	/	○
B1	○	○	○	○	×	○	○	○	○	/	○
B2	○	○	○	○	×	○	○	○	○	/	○
B3	○	○	×	○	×	○	○	○	○	/	×
C1	/	/	○	×	○	/	/	/	/	/	/
C2	/	/	○	○	×	/	/	/	/	/	/
C3	/	/	×	○	○	/	/	/	/	/	/
D1	○	○	○	○	○	○	○	○	○	○	/
D2	○	○	○	○	○	○	○	○	○	○	/

Note: ○ means that the GBI has the service; × means that the GBI doesn't has the service; / means that we haven't considered the service.

This study intends to use emergy method to quantify the ecosystem services of GBIs in sponge community. Emergy is the amount of another kind of energy contained in a certain flow or stored energy, that is, the sum of all kinds of energy consumed directly and indirectly in the process of forming a product and receiving services in terms of solar energy (Odum, 1996). The advantage of emergy method is that it can convert different levels and categories of matter or energy into a unified measurement scale through emergy conversion rate, thus solving the problem of lack of common measurement scale in current ecosystem service accounting. Emergy analysis is not only an important method of environmental accounting, but also a detailed analysis of material flow and energy transfer, making it an important tool for systematic analysis and evaluation. Therefore, emergy method is more suitable for accounting ecological products from natural ecosystems than economic method.

The ecosystem services accounting techniques are detailed below:

- *Biomass increase*

$$E_{mNPP} = Max(R_i) \qquad (1)$$

Among them, E_{mNPP} is the required emergy value (sej) for increasing NPP, and R_i refers to the input amount of all renewable emergy values in the area. The R_i includes the sum of solar, geothermal emergy, wind emergy, and the sum of other renewables (e.g.: rain chemical energy, irrigation water).

- *Carbon sequestration*

The process of photosynthesis is generating organic matter and fixing carbon dioxide, but the amount of carbon sequestered is only one-half of the biomass, and the solid state of the ecosystem is $\frac{1}{2}(\Delta B+\frac{B}{T})$. The carbon sequestration rate is used in the calculation in this study. Therefore, the calculation formula is:

$$E_{m(CF)} = v \times S \times UEV_{csi} \qquad (2)$$

$$UEV_{csi} = \frac{E_{\mathrm{sm}NPP}}{NPP} \qquad (3)$$

Among them, $E_{m(CF)}$ is the emergy value required for carbon sequestration (sej); v is the carbon sequestration rate, which is the amount of carbon sequestration per unit area of GBI per year ($g \cdot m^{-2} \cdot a^{-1}$); S is the infrastructure area (m^2); UEV_{csi} is the transformity of carbon sequestration ($sej \cdot g^{-1}$); E_{smNPP} is the emergy value required to increase NPP per area (sej); *NPP* is the biomass of this type of GBI (g).

- *Surface water regulation*

$$E_{m(WSR)} = M_{water} \times UEV_{water} \qquad (4)$$

$$M_{water} = S \times d \times \rho \qquad (5)$$

The density of water ρ is $1000 kg/m^3$, UEV_{water} is the transformity of water, M_{water} is the total water storage (m^3), *S* is the area of the infrastructure (m^2), and *d* is the depth of runoff (m), which is actually designed by the specific infrastructure.

- *Groundwater recharge*

$$E_{gw} = R \times \rho \times S \times k \times UEV_{gw} \qquad (6)$$

Among them, E_{gw} is the emergy value (sej) required to recharge the groundwater; *R* is the annual precipitation in the study area ($m \cdot yr^{-1}$); ρ is the water density ($kg \cdot m^{-3}$); *S* is the infrastructure area (m^2); *k* is the precipitation infiltration recharge coefficient; UEV_{gw} is the transformity of groundwater ($sej \cdot g^{-1}$). Some GBIs have this ecosystem service due to the permeable ground but some are not, if they are constructed on hardened ground or roof.

- *Air purification*

GBIs can purify SO_2, CO, O_3, PM_{10}, $PM_{2.5}$, fluoride and nitrogen oxides and other air pollutants, based on different vegetation choices. In consequence, it can reduce the loss of human health and ecological resources caused by air pollution. Specifically, there are two aspects:

Reduction in human health loss:

$$E_{m(HM)} = \sum (M_i \times S \times DALY_i \times \tau_H) \quad (7)$$

Reduction in ecological resource loss:

$$E_{m(ER)} = \sum (M_i \times S \times PDF(\%)_i \times E_{Bio}) \quad (8)$$

Among them, $E_{m(HM)}$ is the emergy value (sej) of the reduction in human health loss after the purification of air pollutants; M_i is the ability to purify the *i*-th air pollutant (kg·hm^{-2}·a^{-1}); S is the area of the infrastructure (hm^2); $DALY_i$ is the influencing factor of the *i*-th air pollutant; τ_H is the ratio of the total regional medical expenditure per capital (sej·person^{-1}); $E_{m(ER)}$ is the emergy value of the reduction of natural resource loss after air pollutant purification (sej); $PDF(\%)_i$ is the potential extinction ratio of species affected by the *i*-th air pollutant; E_{Bio} is the emergy value required by the species in the study area, which is measured by the emergy value of regional renewable resources (sej).

$$E_{m(AP)} = E_{m(HM)} + E_{m(ER)} \quad (9)$$

- *Microclimate regulation*

$$E_{mE} = E_{EW} \times S \times \rho_w \times UEV_{EW} \quad (10)$$

E_{mE} is the emergy value required to regulate temperature and humidity (sej); E_{EW} is the average annual evaporation (m); *S* is the area of the study area (m^2); ρ_w is the density of water (g·cm^{-3}); UEV_{EW} is the transformity of water vapor (sej·g^{-1}).

Our study also consider the investment of GBIs'application as economic input and residents' opinions as social cognitive attitude, in addition to the ecosystem services provided by GBIs. Because sustainable development is not only about the improvement of the environment, but also includes the influence of social and economic factors, especiallly for a city. In a word, sustainable development is a compound development path involving three aspects of society, economy and environment. Therefore, on the basis of considering the ecological benefits of GBIs, it is also crucial to further consider the comprehensive benefits of GBIs under the theory of sustainable development.

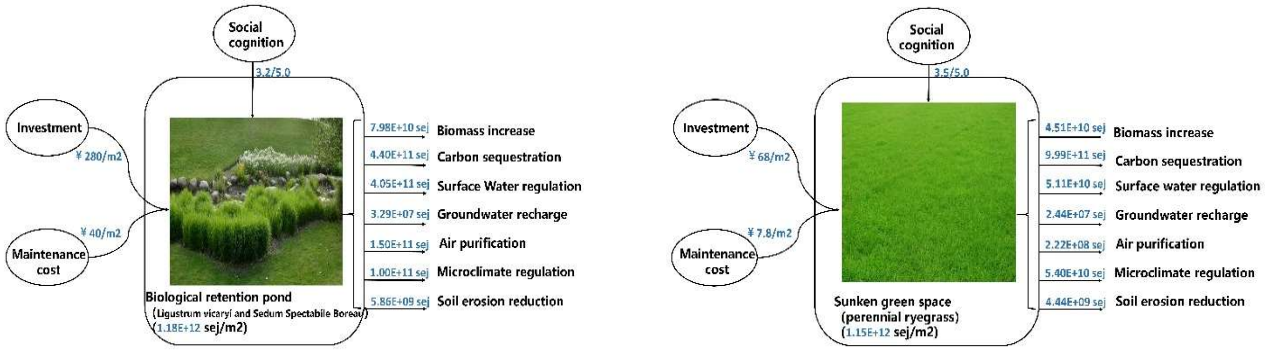
3. Results and Discussion

In this study, we applied the emergy method of GBIs to seven cities, including Beijing, Qingdao (Shandong Province), Changde (Hunan Province), Nanning (Guangxi Province), Pingxiang (Jiangxi Province), Wuhan (Hubei Province) and Xiamen (Fujian Province), with a total of 20 Sponge residential communities. We analyzed and compared the application potential and effects of different kinds of GBIs in Beijing, and compared the effects of the transformation leading by GBIs in 20 Sponge residential areas distributed in the north and south of China, to identify the role and heterogeneity of

GBIs in urban sustainable transformation. All datas in this study come from literature, field research and national annual statistics.

3.1 Sustainable performance of GBIs in Beijing

Taking Beijing as the research area, we studied nearly 100 kinds of GBIs including ABCD types. The emergy method is used to calculate the ecosystem service value(ESV), which is regarded as a measure of the sustainable performance of BGIs. For type A, with vegetation of shrubs and water-resistant grass species, the ecosystem service values(ESVs) are relatively balanced, among which carbon sequestration and rainwater regulation are the dominant ones. Among the 10 bioretention ponds with different vegetation, privet privet and zoysia japonica provided the highest ESVs, followed by the combination of boxulus macrophylla and zoysia japonica. For type B, there is little difference in the ESVs provided by six sunken grasslands with different vegetation, which all show strong capacity of carbon sequestration, water storage and microclimate regulation. Green roofs were classified into intensive, semi-intensive and extensive types for consideration. ESVs of intensive, semi-intensive and extensive vegetation types all show a step-variable decrease in different vegetation choices, indicating that the more intensive vegetation planting is, the higher ecological benefits it will bring into play. In addition, vertical greening was also considered and its prominent ecosystem services were air purification and carbon sequestration, followed by microclimate regulation and biomass increase. The total ESV was 4.24×10^{11} sej/m^2/yr. For type C, the three kinds of permeable pavement mainly play a role in replenishment of groundwater and reduction of soil erosion, and the total ESV is concentrated in the range of 6.05×10^{9} -- 6.14×10^{9} sej/m^2/yr. In type D, the dominant ecosystem services are soil erosion reduction and carbon sequestration. Among the 20 kinds of street tree facilities, sycamellia, poplar and oak showed outstanding performance because of their strong carbon sequestration capacity. Sycamellia was the highest, and the ESV reached 6.11×10^{12} sej/m^2/yr, the ESV of other types was 1.63×10^{12}-2.75×10^{12} sej/m^2/yr. The emergy flow of different kinds of GBIs is illustrated in the figure 1.



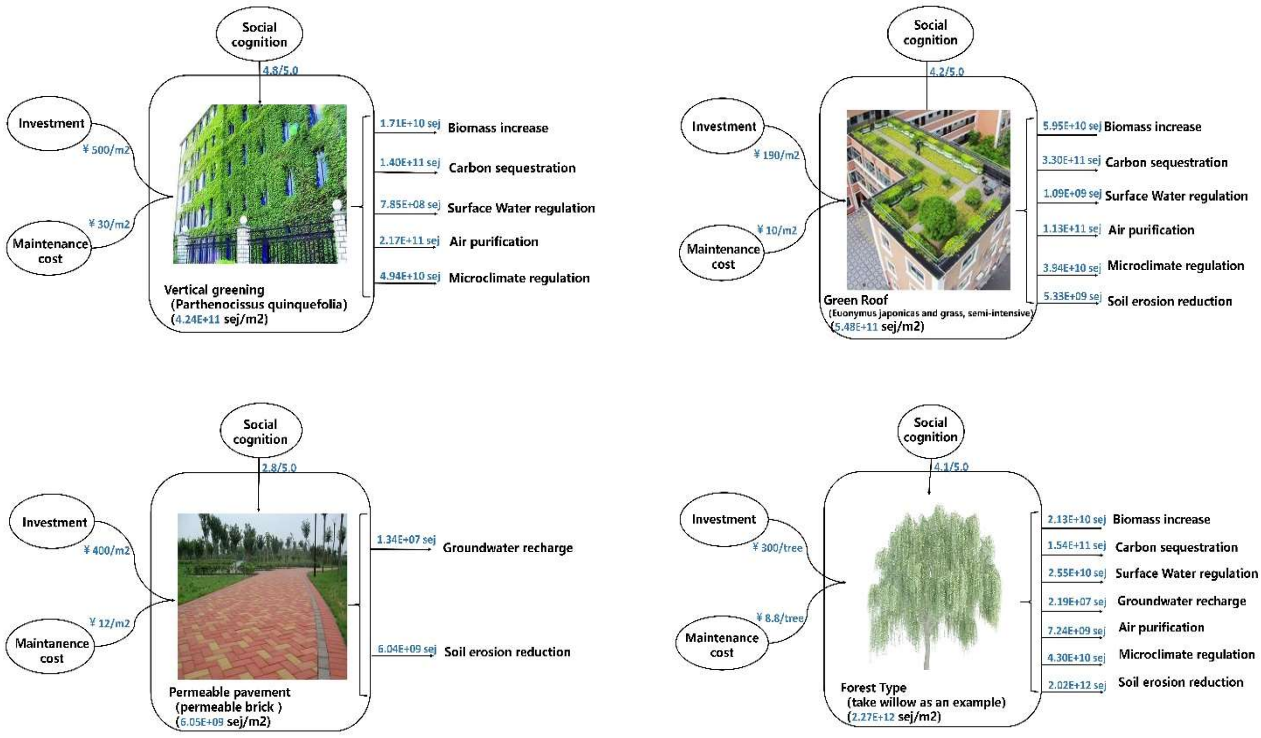


Figure 1*. The emergy flow of different kinds of GBIs.* (The six images, in order, are emergy flow of Type A (biological retention ponds), Type B (sunken green space, vertical greening and green roofs), Type C (permeable pavements) and Type D (street trees))

On the basis of ecosystem service accounting, this study conducted ecological benefit scoring based on ESV, economic scoring based on construction investment and maintenance cost, social cognition scoring based on residents' opinion and feedback. Combined with the three-dimensional scoring, we comprehensively evaluate all kinds of blue-green infrastructure, so as to explain the performance of all kinds of GBIs in urban sustainable development and transformation.

As shown in Figure 2, among the six types of GBIs, street trees, green roofs and sunken green spaces perform better overall. In the ecological score, street trees scored the highest because their ESV was more than twice as high as that of other types of GBIs. Permeable pavement scored the lowest because it played a single ecosystem service and had the lowest ESV. In the economic score, the sunken green space has the highest score due to its lower construction input and maintenance cost, while the vertical greening has the lowest score due to its complex technology, high maintenance frequency and high investment. In the social score, vertical greening has better landscape and ecological benefits, which is favored and recognized by residents and gets the highest score. Permeable pavement gets the lowest score because its application is concealed and its function is not well known by residents. From a comprehensive perspective, street trees are the most highly evaluated for their outstanding ecological services, relatively economic costs and good social recognition, which are important infrastructures to promote urban sustainable transformation. Permeable pavement has a relatively low comprehensive

score due to its high frequency of daily maintenance, complex procedures and high economic input, as well as its single and relatively hidden ecological services, which are not recognized by the public. However, in the real transformation, due to the wide application range of permeable pavement, the city cannot ignore the importance of permeable pavement, and should increase the application of it on the hard ground, so as to achieve the added value of urban ecological benefits and promote the sustainable development of the city.

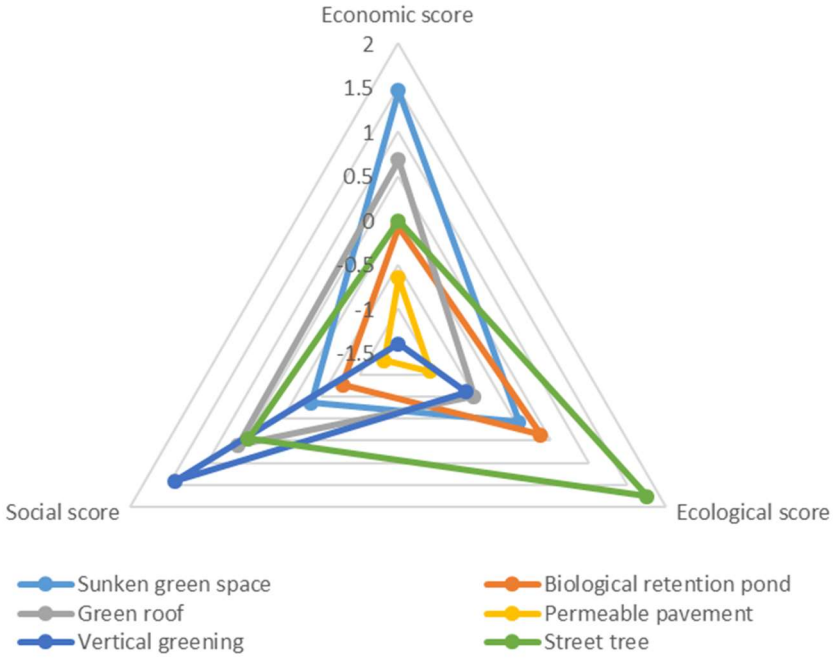


***Figure 2**. Comprehensive score of different kinds of GBIs.*

3.2 North-south differences in the sustainable performance of BGIs

Using the comprehensive evaluation method, we also carried out ecological, economic and social evaluations for 20 sponge residential communities in 7 studied cities, as shown in table 2, in order to reveal the impact of sponge transformation and the application of blue-green infrastructure on the improvement of ecological benefits and sustainable development of the communities. Among the 20 sponge residential communities, communities 1-5 are distributed in the north and the rest are in the south of China. As for the ecological score, we can find that the southern community generally has a higher score than the northern community, except for the No. 2 community in Beijing. The ESV of the southern community is markly higher than that of the northern community according to the ecosystem service evaluation. The BGIs in the south can provide better ecosystem services and improve the overall ecological benefits of the community. In particular, the management of rainwater can greatly increase the flexibility of the community, which is in line with the concept of sustainable development of the community. For the economic score, different communities have different scores due to their different economic situation, reconstruction and investment. Score for the society, the southern communities also scored higher than the north ones, which is largely associated with the play of ecological benefits. The

ecosystem services provided by BGIs can be exerted by the residents' perception, directly or indirectly affect residents' cognition to the infrastructure. Therefore it's important to improve the ecological benefits of BGIs, both affecting residents' well-being and the sustainable development of communities.

Table 2. The ecological - economic - social score and ranking of 20 communities

Community Number	1	2	3	4	5	6	7	8	9	10
Ecological score	0.000	1.000	0.201	0.222	0.169	0.300	0.676	0.587	0.930	0.113
Economic score	-0.103	-1.000	-0.251	-0.255	-0.102	-0.114	-0.101	-0.101	-0.324	-0.110
Social score	0.115	0.115	0.115	0.115	0.282	0.282	0.604	0.475	0.338	1.000
Total score	0.004	0.038	0.022	0.027	0.116	0.156	0.393	0.320	0.315	0.334
Ranking	**20**	**16**	**18**	**17**	**12**	**9**	**1**	**3**	**4**	**2**
Community Number	11	12	13	14	15	16	17	18	19	20
Ecological score	0.392	0.216	0.381	0.432	0.201	0.146	0.299	0.263	0.096	0.501
Economic score	-0.135	0.000	-0.150	-0.114	-0.117	-0.083	-0.049	-0.059	-0.128	-0.309
Social score	0.046	0.162	0.445	0.377	0.513	0.000	0.117	0.353	0.158	0.143
Total score	0.101	0.126	0.225	0.232	0.199	0.021	0.122	0.186	0.042	0.112
Ranking	**14**	**10**	**6**	**5**	**7**	**19**	**11**	**8**	**15**	**13**

3.3 Discussion

Sponge city is a sustainable urban construction model described from the perspective of urban rainwater management which refers that a modern city should have the functions of absorbing, purifies and utilizing rainwater like a sponge, as well as the ability to cope with climate change, prevent and reduce disasters of extreme rainfall, and maintain ecological functions (Zhang et al., 2019). Based on the expansion of water ecological benefits, this study identifies and calculates the various ecological benefits of GBIs. It can be found that although they are all built for sponge cities, different GBIs have different key and prominent ecosystem services. In the process of urban transformation, the key demands of the area and the core supply of all kinds of GBIs should be identified firstly, so as to maximize the transformation benefit and better promote the sustainable development of the city.

From the point of comprehensive benefit evaluation, taking social and economic, the two dimensions, into consideration can be more comprehensive and scientific. For instance, the application effect of GBIs in some cases is not good, because economic investment is less and the quality is not up to standard which leads to influencing the full play of the ecological benefits. As the ecological benefits failed to achieve the desired level, residents' satisfaction of GBIs is decreased, which can indirectly reflect to the investors's future investment decisions on GBIs. As we can see, the three-dimensional benefits of economy, society and environment are interrelated and mutually restricted. In future studies, it's crucial to clarify the interlocking effects of the three aspects on GBIs that will be helpful to make decisions on sustainable urban development and transformation.

Comparison of the comprehensive benefits between the north and south cities in China reveals the spatial heterogeneity of GBIs that is also the key difference for consideration. Based on the differences of regions in natural environment, cultural atmosphere, and economic development, the application effects of different GBI in the north and the south cities distinguish obviously. If we can identify the severe "city disease" of different regions at first and equip the most suitable GBIs, construction of GBIs or sponge city transformation will be carried out in different regions according to local conditions to ensure the optimization of regional sustainable development.

4. Conclusions

This study constructed a donor-side accounting methodology for evaluationg the ecological effects of 20 sponge residential communities in 7 cities in China, including 85 GBIs, to show their contributions to urban sustainablity. The results show that forest type can provide the highest ecological benefit per unit area to promote the sustainability of a city, followed by wetland type infrastructure and grassland type, and the smallest is special type. Based on the evaluation of comprehensive benefits of ecology, economy and society, the forest type is also the best, while the permeable pavement type is the lowest. However, it is unrealistic to plant all tall trees or not use permeable pavement in a community. So we must comprehensively use all kinds of GBIs based on realistic considerations. In addition, the interactive effects of comprehensive benefits and the north-south spatial heterogeneity deserve further study in the future, but we make sure that these two factors will affect the sustainable performance of GBIs, and they should be fully considered in urban and regional transformation to build a more sustainable city.

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Airport integration in the rail network: case study of Beja Airport, Portugal

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Abstract

Integration between different modes of transport is a key-factor to increase the efficiency of public transport and a modal shift from cars. This is an essential contribution to the energy transition and to the achievement of greenhouse gas emissions and climate change targets stated in the European New Green Deal. This research is focused on the linking of two infrastructures which serve as longdistance transport hubs: airports and railway networks. Our case-study is the Beja airport in Portugal and the rail link between Lisbon and Beja. There has been a large discussion in Portugal about the creation of a new airport to substitute or complement the Lisbon airport due to its saturation. Recently, the Portuguese Government approved the installation of a new airport at Montijo. However, it has been involved in controversy due to its social and ecological impact, and the absence of a mandatory strategic environmental assessment. The hypothesis of this study is to use the existing, underused, Beja airport as the complementary airport for Lisbon. Beja should be primarily used for long-haul flights and have a high-performance rail link to Lisbon. The methodology comprehended the following: a survey targeting potential airport users and the population of the Alentejo region; a detailed analysis of the rail link to Beja and the air traffic in Lisbon to identify the improvements needed to the infrastructure; and computation of performance indicators to compare Montijo and Beja solutions. The survey shows public interest in the Beja alternative. The overall analysis shows that the qualification of the Lisbon-Beja rail line and the necessary expansion of the Beja air terminal will have an investment cost several times lower than the Montijo airport, with none of the major impacts, and more in line with commitments regarding climate change and energy transition.

Keywords: airport; railway; air-rail intermodality; air traffic segregation; modal shift.

1. Introduction

Facing climate change requires a reform of the economic and social model. The European Green Deal reinforcers the commitment to promote more sustainable mobility based on decarbonization and energy transition towards carbon neutrality.

Railways are one of the most energy and environmentally efficient modes of transport, so it is crucial to invest on rail to reduce carbon emissions and to mitigate climate change (IEA, 2019; EC, 2021). Air

travel is the preferred mode for long-distance travel, yet it has high energy consumption, high GHG emissions intensity, even at full capacity, and is one of the most challenging modes of transport to decarbonise (Givoni and Banister, 2007; IEA, 2019; Postorino et al., 2018).

The relationship between rail and airports can be defined in three categories: competition, when train and plane compete for the same journey; cooperation, which occurs when one of the modes complements or relieves the services of the other; and integration, which can vary between replacing or complementing the air service, becoming the most viable option for air-rail interaction as it provides a more fluid and convenient passenger experience (Givoni and Banister, 2006). Up to distances of 800 km it is possible to have competition between air and rail. The replacement of shorthaul air traffic by rail and the connection of all airports to the rail network is mentioned in the White Paper on Transport as one of the strategies to achieve climate targets by 2050 (EC, 2011).

Evidence suggests that when a railway connection is materialised at airports, airport operators consider the complementarity advantageous because it enables the creation of new business models. Following the Hub-and-Spoke model, air-rail integration can occur, for example, when the journey from the hub airport to the destination airport can be made by train (spoke) instead of a second flight. Givoni and Banister (2007) refer a set of criteria that can make air-rail integration feasible and efficient, namely: ticket integration, proximity between terminals, baggage handling, timetable synchronization, and frequent services (Postorino et al., 2018).

Lian and Rønnevik (2009) and Givoni and Banister (2007) point out that air passengers value more the time of access than the distance, so they are more predisposed to travel to a more distant airport with cheaper fares and better service. On leisure travel, as there is a greater volume of luggage to be transported, passengers are willing to pay more for modes of transport that value the passenger experience and comfort and provide intuitive and safe baggage handling during long journeys to access the airport (Pels et al., 2003; Tsamboulas and Nikoleris, 2008).

Air travel is considered a decisive factor of regional development and quality of life, however, the existence of transport infrastructure does not dictate development, but the opposite. The market and viability of an airport depends on the social and economic dynamics that will determine the need for transport (e.g. population, flight propensity, economic activity and access time), and the services that the airport offers (Postorino et al., 2018). In Portugal, Melo et al (2020) propose a doctrine for the use of railway as the mainstay of in-country long distance passenger mobility, including the transfer of all regional air traffic to rail.

Before the pandemic, Lisbon airport, located on the city limits, was approaching saturation. Several solutions have been proposed, but all have severe limitations. A strategic environmental assessment is required by European and Portuguese law for major regional-scale transport developments such as a new airport. However, such a study was not carried out, even though the government already approved

the construction of a new airport at Montijo, located at 40 km from Lisbon and close to the Natural Preserve of the Tagus estuary to complement Lisbon airport. Among other solutions, the existing Beja airport was never considered to be a viable alternative due to its distance from Lisbon (170 km).

Based on the doctrines of complementarity between airport and railway and air traffic segregation, this paper examines the possibility to consider the underused Beja airport as a complement to Lisbon airport, avoiding the construction of a new infrastructure with potentially more negative impacts.

This study addresses several SDGs: SDG 7, as electrification of the railway will eliminate the need of diesel and consequently invest in renewable sources for electricity (7.2,7.3); SDG 8, as improved access to the interior of the country could promote the socioeconomic development and attractiveness of a less developed region (8.1,8.2,8.3,8.9); SDG 9, as the requalification for more efficient and sustainable infrastructure will promote the establishment of companies and industries (9.1,9.2,9.3); SDG 11, regarding the inclusiveness of communities in the interior of the country (11.2,11.3,11.a); and SDG 15 (15.1,15.2), as it takes in consideration the protection and conservation of the Natural Preserve of the Tagus estuary Tagus Estuary.

2. Methods

The study was developed in six steps:

1. A brief characterization of the case study is made involving Baixo Alentejo subregion, the rail connection from Lisbon to Beja, Beja airport "Terminal Civil de Beja", and Lisbon airport "Aeroporto Humberto Delgado".

2. Online survey to the population and visitors of Beja, to those interested in the promotion of Beja airport (Questions in Table 1). Its purpose was to analyse the satisfaction with the current rail link to Beja, identify the aspects that need to be improved, and find out the population's opinion about the potential use of the Beja airport as a complement to Lisbon airport.

3. Analysis of the technical components of the rail link, based on the Network Directory 2022 (IP, 2020) and IP (2021).

4. To determine the approximate volume of long-haul passengers that Beja airport could receive from Lisbon airport, the EUROCONTROL (2021) classification was used: regional (<500 km); short-haul (500-1500 km); medium-haul (1500-4000 km); and long-haul (>4000 km), and the data from demand of the most popular air links in 2019 (INE, 2020). The same database was used to identify the number of passengers of regional flights.

5. The quantification of GHG emissions of airport link was based on the European average emission factors reported by the UK Government for rail (0.0277 kg CO_2eq/pkm) due to the different share of generation efficiency and electricity sources, and for taxi (0.1455 kg CO_2eq/pkm) (Hill et al., 2020).

6. A brief comparison between the options of Montijo and Beja was made, based on costs, travel time, distance, GHG emissions from access, and constrains that are worth highlighting.

Table 1. *Questions of the survey.*

1. Do you usually go to Beja?
2. If the rail connection to Beja was improved and of high performance, would you be more interested in frequenting the region?
3. What is the reason why you travel?
4. What is your municipality of residence?
5. What mode of transport do you use most to get to Beja? 6.
6. What are the most important factors in your choice of mode of transport?
7. Are you satisfied with the current rail connection to Beja?
8. How satisfied are you with the following aspects of the current railway connection to Beja?
9. Do you think that there is a need to mention any other aspect besides the ones already mentioned?
10. If the railway connection were to be upgraded, would you be willing to change your mode of transport?
11. What advantages could an improved, high performance rail link have in Beja?
12. Do you think that Beja airport has the potential to be complementary to Lisbon airport, hosting intercontinental flights?
13. Justify.
14. Could the improvement of the Lisbon-Beja rail link promote Beja airport as complementary to Lisbon airport?
15. Justify.
16. In your opinion, what conditions are missing for Beja airport to operate as complementary to Lisbon airport?
17. If Beja airport were operational, what more advantages could it bring to the region?
18. Imagine that Beja airport is an extension of Lisbon airport and hosts intercontinental flights. There is a high-speed rail link between the two airports, which allows the Lisbon-Beja connection to be made in 1h15. What do you think?

3. Case study

Baixo Alentejo is characterized by having the lowest population density at national level and high rates of ageing and population loss that, combined with the lack of settlement by young and workingage population, affects the region's development and competitiveness. The main economic activity is agriculture.

The railway line that ends in Beja (see Figure 1) is a single track 166 km long and operates since 1884. The line is electrified up to Casa Branca and to continue to Beja it is required to transfer to diesel traction. Although the state of conservation is good due to the complete renovation of the track in the 1980s, the line is underused and the nominal speed on the Casa Branca-Beja section is well below the technical speed threshold (IP, 2020; Furtado, 2020).

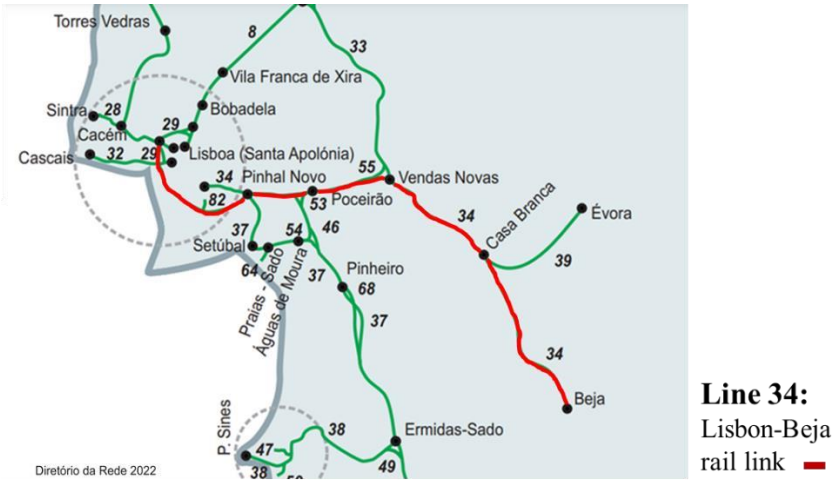

Figure 1*. Rail connection to Beja.*

Beja airport is built on the site of the Air Base no. 11 of the Portuguese Air Force, also used for years by the German Air Force for operational trainings. When the German Air Force left, in 1992, it was converted for mixed use, civil and military. This location was chosen for the local conditions of the area: good weather and visibility, uncongested airspace, relative distance to urban centres and the absence of natural barriers (Freitas and Sousa, 2011). Beja airport's main runway is the only one in mainland Portugal to operate the A380, and the only one considered for a possible emergency landing of NASA's Space Shuttle (Airportwatch, 2013). Beja airport has very poor connection to the transport network, being only achievable by car (individual or taxi), although a railway connection was projected if the demand of the airport was high enough. Despite many attempts to attract airlines, the use of the infrastructure has always been far below expectations (Freitas and Sousa, 2011). Nowadays, the Beja airport is used mostly for aircraft parking and maintenance. Beja airport is an exemplary case that the existence of an infrastructure does not lead to socio-economic and regional development.

Lisbon airport is the biggest Portuguese airport having received in 2019 about 31 million passengers. Nowadays, it is associated with noise and air pollution impacts and for being congested in several sectors of operation: declared capacity of the runway, processing passengers and cargo in terminals, aircraft parking, and curbside. Given that the infrastructure is surrounded by densely populated urban agglomeration which limit physical expansion, relocation or the complementary option has been studied for over 50 years (Roland Berger, 2016). Currently, the alternative preferred by the Portuguese Government for "Lisbon+1", which involves the capacity expansion of the Lisbon airport and the construction of a new airport, is the Air Base no. 6 site at Montijo, despite the absence of a mandatory strategic environmental assessment, the lack of rail connection, and the conflict with the Tagus Estuary Preserve and Natura 2000 site. Figure 2 shows both locations.

Figure 2*. Beja airport and Montijo Air Base no.6.*

4. Results and discussion

The survey gathered a sample of 1110 answers. The people enquired revealed that when they travel to Beja, they give preference to individual rather than public transport given the poor offer of quality services, mainly due to the lack of schedule flexibility, comfort, and autonomy. On the railway service, the survey reveals that 92% of the respondents are dissatisfied with the current railway connection Lisbon-Beja (Figure 3).

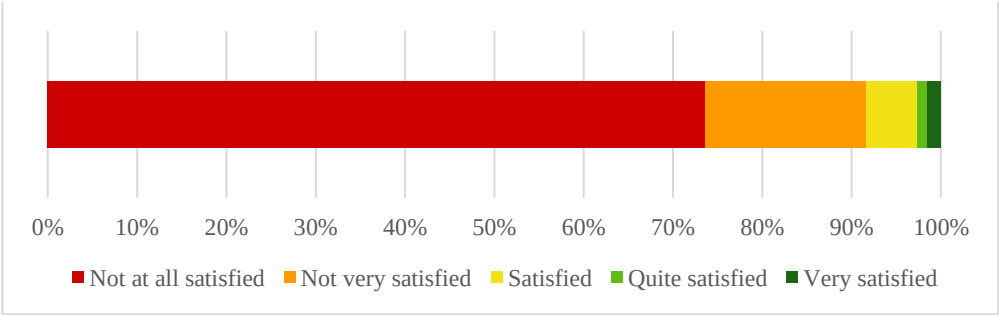

Figure 3. *Level of satisfaction of the current rail connection to Beja.*

The satisfaction of several aspects of the current rail link to Beja shows, in general, total dissatisfaction with these features, as it is shown in Figure 4.

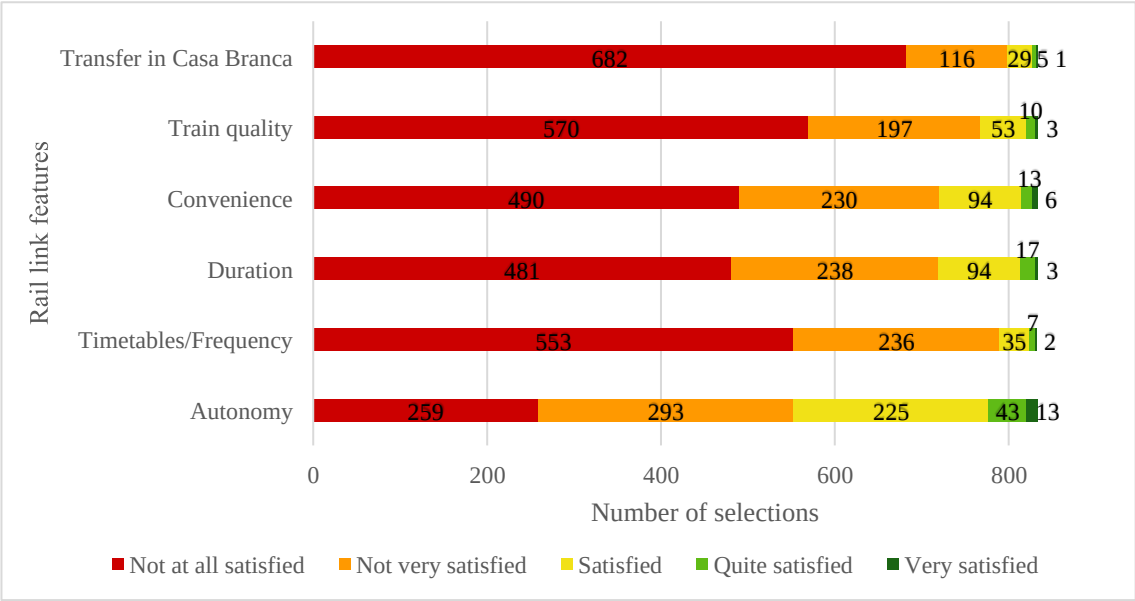

Figure 4. *Level of satisfaction with features of the current rail connection to Beja.*

The most criticised aspect is the transfer in Casa Branca, necessary due to the absence of electrification of the section between Casa Branca and Beja. Exchanging from an intercity train to diesel powered old railcars of lower quality and efficiency, in addition to extending the travel time, is an uncomfortable process for the passengers, especially for the elderly and with reduced mobility. The lack of coordination of timetables with the need of the population can be overcome with demand analysis since there is demand from other modes of transport (e.g. express bus).

The proposed solutions to improve the service and enable homogeneous circulation at 200 km/h are: in technical terms, electrification, sealing of the railway channel, elimination of level crossings, straightening the route and modernisation of safety and traffic management systems; and in terms of operation and service, to consider increasing the frequency of intercity and regional services and adaptation of support infrastructures to the population (IP, 2021, 2020). The investment in technical requalification of the infrastructure, including the relocation of the line to serve Beja airport, totals 120 M€ (Refer, 2015).

A high-performance rail link to Beja will allow the travel time to Lisbon city center to be reduced from 2h15min to 1h20min, with a strong accessibility to the public transport network on the capital and to Lisbon airport. About 81% of the respondents mentioned that, with such a modernisation of the railway connection they were willing to change their mode of transport to Beja.

Beja airport has favourable conditions for air traffic and is fully operational, although terminal facilities would have to be expanded to serve as an alternative to Lisbon airport.

The requalification of the national railway network and the improvement of long-distance services are foreseen in national strategic plans, so it is possible to consider the substitution of regional flights (<500 km) to rail.

Regarding the complementarity between Lisbon and Beja airports, the proposed strategy is to shift long-haul air traffic from the Lisbon airport to Beja. Long-haul passengers have more luggage and local transfer is a small part of total travel time, so they are more predisposed to go to a more distant airport that offer cheaper fares, if the transfer is efficient. Moreover, increasing traffic in the Beja airport will have low impact on the surrounding environment, since it was already accounted for when the airport was built. The construction of a railway bypass to Beja airport is an innovative strategy that complies with the CE (2011) guidelines, as none of the other Portuguese airports are integrated in the rail network.

Table 1 shows the number of passengers at Lisbon airport in 2019, according to EUROCONTROL classification, excluding national air traffic.

Table 2. *Number of passengers at Lisbon airport in 2019 according to the type of international air traffic.*

Lisbon airport air traffic	Passengers
Regional (<500 km)	3 429 869
Short-haul (500-1500 km)	4 318 135
Medium-haul (1500-4000 km)	11 121 982
Long-haul (>4000 km)	5 027 814

Source: INE (2020).

Table 2 shows the number of long-haul passengers and the corresponding number of passengers per hour generated, considering a fully occupied 300-passenger aircraft and the Lisbon airport operating hours (06:00-24:00).

Table 3. *Estimated passenger traffic at Beja airport after the transfer of long-haul passengers from Lisbon airport.*

Long-haul passengers/year	Flights/year	Passengers/hour
5 027 814	16 759	765

The Beja air terminal has a processing capacity of 250 passengers/hour, so the expected hourly volume of passengers is nearly three times the current capacity of the passenger terminal. Assuming this strategy, Beja terminal will have to be expanded. However, it should be noted that the pandemic

situation has affected the aviation sector, so the recovery of air traffic seen in 2019 will probably be delayed.

There is no official estimate for the costs of expanding the Beja terminal. The "Lisbon+1" project foresees the allocation of 500 M€ for Montijo airport to receive 7.8 Mpax/year, equivalent to 64 € per passenger/year (Dinheiro Vivo, 2021). The construction of the Beja terminal cost 33 M€ for a declared capacity of 1.4 Mpax/year, equivalent to 24 € per passenger/year (Observador, 2016). We assume the average value for the expansion of the Beja terminal of 44 € per passenger/year. Thus, the investment needed to expand the Beja terminal is estimated at 160 M€.

The integration of air and rail services require high levels of cooperation and data sharing among the operators and stakeholders involved, and a service focused on the passenger experience should be promoted. Therefore, options such as schedule coordination among services, ticket integration with the option of accumulation air miles, and the offer of quality services on board the train (e.g. incorporated check-in and baggage management, Wi-Fi, meals) can be considered.

The differentiated use and exploitation of Beja airport (e.g. commercial, maintenance, parking) can contribute to the attractiveness of the Alentejo aeronautical cluster and attract investments, new residents, younger and qualified population.

Considering the demand of 2019, the air-rail modal substitution of regional air traffic and the relocation of long-haul flights to Beja airport would contribute to a 25% reduction in the number of passengers using Lisbon airport, which would greatly help the management of operations and reduce congestion in the infrastructure. Medium-range flights may also be reduced in the long term due to substitutions of some travel with teleconference, particularly regarding European institutions and some business travel.

When comparing the two alternatives, Beja and Montijo, the difference in the predicted investments is clear (Table 4). Montijo, including the expansion of the Lisbon airport, is about five times more expensive than Beja, considering the requalification of the railway, including the direct link to the Beja airport, and the approximate air terminal expansion cost. In terms of accessibility, Montijo lacks an integrated accessibility plan, as the current accessibility system is based on road transport and there are no consistent plans to change that (Roland Berger, 2016).

Table 4. *Brief comparison between Beja and Montijo alternatives based on a few indicators.*

Indicators	**Beja airport**	**Montijo airport**
Distance to Lisbon	174 km	37 km
Travel time from Lisbon	1 h 20 min (modern train)	35 min to 1 h (taxi)
GHG emissions	5.1 kg CO_2eq/pax (modern train)	5.3 kg CO_2eq/pax (taxi)
Required investment	280 M€ (rail upgrade + Beja air terminal expansion)	1 500 M€ (expansion of Lisbon airport + construction of new Montijo airport)
Impacts, risks and opportunities	- In line with the European Green Deal and the European Climate Law; - Population in favor of better use of airport and rail link upgrade; - An innovative business model must be developed.	- No rail link; - Negative impacts on local population; - Most affected municipalities are against the project; - Significant impacts on the Tagus Estuary Nature Reserve and Natura 2000 Site; - Significant risk of birdstrike accidents.

Source: Refer (2015), Roland Berger (2016), APA (2020), Dinheiro Vivo (2021), IP (2021), Google Maps.

Another evidence that can be drawn from the study is the potential savings on GHG emissions when traveling to airports. Although it is more distant to Lisbon and the direct train trip to Beja airport is slightly longer, it offers a convenient quality of service and passenger comfort and autonomy, besides having lower intensity of emissions than travelling by taxi or car to Montijo. In addition, the improvement of the Lisbon-Beja rail link will certainly improve GHG emissions resulting from modal transfer from car and bus to train, for traffic not airport-related.

Regarding the impacts on biodiversity conservation, the Montijo option affects the protected area of the Tagus Estuary, which is part of the Natura 2000 network as a Special Protection Area in accordance with the Birds (17/409/CEE) and Habitats (92/43/CEE) Directives and is also a Wetland of International Importance under the Ramsar Convention. The local authorities of the municipalities affected by the operation of the future airport of Montijo have also reproved this option, given the impacts and risks it imposes on the population. Environmental NGOs advocate a strategic environmental assessment to analyse other alternatives with fewer impacts. Even with the implementation of measures to mitigate impacts on public health and biodiversity, the risk is still significant.

5. Conclusions

Our research concludes that, according to the concepts of air and rail integration, the implementation of a high-performance rail link makes it possible to consider Beja airport as a complementary solution to Lisbon airport, based on the transfer of long-haul air traffic from Lisbon to Beja. An inquiry to the population supports this idea, consolidating with the potential socio-economic and environmental benefits and promotion of an undeveloped Region. Respondents also pointed out that after the modernisation of the line, travellers would be more interested in using the railway as a mode of transport.

In total, the transfer of long-haul flights to Beja and the regional traffic to rail reduces the volume of passengers at Lisbon airport by at least 25%, which allows to increase the lifespan of the infrastructure, to focus on other markets, and a reduction of environmental impacts in Lisbon.

Compared to Montijo, Beja airport has many advantages from an economic, social, and environmental point of view. It is built in an area relatively remote from urban centres, so conflicts and impacts on the surrounding environment are modest. Because rail is so much more efficient than cars, Beja with a modern rail link compares well with Montijo, despite the difference in distance. Therefore, "Lisbon+1" at Beja is worth considering as an alternative to a new airport.

The combination of proposed solutions prioritises sustainable mobility, air-rail intermodality, airport integration with the rail network, and the use of rail on long-distance travel. This approach supports energy transition, decarbonisation, and biodiversity conservation objectives, demanded by the European Green Deal, as well as the Portuguese goal of carbon neutrality by 2050.

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Whitter End-of-Life Vehicles (ELVs) Laws for Malaysia?

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Abstract

ELVs can cause environmental hazardous to cities through the abundance of abandoned vehicles (AV) or improper scrappage of vehicles. ELVs laws set out measures to deal with the collection, storage, treatment, dismantling, reuse, and recycling of end-of-life vehicles. In addressing ELVs issues, Malaysia is at the crossroads as to which direction of regulations to put in place. Malaysia is among the biggest market for automotive industry in Southeast Asia. However, ELVs issues are not dealt with in a structured specific legislation. This paper will discuss the ELV status in Malaysia with a view to explore possible directions of ELV legislation in Malaysia. The analysis is doctrinal evaluating the applicable laws and regulations dealing with ELV and comparing them with the likes in Japan and European Union (EU). The paper finds that ELV issues are governed quite inconsistently under various laws, regulations and guidelines dealing with environmental issues, local authority's jurisdictions, and road transport rules. The paper also takes cognizance of the state of preparedness among the relevant regulatory bodies, industry participants especially relating to recycling of parts and vehicle shredders, and car owners generally. The paper proposes factors for consideration in setting up for a holistic legislation on ELV which reflects the Malaysia's circumstances based on the lessons learnt from established practices especially from Japan, China, and EU. An effective coordination among all the relevant parties to deal with the ELVs issues will require effective participations from vehicle owners, car manufacturers or dealers, local authorities, treatment facilities, and various regulatory bodies concerning environment management, road transport affairs, etc. ELVs regulation will help to change a wide range of urban and regional transformations through a prescribed environmental standard where much of the materials derived from ELVs are recovered and recycled. This paper will benchmark laws that are aimed at ELVs, which are vital at achieving the Target 11.6: Reduce the environmental impacts of cities; and Target 11.B: Implement policies for inclusion, resource efficiency and disaster risk reduction; under SDG 11: Mobilize Sustainable Cities and Communities. Further, the laws are instrumental at achieving Target 12.4: Responsible management of chemicals and waste; under SDG 12: Ensure sustainable consumption and production patterns. ELVs laws are crucial in transforming the cities through sustainable strategies, policies, initiatives, and actions by all the collective agents relevant to implement a set of viable laws that govern ELVs.

Keywords: smart cities, scheduled waste management, deregistration of vehicles, product liability.

1. Introduction

Malaysia has no specific legislation governing issues on end of life vehicles (ELV). At the same time, Malaysia has introduced the National Automotive Plan (NAP) since 2014 and enhanced the Policy in 2020 through the NAP 2020. In addition to ensuring Malaysia develops a sustainable local automotive industry, NAP 2020 aims to make Malaysia a regional leader in manufacturing, engineering and technology. The sustainable management of ELV is in line with the development of green technologies in Malaysia. Unfortunately, the glaring vacuum on the law dealing with ELV problems has been the main drawback of the Malaysian automotive policy.

The purpose of this article is to explore possibilities for Malaysia in dealing with ELV issues. The primary references for comparison are the ELV laws in Japan and the EU, respectively.

2. What is ELV Law?

ELV law is not only about governing roadworthiness but the environment. Besides, 3R (reduce, recycle, and reuse) issues are also the most significant driver behind ELV law. Recycling of scarce metal contained in car and electronic products should be of high public relevance in Malaysia as it has been in other parts of the world such as Japan and the European Community (EC) (Andersson, 2019). ELV law also deals with an annual test of a vehicle for roadworthiness after the vehicle attains a certain period of age. Article 1 of United Nation Consolidated Text of the 1997 Agreement on Periodic Technical Inspection of Wheeled Vehicles provides that roadworthiness is the ability of the vehicle to be in a satisfactory operational condition for usage on public roads, while also meeting the safety and environmental requirements outlined in the Rules.

(a) Japan's Development of ELV Laws

Japan has enacted the End-of-Life Vehicle Recycling Law 2002 to address the issues regarding ELV. ELV is defined under Article 2(2) of Japan End-of-Life Vehicle Recycling Law 2002 as vehicles that are no longer in use. Japan does not have a mandated period for a vehicle to become ELV (Zhao, 2011). The vehicle can be used as long as it passes the stringent annual inspection. In cases where the vehicle owner no longer wants to use the vehicle, scrapping is always an option.

(b) EU's Development of ELV Laws

EC's seriousness in balancing the dynamic of its member states' (European Union - EU) automotive industry and sustainable development was translated into a legal document. Promulgation of ELV regulations in the EU has been driven by progressive automotive industrial revolution in the region (Despeissi, 2015). The European Parliament and the Council of the European Union passed the Directive 2000/53/EC on End of Life Vehicles (the 2000/53/EC Directive) to encourage standardization of practice and procedures in handling ELV related issues within its member states.

Generally the 2000/53/EC Directive imposes liability on the last holder/owner to surrender their ELV to an authorized treatment facility (ATF) for disposal at zero (or minimal costs). The Directive then put responsibility on vehicle manufacturers to take back the products they put up in the market once such products had reached their end of life service. However the procedures on disposal of ELV differ from one member state to another. For instance, a deregistration certificate is issued for ELV disposal

in the UK and not for change of ownership as in Austria, Germany and Italy (Scheinder, 2010). Thus data on increase of deregistered vehicles in the 3 member states cannot be a reflection of an increase in ELV disposal as opposed to the situation in the UK.

(c) Malaysian Laws on ELV

ELV revolves around the problem of AV at the municipalities, especially in public parking areas. The problem is quite acute in Malaysia. There is no official statistic indicating the actual numbers of abandoned vehicles. From some sources the number is estimated at 60,000 as of 2018 (New Straits Times, 2018). There are also conflicting figures between different sources which imply that the problems surrounding abandoned vehicles are not properly monitored and regulated. There are concerns about environmental damages and public nuisance caused by the abandoned ELV. Unfortunately Malaysia has no specific laws governing ELV. There are many ELV related laws which are scattered.

Malaysia has yet to define the meaning of roadworthiness. In fact one can hardly find a conclusive definition of roadworthiness in any piece of Malaysian legislation. Neither can one find judicial interpretational guidance on the same. Section 66(1) of Road Transport Act 1987 does not expressly state about roadworthiness, but it vests a power on the Minister to regulate on the deregistration of motor vehicles that are not worthy of repair due to serious accidents, old age or other causes or where the chassis number thereof has been tampered with.

Section 46(3)(a) of Street, Drainage And Building Act 1974 empowers the Local Authority to remove obstruction in any public place. Abandoned vehicles are included in the non-exhaustive list of obstruction under section 46(1)(e) of the 1974 Act. Further, the Ministry of Housing and Local Authorities of Malaysia had issued a guideline for the Management of Abandoned Vehicle in the Local Authority Jurisdiction in 2020 (JPPBT, 2020). The Guideline provides standard operating procedures (SOPs) on how abandoned vehicles should be handled by the selected local authorities. The Guideline proposes to shorten timeline in the management or disposal of AV from 6-12 months to 2-4 months only by adopting a simpler workflow for processing of change of ownership, de-registration and disposal of AV. The Guideline serves only to facilitate the local authorities in dealing with AV issues in their local jurisdiction but it is not binding on them. Therefore the implementation is subject to the local authorities' respective interpretation and discretion. Non binding guidelines that are open to various interpretations create inconsistencies and conflicting practices among the local authorities involved. The Focus Group Discussion (FGD) Session conducted on 9.04.2021 revealed this very point. The attendees admitted that they adopt different approaches in handling ELV and AV issues. For instance, the time frame on which an AV may be towed to a local authority's yard varies between 30 to 90 days. Still, the implementation is subject to the local authorities' priority. While at the same time the local authorities concerned have no specific measure to handle the AVs once they are towed to their respective graveyards. The AVs have been left unattended and have not been subject to proper waste management and procedures.

Section 101 of Solid Waste and Public Cleansing Management Act 2007 provides that the Minister of Housing and Local Government has the power to require any person to use any method to reuse, reduce and recycle controlled solid waste. Solid waste that falls under the regulation of this Act does not include scheduled waste provided under Environmental Quality Act 1974 (the 1974 Act).

However, based on section 18 of the 1974 Act, the Minister has the power to prescribe certain premises to provide and serve as automotive treatment facilities. On 2 March 2021, the Malaysian Environment and Water Ministry launched a pilot initiative on authorized automotive treatment facilities (AATF) to

pave the way for sustainable disposal of ELV in Malaysia. AATF is a facility that conducts dismantling and shredding of various components, especially those containing scheduled wastes. As of now, there are 8 AATFs under this initiative to set a benchmark for future direction of sustainability of Malaysia ELV management (DOE, 2021). The deregistration of ELV by the Malaysian Road Transport Department is a pre-condition before dismantling and shredding of any component can be carried out by the AATF, a pre-condition similar to that of in the UK. These components will be segregated to allow the next steps of reusing, recycling or recovering the parts and complete disposal of the ELV.

Section 21 of Environment Quality Act 1974 provides a power for the Minister of Environment and Water to regulate conditions for emission, discharge and deposit or hazardous waste. Furthermore, section 51 of the Act also enables the Minister to regulate any matters necessary to give effect to the Act in addressing the issue of ELV. A prohibition is set out under section 34B to penalise individuals who deposit scheduled waste without written approval from the Director-General.

Section 63 of Local Government Act 1976 gave power to the Local Authority to manage the public places within its jurisdiction. The Local Authority, based on section 80 of the Act, is allowed to remove any nuisance in public areas within its jurisdiction. Section 2 of the Act defined nuisance to include any act that causes harm or annoyance detrimental to health or property.

3. Methodology

This research draws on provisions of law, current literature and secondary references, such as scholarly reviews and press coverage of abandoned vehicles. This study highlights the problems of ELV law in Malaysia and also refers to the model of ELV law in Japan and EU.

4. Discussion

(a) Problems of ELV in Malaysia

There are hose problems regarding the applicability of the existing laws on ELV implementations. Firstly, data on the numbers of abandoned vehicles and ELV are scattered, though too many vehicles seen abandoned in public areas or left by the roadside in every corner of this country.

Next, there are no clear deregistration procedure that can be used as a guide by the vehicle owners. A guideline for the deregistration of vehicles is issued to enable the local authority to forfeit the abandoned cars parked by roadsides or public parking areas. The implementation still suffers from the non-clarity of the procedures. The main problems lie in the usable power of the respective authorities and the prosecution. Besides, issues revolving around the deregistration procedure lie in that most abandoned vehicles' owners cannot be easily traced. Delay is possible when the Investigating Officer from the local authorities cannot trace the last owner. Hence, the documentation is incomplete for deregistration purposes. Their consent is required to give effect to the deregistration. The provision relating to the forfeiture and towing of the vehicles is not explicit. Section 46(3)(a) of the Street, Drainage and Building Act 1974 provides the power on Local Authority to remove an obstruction in public places.

Besides, Malaysia has an unfriendly procedure on the voluntary surrender of vehicles. There is a cumbersome procedure for vehicle owners to deregister the vehicle as they need to attend the Road

Transport Department (RTD) counter physically. The current transfer of vehicles requires biometric fingerprint authentication. The registered owner (seller) and the new owner (buyer) for private cars need to execute biometric fingerprint authentication personally. The vehicle owners who wish to surrender their vehicle voluntarily to AATF may find that the existing procedure is not user-friendly.

Regarding practices in the UK, the deregistration process is relatively straightforward when an ELV is surrendered to an AATF for disposal purposes. The said vehicle may be deregistered upon issuance of a certificate of destruction by the AATF. The less-hassle process and procedures should be in place to encourage the voluntary surrender of ELV for disposal at ATF by the vehicle owners. The process in the UK has been made easy by the established network between ELV stakeholders. ELVs may be towed from the holders or owners' premises with their consent, with considerable towing costs borne by the holders or owners. The UK practice also reveals that the vehicle manufacturers practice a free take-back process of an ELV of their products upon the surrender of the vehicles by the last vehicle owners at their partner ATF or collection centres.

In addition, problem may arise on the ownership by the financial institution. Financial institutions generally fund property acquisition in Malaysia through various financial schemes such as hire purchase and sale-purchase agreements. Properties like houses or vehicles are sold to customers on agreed terms, for instance, on deferred payment of 96 months. Indeed, most cars are subject to loan agreements with financial institutions through hire-purchase instruments. Throughout the financial agreement period, the use and maintenance of a purchased vehicle are rendered to the customer, but ownership shall remain with the financier. In another saying, until and unless the loan is settled, the vehicle can never truly belong to the customer.

The financial arrangement poses no headache if both parties abide by the terms of the hire purchase agreement since ownership of a purchased vehicle will be transferred to the purchaser upon completing the payment period. Problems will arise when purchasers begin to default loan payments and cars are abandoned by the roadside or seized by enforcement agencies. Defaulted loan payment complicates the matter as ownership of abandoned vehicles remains with the financier.

Thousands of vehicles are abandoned by the roadside, and other thousands can be seen rusted within the Malaysian Royal Police (PDRM) garage. These are just among numerous vehicles that have reached the end of their service life (ELV is a loose term). Though the exact number cannot be verified, it has become a judicial notice that the authorities face problems with the ownership issue when attempts are made to dispose of ELV within their local jurisdiction.

Article 13 of the Federal Constitution guarantees the right to property in Malaysia, which means nobody can be deprived of their property unless provided by the law. A contract between the parties governs ownership of the vehicle. There is little room for the authorities to interfere unless the parties consented to the disposal of ELV. In other words, the problem is aggravated because some of the abandoned vehicles are still subject to the financier's ownership because of the unpaid loans. Technically, the financial institution's consent as the vehicle owner is required but usually is not forthcoming.

Last but not least, there is inconsistent practice between Local Authorities. Each Local Authority may have a different set of procedures in dealing with the issues relating to abandoned vehicles. Different sets of systems lead to non-uniformity and inconsistent practices even though the Local Authorities are within the same jurisdiction of a particular State. For the moment, the Ministry of Housing and Local Government does not have a standard practice relating to the management of ELV. The respective Local Authorities can exercise their discretion and best practices.

Reccommendation

Firstly, AV problem must be addressed by the repective authorities. In this case, reference is made to the law on ELV in Japan. Article 6 of Japan End-of-Life Vehicle Recycling Law 2002 listed the responsibility of the State. The duties of the State are promoting the recycling of ELV, providing resources for recycling ELV, promoting voluntary delivery of ELV by vehicle owners and educating the public to cooperate in implementing the ELV law. In comparison with Malaysia's Solid Waste and Public Cleansing Management Act 2007. Section 101 of the Act promotes recycling of solid wastes which are not prescribed as scheduled waste. But no specific mention is made to ELV and its components. Unlike in the 2000/53/EC Directive that clearly drew targets on disposal and recycle, reuse rate, Malaysian road to systematic ELV management has a long way to go.

Next, the authorities should outline the threshold for vehicles' life until they are subject to roadworthiness inspection. In Japan, Article 5 of Japan End-of-Life Vehicle Recycling Law 2002 provides that vehicle owners are responsible for upkeeping their vehicles until it becomes end-of-life vehicle with the condition that they must pass the periodical roadworthiness inspection called "shaken". All vehicles must be inspected on a regular basis. After three years, new vehicles must be tested and it must be tested every two years afterward. Such provision was not made clear in any of the Malaysian laws in handling AV.

Malaysia also should have an agency to supervise ELV fund management. Japan has established Japan Automobile Recycling Center (JARC) as a Deposit Management Entity to supervise ELV fund management based on Article 92 of Japan End-of-Life Vehicle Recycling Law 2002. JARC is only limited to one in the whole country.

Article 73(1) of Japan End-of-Life Vehicle Recycling Law 2002 requires vehicle owners to deposit recycling fees to the JARC. The recycling deposit will then be made public by the JARC. Article 76 of Japan End-of-Life Vehicle Recycling Law 2002 provides that the JARC has to make payment of recycling deposit to the vehicle manufacturer upon collecting vehicle parts for recycling.

This type of Deposit Management Entity may serve as an option for Malaysia. Malaysia has to determine whether deposit-taking through vehicle owners is an acceptable practice. The money is partly refundable upon delivery to the recycling centre. Further, the vehicle manufacturers have to agree to bear responsibility in recycling usable parts of their vehicles.

AATF and diagnostic center for vehicles must be regulated too. AATF is a new concept in Malaysia. The flow of vehicles for disposal depends on the unfriendly voluntary procedure. The public who intends to send their car has to deal with the deregistration procedure at the counter of the Road Transport Department. Even worse, the awareness among the public members to dispose of ELV sustainably is deficient. There are no other conducive regulations for them to facilitate the disposal of ELV.

Lastly, ELV in Malaysia should address the automotive industry as a whole. Malaysia has intensified in the developing automotive industry since the early 1980s, primarily through the introduction of the national automotive industry. However, ELV has not been taken into account throughout its development. Unlike the EU, Malaysia is still far behind in implementing ELV laws comprehensively. The Transport Ministry attempted to address ELV issues in 2018 through amendment of section 66(1)(nn) of the Road Transport Act 1987 (the 1987 Act) that empowers the Minister to make regulations on deregistration of ELV. However, to date, the execution has yet to be materialised.

In the EU (notably the UK and Germany), vehicle manufacturers had assumed more responsibilities on ELV disposal in terms of ELV disposal costs and creating environmentally-friendly vehicle designs. Manufacturers are required to take back their products when they have reached the end of life service. Consumers are not burdened with disposal costs of ELV but are responsible for sending their vehicles for periodic checks to ensure their roadworthiness. The failure of which may render the vehicle unfit and subject to disposal. Any irresponsibility in handling abandoned vehicles may attract fines and compounds on the part of the vehicle owners.

Unlike in Japan, ELV fees are not imposed on the vehicle owners and they instead are paid for disposal of ELV when the vehicles are surrendered to the recycling centres. This model puts more responsibility on the manufacturers to bear the costs for ELV management, which according to some commentators are not criticism free, some suggest that a fund management body be established to cater situations when dismantling costs overrides the profits expected upon completion of ELV treatment process (Lucas, 2001).

Conclusion

The Local Authorities should adopt best practices from other developed countries such as Japan and EU with some modifications that suit local circumstances. In addition to a simplified surrender and deregister process, a hassle free procedure for automatic (or by operation of law) deregistration can be helpful to address the issue of abandoned ELV. Local authorities ought to have been vested with more liberties to manage ELV that are abandoned in their jurisdictions. As opposed to complicated bureaucracy procedures, local authorities should be mandated to tow vehicles that are abandoned for a stipulated period to their yard on 14 days notice on all visible places (local authorities office, the on the vehicle itself) and mass media. Towing action may be activated upon complaints and 14 days observation on the abandonment. 14 clear days to notice of intention to remove the abandoned vehicle from the last seen location to the yard.

Malaysia should have an effective penal clause on abandonment of vehicles that not only made it an offence to leave vehicles (particularly those that have reached their end of life service) unattended, but also imposing the costs of its management on the last holder/owner. As great as it sounds, the extended responsibility of manufacturers concept that has been implemented through the 2000/53/EU Directive in the EU is not free of criticism. Certain quarters suggest that a shared responsibility on financial aspects among all stakeholders in the automotive industries and customers should be in place. Thus an independent fund management body as implemented in Japan is desirable.

As indicated earlier, Malaysian law on ELV has a long way to go. Nonetheless studies and research on the move towards a holistic ELV management system should not take a backseat. Whether ELV management is market driven or social responsibility of Malaysians is not an exhaustive choice as todate. It would be great if the Government through cooperation of various Ministries, for example the Ministry of Transport, Ministry of Environmental, Water and Energy, Ministry of Technology, Science and Innovation and Ministry of International Trade and Industry can agree on a holistic framework of intergovernmental agencies network on handling ELV related issues. These 4 ministries should formulate outcomes to tackle the long winded seizure procedures of abandoned vehicles that eventually affect deregistration process of abandoned ELV. The problems of contractual and ownership law should also be paramount consideration in handling LEV issues in Malaysia. Finally the MInistries should agree on which Ministry shall lead in handling an independent ELV fund management that holds payments of ELV disposal costs and profits.

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Ordering the intercity passenger rail service in Portugal

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Abstract

To tackle the climate crisis, all countries have to take measures to change the practice of all economic sectors, the transport sector being one of the most important. There are many studies related to the transportation in urban areas; but for long-distance land travel, the literature is limited. During the past decades, the investments in transport infrastructure in Portugal were mainly in motorways. As a result, the country is one of the best in Europe regarding motorways but has a very unbalanced modal distribution, where 89% of pkm (passenger-kilometre) are travelled by car and only 4% by suburban or long-distance rail. Besides a rail grid that steadily declined in the past decades, part of the problem is that train timetable is not aligned with customers' needs. Both the international literature and past experience in Portugal show that frequency and reliability (rather than speed) are key factors for an option for public transportation. Nowadays, the discourse has changed towards the promotion of rail transport; but investments are being done without an overall transportation system plan. As yet, there is no coherent doctrine to guide either new investments or transport operations. This research focus on the possibility to have an integrated intercity passenger rail service with a higher frequency of trains and with a maximum of one transfer, while requiring small investment in infrastructure. The basis for this is the development of a common operation doctrine, which comprehends: an expanded rail network (reopening currently disused links); an integrated timetable for all long-distance passenger trains in Portugal; a frequency of trains of at least 1 train/2 hours in all lines, up to 1 train/30 min in the main line (Lisbon-Oporto); standard operating speed range; and standard rolling stock adapted to the needs of all kinds of passengers. The paper compares the proposed doctrine with the situation before the COVID-19 pandemic, using performance indicators. Our findings show that, within approximately 10 km distance from each station, the revised network serves 30% more people than the present one, from 5.2 million to 6.8 million habitants. More important, with the new timetable, the demand for rail transport is expected to rise significantly, due to improved service quality. Between Lisbon and Oporto, the train frequency will be almost twice the present one — which should eliminate the Lisbon-Oporto air bridge and reduce the use of individual cars in the same route. In most lines, the quality of service will improve from 2-3 to 7-8 trains per day, which is expected to multiply rail demand severalfold.

Keywords: intercity rail service, optimising rail, decarbonising transportation

1. Introduction

The climate crisis that the world is facing requires climate action by all countries. Each one needs to do its utmost effort to become more sustainable, through changes in its economy and society sectors. Portugal is one of the European countries that not only committed to international and European climate ambition through the Paris Agreement and the European Green Deal, as it also presented a commitment to become climate neutral domestically by 2050. This objective requires a lot of changes, being one of the most important, the reduction of the transport emissions, as it is a sector that is responsible for 25% of the Portuguese national greenhouse gas emissions (RNC, 2019).

Internationally, studies have shown that characteristics related to the timetable, as frequency, punctuality, number of transfers and travel time and also price and accessibility to the station can influence the transfer of people from the car to the train (Givoni & Rietveld, 2007; Reichert & Holz-Rau, 2015; van der Waerden & van der Waerden, 2018). For long-distance travel, the passengers prefer direct trip, without transfers or as few as possible (Goverde et al, 2016; Vansteenwegen & Oudheusden, 2006). One of the reasons behind the negative opinion about the transfers is the fact that people tend to perceive the waiting time during a transfer in a different way than the in-vehicle time. In fact, for people, 1 minute of waiting time could be compared to 2,5 minutes of time inside a car, which can influence their choice of mode of transport (Vansteenwegen & Oudheusden, 2007).

The organisation of the current Portuguese intercity rail service is not attractive to many passengers and consequently results in a very unbalanced modal split. Portugal is still a long way behind most of the European countries regarding the use of public transport. In Portugal, the modal split of transports is dominated by the car, representing almost 89% of the modal split. It is a higher number than the average for the EU27 (83%) and the other European countries similar in land dimension to Portugal, where the lower usage of the car is compensated by the larger expression of the train, as seen in figure 1.

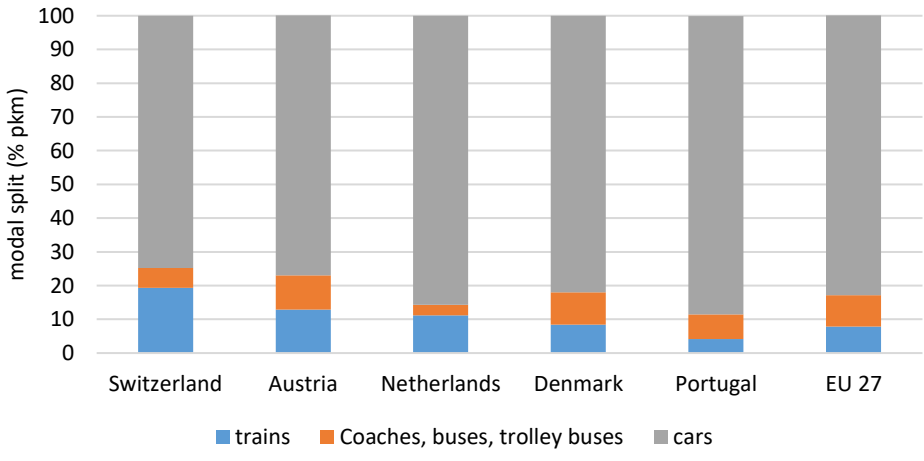

Figure 1. Comparison between the modal split in some European countries with similar characteristics (Adapted from Eurostat, 2020)

The objective of this study is to analyse a possible alternative for the current organisation of the Portuguese national intercity rail service, by providing a service that fulfils passengers´ needs.

This study is closely related to the 11th Sustainable Development Goal, target 11.2. The proposed rail service contributes to the reduction of Greenhouse gas emissions while its characteristics (frequency, number of transfers, covered territory) provide inclusive, safe and less crowded travel opportunities during the pandemic.

2. Methods

The approach that was used to explore improvements in current intercity rail service is a doctrine that establishes a new way for operation of the railway intercity passenger service in Portugal (Zúquete, 2021). Its main characteristics are the extension of the territory served by the intercity train and the establishment of a new integrated timetable with higher frequencies and interlinkages between lines, with a smaller number of transfers needed, while operating with standard speed.

The proposed timetable is compared with the current one, using performance indicators, such as frequency of trains/weekday, number of transfers and travel time (time inside the train + waiting time during a transfer). This analysis is based on the most used train routes between major Portuguese cities. Another objective of this study is also to understand how different regions of the country are served by the intercity rail service. For the comparison between the current and proposed travel time, the approach was to analyse the performance of this indicator by using pairs of routes that are most used by the intercity passengers in Portugal, while also including some other important connections that permit larger representation of the territory.

This study included a survey to passengers which gives important insights about the modal choice of the Portuguese population for long-distance travel, their perceptions about the current intercity rail service and the type of improvements needed. In this survey, a long-distance travel was considered to be a distance of 50 km or more. This approach was taken based on the dimension of the country and the distribution pattern of the cities through the territory. The questions of the survey are presented in table 1.

Table 1. Survey questions

1. Do you do long-distance travel, above 50 km in Portugal, at least once a year?
2. On average, how many times per year do you do long-distance travel?
3. What is your county of residence?
4. What are your most common destinations? (counties, cities or villages)
5. Classify the frequency per type of long-distance trips? (work, studies, family, tourism, other)
6. With what frequency do you use each mode choice to travel long-distance within Portugal? (car, coach, train, plane, other)
7. Indicate the reason in case you don´t use or rarely use the train for long-distance travel?
8. Classify the importance of each characteristic of intercity rail service
9. Age group
10. Gender
11. Education
12. Do you have any suggestions to improve rail service?

In addition to mobility performance indicators, the emission reduction of CO_2 equivalent is also calculated, in other to understand the environmental impact of the new intercity service proposal. This calculation is based on the number of long-distance trips that are expected to be transferred from cars to the intercity train service with the implementation of the proposal. For the calculation of this estimation, the relation between the current frequency of intercity trains and the demand by the population in each railway line were used.

The calculation of cars trips avoided was based on the expected increase of the number of intercity rail passengers and an assumption of the occupation of the car. It was considered that the average car occupation rate is 2 people/car. It corresponds to the average between the occupation rate in Portuguese metropolitan areas (1,5 people/car) and the average size of a Portuguese family (2,5 people), representing a car used for holidays or to visit relatives. Then, the calculation of the reduced emissions is based on the average value of emission factors for an average European train (0.0277 kg CO_2 eq/km) and average car (0.16844 kg CO_2 eq/km) (Shorter, 2011) and the average length of a long-distance trip by train in Portugal, 123 km (INE, 2019).

3. Results and Discussion

3.1. Selected survey results

In the survey, respondents were asked about their modal choice when doing long-distance travel within Portuguese territory. The results of this question can be seen in figure 2.

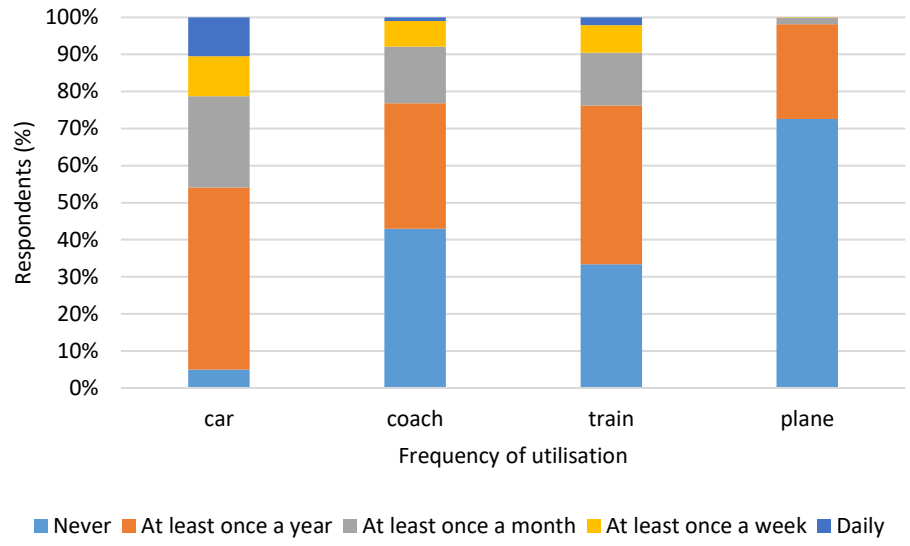

Figure 2. Frequency of utilisation of each mode of long-distance transport

The results about the use of each mode of transport suggest that the car, the coach and the train are the three types of transport that are the most used by the survey respondents, while the plane is less popular. It is also visible that the car is by far the most used one, with only 5% of the respondents saying that they never use the car for long-distance trips.

On the other hand, the train and the coach have similar percentages but still, the train seems to be more used than the coach. Although the results showing the train as the second preferred mode of transport, the train is still not frequently used and there are also 33% of respondents who said that they never use the train. Having this in mind, the participants in the survey were asked about the reasons that make them never or seldom use the train. The results can be seen in figure 3.

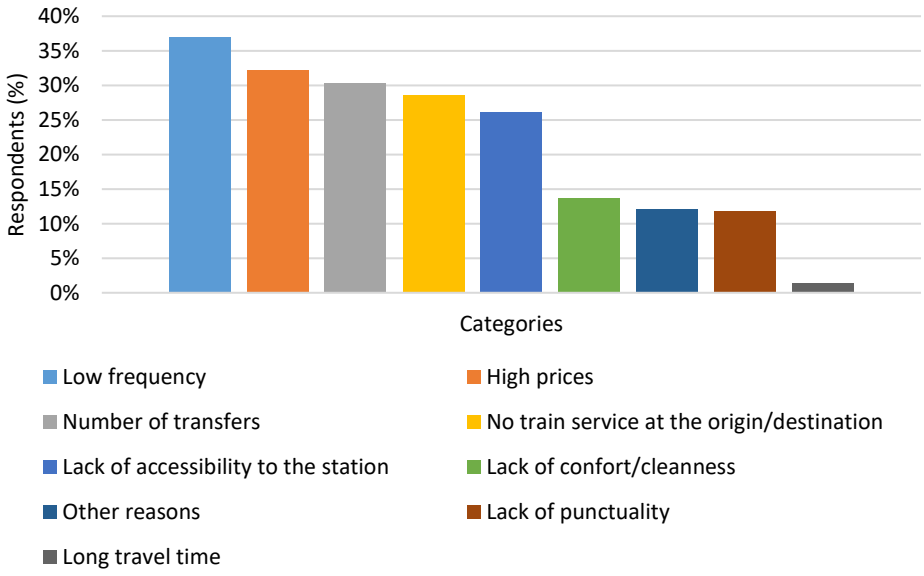

Figure 3 Reasons behind the low use of train for long-distance travel

From the results above, it can be seen that the respondents choose the low frequency (37%), the high prices (32%), the number of transfers (30%), the inexistence of train service at the point of origin or destination (29%) and the lack of accessibility to the station (26%) as main reasons for not using or using less the train for long-distance travel. It is important to notice that these results confirm the evidence from the international literature about the importance of the high frequency (van der Waerden & van der Waerden, 2018) and the direct trips without transfers (Vansteenwegen & Oudheusden, 2006). The price and the accessibility to the station are very important parameters, but they are not going to be analysed in this study, as they are not part of the process of technical organisation of rail service.

This way, the results show that the solution to transfer people from the cars to the intercity trains is not primarily to reduce the travel time. The priority is to guarantee a stable passenger long-distance rail service that covers all existing railway infrastructure and offers an integrated and stable timetable with high frequencies and diverse destinations and then improve the current travel times.

3.2. Comparison between the current rail intercity timetable and the proposed one

The proposed railway intercity timetable proposes a completely different approach to organise the intercity rail service which is expected to significantly improve the current one. A comparison between both is made, in order to analyse the differences and identify the improvements that the proposed doctrine offers. The figures 4 and 5 shows a visual comparison between the railway lines that are included in the current operational intercity service and the proposed one.

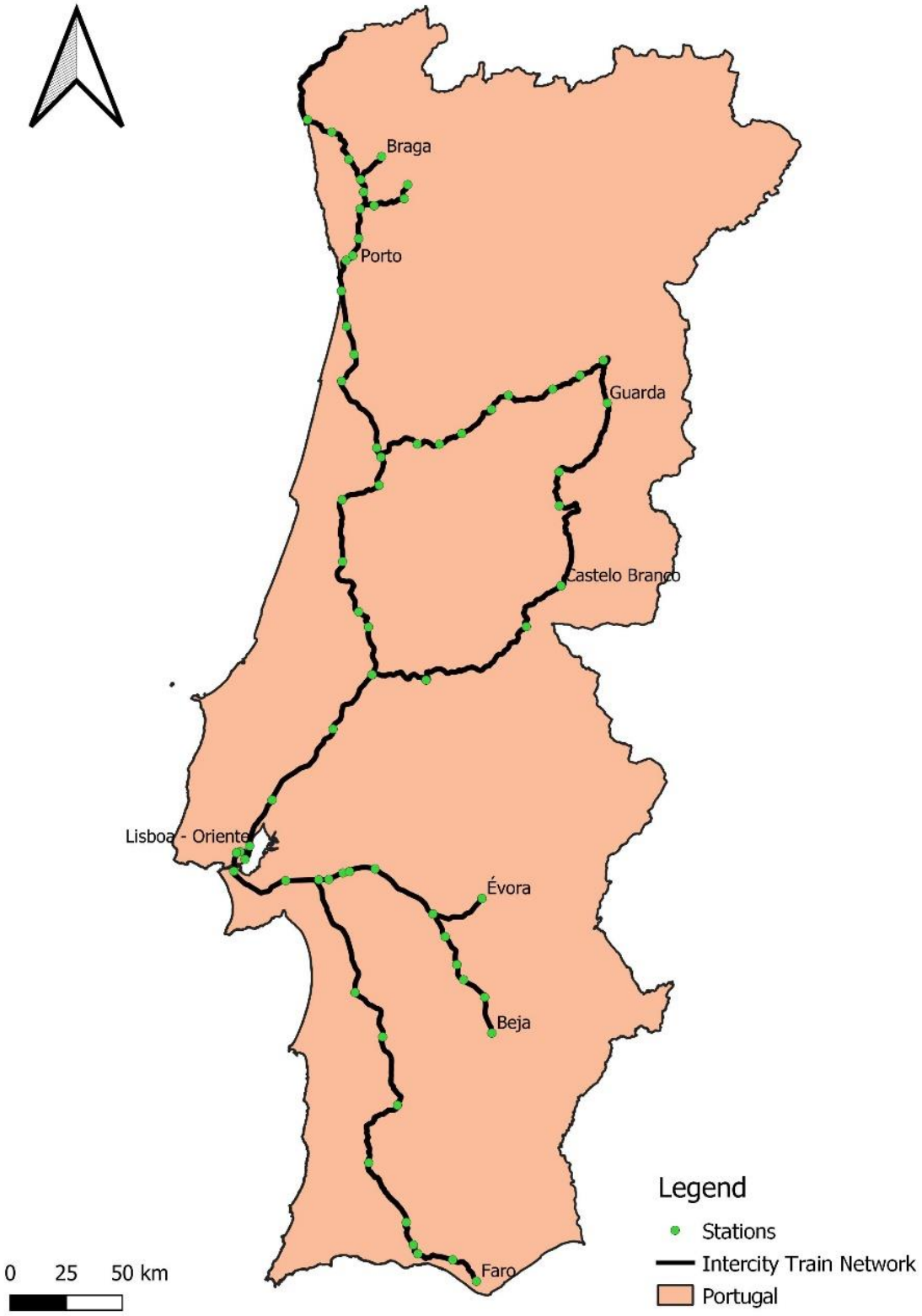

Figure 4. Current Intercity train network

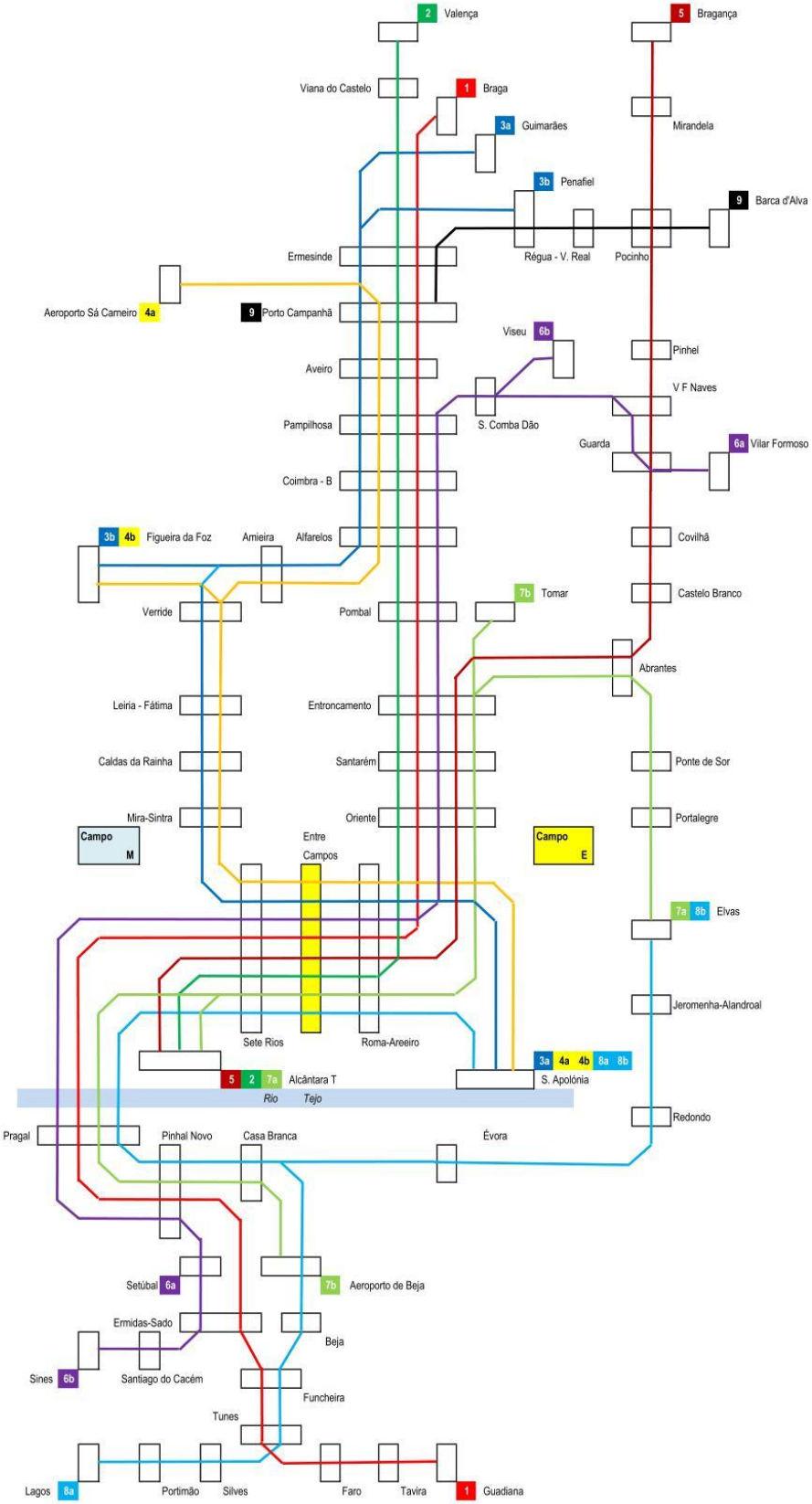

Figure 5. Scheme of the proposed intercity railway system (Zúquete, 2021)

The proposed form of organisation of the connections between cities shows an inclusive approach of all of the Portuguese territory. The proposed intercity service covers 124 stations which represent a two time increase in comparison with the current 76 stations.

To better understand the service behind the current intercity timetable, an analysis of the relation between the service frequency of each line and the demand were made, considering a distribution of the realised trips in each line during 2019 to the population that lives in 10 km of radius around each intercity station. The figure 6 shows the results of this analysis.

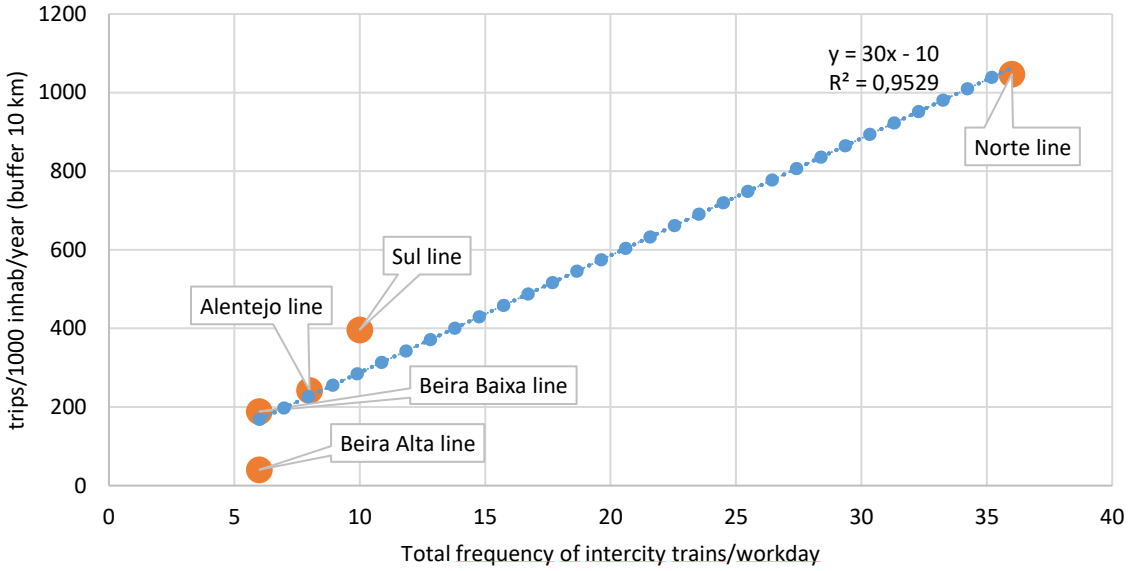

Figure 6. Relation between the frequency of intercity trains and the passenger demand in each railway line with the current intercity train service

Figure 6 shows that there is a strong relation between train frequency and demand. An exception is the Beira Alta line, where the characteristics of the cities and their localisation through the territory may have an impact on the number of trips.

Considering the responses from the survey, two of the most important parameters that influence the passengers to use or not the intercity train are the frequency and the number of transfers. Figure 7 shows the analysis of the frequencies between seven train routes in Portugal. Table 2 represents also seven chosen routes that contain transfers.

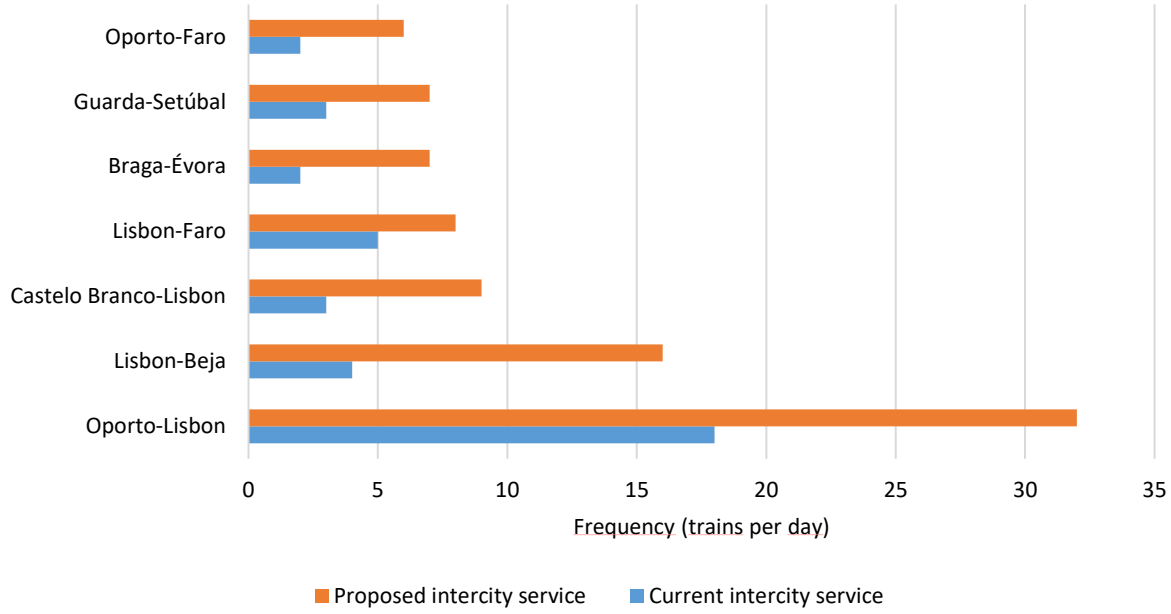

Figure 7. Frequencies of the intercity service in the current timetable versus the proposed one between seven chosen routes

Table 2 Minimum number of transfers in a weekday that are required in the current timetable versus the proposed one between seven chosen routes

Routes	Number of transfers Current service	Number of transfers Proposed service
Guarda - Setúbal	2	0
Portalegre - Setúbal	3	1
Braga - Faro	1	0
Oporto - Leiria	1	0
Leiria - Beja	3	1
Lisbon - Beja	1	0
Beja - Portimão	3	0

Considering the connections above, it can be concluded that the proposed timetable improves the frequency, on average, by two to three times comparatively to the current timetable; it improves almost

twice the current frequency of trains/weekday in the main line (Lisbon-Oporto), which is the link with more passenger traffic. It also rises substantially the frequency of the intercity service in lines that have low frequencies and improves the interconnections between lines. The number of transfers also diminish. Another important feature is that Lisbon becomes a direct destination for all stations of eight out of nine lines.

Despite the fact that the respondents of the survey consider the travel time as no limiting parameter for them to use less or not use the railway services for long-distance travel, it still remains an important factor that would rise the competition with the road transport and possibly capture those people who are very attached to their cars. Figure 8 shows the results of the comparison between the travel time by car and the current and proposed travel time by intercity train between seven routes.

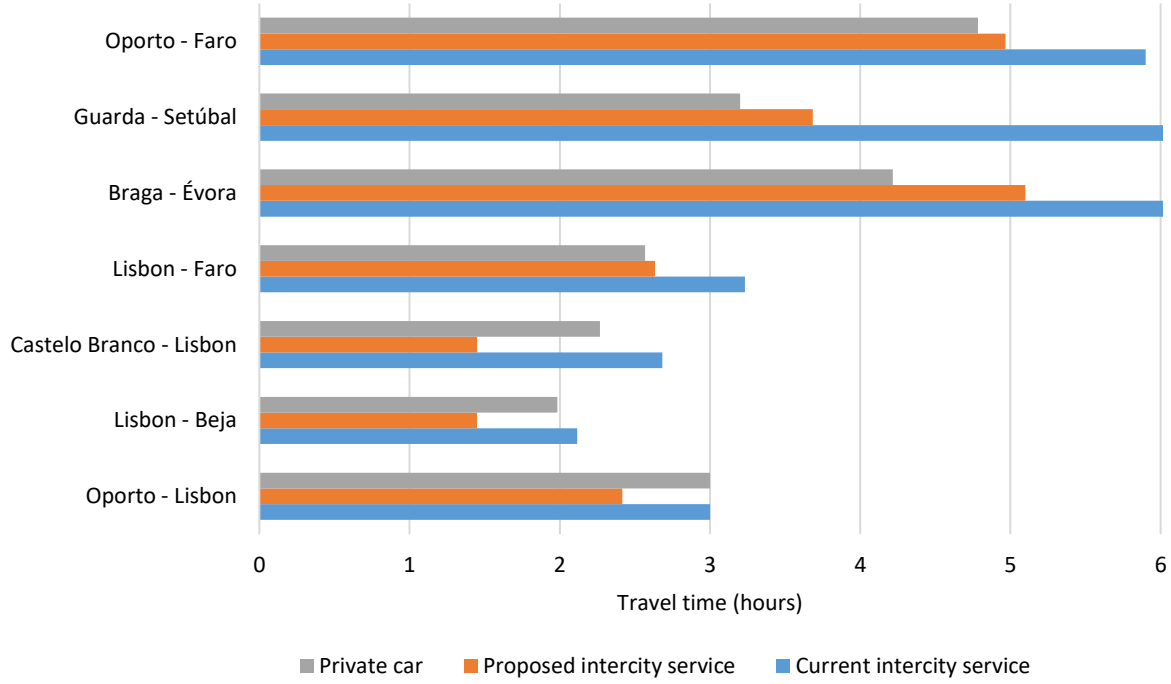

Figure 8 Current travel time by intercity train and car versus proposed travel time by intercity train for seven chosen routes

The results show that the proposed timetable could improve drastically the travel time that exists now, while operating with standard speed. This new travel time reduces the gap between the current travel time by intercity train and the travel time by car. It increases the competition with the road transport in all connections and consequently provides better chance for mode transfer.

An improvement of the intercity rail service also contributes positively to the environment by reducing the number of cars in long-distance trips and consequently the greenhouse gas emissions. The results of the environmental improvements are presented in table 3.

Table 3. Improved parameters that lead to positive environmental consequences

Long-distance rail trips in 2019 (Mpax/year)	4,7
Long-distance rail trips gain (Mpax/year)	8,0
Total expected long-distance rail demand (Mpax/year)	12,7
Reduced number of trips by car in long-distance travel (million car trips/year)	4,0
CO_2 emission reduction (kt CO_2eq/year)	55

The results show that the number of new intercity rail passengers increase substantially, representing a positive variation of 2,7 times. This reduction of CO_2 emissions is a very positive contribution to the reduction of greenhouse gas emissions in long term and could be increased with the improvement of the transport system in Portugal.

4. Conclusions

Given the importance of travel, having an organised railway passenger system with a stable intercity timetable would be an opportunity for Portugal, to create a sustainable public transport network, where the railway is the base for domestic long-distance travel. This study demonstrates that an integrated long-distance passenger rail service, as the proposed one, could improve the demand for public transport for long-distance travel, gaining about 8 million passengers/year and consequently reducing the use of individual cars, by 4 million car trips/year. This modal shift would cause a reduction of greenhouse gas emissions in 55 kt CO_2 eq, which is a positive contribution to the commitment to cut emission and achieve climate neutrality in the country by 2050.

Besides significant environmental improvements, the proposed model (higher frequency, lower needed number of transfers and less travel time with standard speed range) and the extension of the intercity service to all lines are of great importance for the Portuguese territory, as they fulfil most of the requirements set by the survey respondents as important parameters that influence their choice to use the train for long-distance travel. This new approach creates territorial cohesion and opportunities for easier travel experience for the residents from all over the Portuguese territory, while ensuring excellent service in the main lines.

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How does transdisciplinary knowledge co-production take place?

A case study on the project of "Decision Making Support Platform for Sustainable Taipei"

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Abstract

In 2020, 8 research groups from civil engineering, construction management, computer-aided engineering, transportation planning, water conservancy, earthquake prevention, ecological conservation, database management, and urban planning, networked to develop a main project, "Decision Making Support Platform for Digital Governance of Sustainable City in Response to Environmental Changes", submitted for Ministry of Science and Technology in Taiwan. It aims to design an urban planning simulation platform for co-delivering the decision support by simulation and visual analysis based on different solution scenarios. This project also introduced a key stakeholder, namely the Taipei City Government. In its design, within a four-year prospect this project will start from an initial pilot project simulation, and proceed to assist a revised framework for developing the Voluntary Local Review (VLR) for Sustainable Development Goals (SDGs) of Taipei city.

This paper aims to explore the process of transdisciplinary knowledge integration in the early stage of this project. It examines how our team overcome difficulties from the different epistemic cultures and path-dependent learning processes. Five factors, including (1) Leadership and Organizational Culture, (2) Individual's scope and interests (3) Adaptability, (4) Translation and Bridging, (5) Dynamic Management and Digital Tool, are identified as the keys for knowledge co-production. Among them, we point out that an organizational culture which can tackle changes and induce innovative "ways of doing things" is most critical for Transdisciplinary knowledge.

Keywords: Transdisciplinary knowledge co-production, Smart city, Taipei, Urban simulation, Co-design

1. Introduction

To address the challenges of urbanization and environmental changes in urban and regional planning, coordination across different professional fields for knowledge production is essential. In late 2020, 8 research groups from areas covering construction engineering and management, computer-aided

engineering, transportation planning, water conservancy, earthquake & flood hazard reduction, ecological conservation, infrastructure lifecycle management, and urban planning, networked to develop an integrated research project, “Decision Making Support Platform for Digital Governance of Sustainable City in Response to Environmental Changes”, for Ministry of Science and Technology in Taiwan. It aims to design an urban planning simulation platform for co-delivering the decision support analysis based on different solution scenarios. To apply research into practices, and also in return to examine the research result, this project involves a key stakeholder, namely the Taipei City Government (TCG). TCG provides basic data and feedback on team’s scenarios. The two parties agreed to conduct simulations from the initial pilots during the 3-4 years of cooperation, and then proceed to the analysis with the entire Taipei City as the scope. Shezidao and Guandu area was selected for the initial pilot project because this location will have a decisive influence on the urban transformation and sustainability in Taipei City. On the other hand, TCG also agreed to cooperate that the two parties will jointly revise the procedures and content of the Voluntary Local Review (VLR) of Taipei city, which is currently established every year, under the framework of the 2030 Sustainable Development Goals (SDGs).

This article examines the process of transdisciplinary knowledge integration and production in the initial stage of the project. Many studies have pointed out that the cognitive culture of different professions and the process of knowledge development with path-dependent characteristics are the reasons why transdisciplinary communication is difficult. This article explores how our team overcomes the above obstacles, and then sorts out several key factors for team-building and knowledge production. We obtained the main ideas from the existing literature and formed a preliminary research framework. Field observations, activity records, semi-structured interviews, and focus group interviews are used to analyse the characteristics of team composition. We interview members to understand their motivations and how individuals understand the team’s tasks, and develop and adjust their research design accordingly. We tested back and forth between the initial research framework and the experience collation, and then constructed our own arguments.

2. Literature Review

Sustainable research is a new research agenda that requires the cooperation of researchers from nature, society, humanities, and engineering. It also involves aspects such as transdisciplinary integration, interpretation of local knowledge, and public decision-making. Therefore, in recent years, the emphasis on multi-actor joint knowledge production has gradually gained attention. The Future Earth research community defines the knowledge production of sustainable research as "a process of introducing different types of expertise, knowledge and actors to produce specific contextual knowledge and an interactive and cooperative process towards a sustainable future."

Future Earth also pointed out that there are four principles for successful common knowledge production: (1) Context-based: This means understanding how a challenge emerged, how it is affected by its particular social, economic, and ecological contexts, and the different beliefs and needs of those affected by it. (2) Pluralistic: The process should explicitly recognize a range of perspectives, knowledge, and expertise and consider gender, ethnicity and age in developing the project. (3) Goal-oriented: This implies articulating clearly defined, shared, and meaningful goals that are related to the challenge at hand. (4) Interaction: It is critical to allow for ongoing learning among actors, active engagement, and frequent interactions (Norström, et al., 2020).

But transdisciplinary knowledge integration is not simple. Sometimes, the problem is that the system is not really conducive to transdisciplinary research, and this also affects the motivation of researchers. In many cases, researchers must strategically strike a balance between their existing disciplinary and the desired transdisciplinary research. Woiwode and Froese (2020) investigated why and how researchers conduct transdisciplinary research in Germany when the current teaching, promotion, and salary systems are still more favorable for monodisciplinary research. They used interview data to summarize four major strategies for researchers to move from a single field to cross-field research, including disciplinary innovation, strategic alliances, seeking niches, and creating disciplines.

But more scholars pointed out that the key is the epistemological differences between different fields. Jetzlowitz (2019) believes that natural and social sciences must deal with the topic of epistemology in the knowledge integration of sustainable research, because the two have quite different views on rationality. He went beyond the idea of connecting people to nature, and suggested adopting a co-evolution view of nature and society as the epistemological basis of the new discipline.

This approach above actually challenges the conventional research methods in various disciplines. For example, Howartha and Monasterolobc (2017) used the energy-food-water nexus as the field to study why transdisciplinary knowledge production helps decision-making. They pointed out that the issue of the energy-food-water nexus is characterized by multi-sectoral, non-linear, and time-sensitive processes. Faced with such a complex system, traditional analysis, modelling, and decision-making methods are no longer sufficient to grasp various positive and negative externalities and the interaction of different stakeholders. However, the co-production of knowledge among decision makers will help promote transparency, communication, and trust, leading to a kind of resilient decision-making. Their conclusion is that focusing on the context and process, communication and cooperation, strategic thinking, timescale is the key to the success of transdisciplinary knowledge production.

However, in this process, researchers may not be aware of their own limitations due to cognitive lock-in. Carins (2014) pointed out that the fundamental obstacle to knowledge integration is that each discipline has its own cognitive process, technical paradigm, evaluation method, or the mindset of "how to do things". These influences cover strict legal norms as well as factors such as community culture.

Therefore, we must pay attention to the possible path dependence caused by the previous epistemological framework of various disciplines, which often leading to the lock-in of knowledge production. The so-called path dependence refers to the important technological development and institutional influence of a particular discipline in its past development history, and these factors still dominate the researcher's method of defining issues or process of conducting research. In that, cognitive lock-in is a common negative result, which limits the researcher's innovation possibilities.

Mauser et al. (2013) emphasized that in order to integrate knowledge, researchers and stakeholders need to reflect on their interactions in the stages of knowledge design, production, and application. They explained that the so-called "integration" often needs to overcome the problems of the original organization, technology, and cultural structure. This requires not only new methods and concepts, but also appropriate communication tools, institutional arrangements, funding and resource input, as well as the continuous review and correction of stakeholders in various stages of the process. Mauser et al. (2013) also followed Thomas Kuhn's view of scientific community epistemology, emphasizing the influence of the researchers' worldview on knowledge production process (Kuhn, 1962). They point out that, the concept of knowledge integration in the scientific community is often different from that of multiple actors. The latter emphasizes continuous formation through learning and practice in a specific context. Among them, social knowledge and scientific knowledge are interdependent and inseparable from each other. From this perspective, the focus of knowledge integration is the need to maintain and improve diversified knowledge forms and discourse language.

Mauser et al. (2013) also described the knowledge integration process between multiple actors, such as researchers and other non-academic organizations including the government and civic groups, and analysed how they gradually progressed from interdisciplinary to transdisciplinary interaction. They divide knowledge integration into three stages, including co-design, co-production and co-dissemination. They emphasized that in this multi-actor orientation, the knowledge integration between the researcher and other stakeholders must occur in all the three stages.

In their knowledge integration ladder diagram, the first stage is joint design, including the formulation of topics and frameworks, the setting of research questions, and the details of implementation. The second stage of the joint production of knowledge is through the contribution of individual domain knowledge expertise by individual stakeholders, and jointly overcome the uncertainty, entering a new stage beyond the original domain. And the next step is to use the results in different groups for evaluation and feedback, which depends on translation, dialogue, and response. The results of the application may come back to re-initiate another round of joint design process (Figure 1). Successful integration depends on criticism and reflection at each stage. It requires new research methods, communication tools, organizational arrangements, and investment of funding. On the other hand, the challenges of knowledge co-creation include developing new skills, dealing with organizational rigidity, clarifying the roles and responsibilities of actors and the rules of participation, setting up

integrated institutions, developing supportive systems, and removing power inequality. (Mauser et al, 2013)

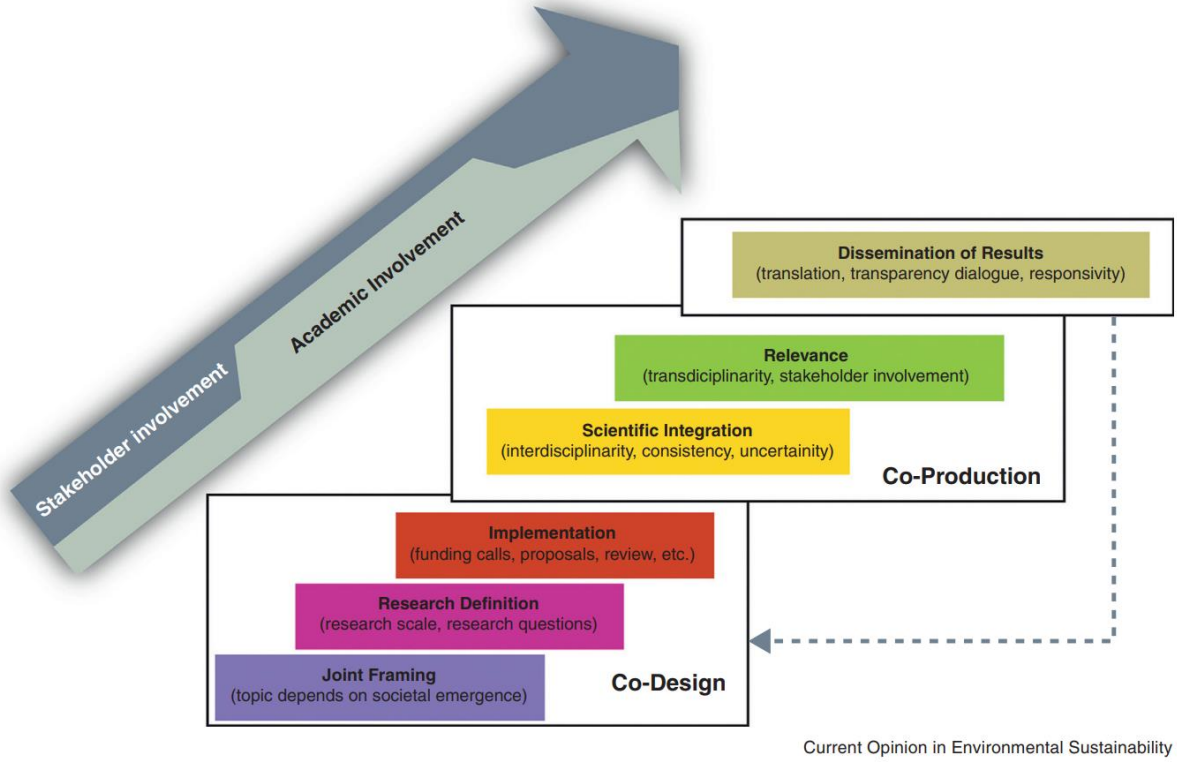

Figure 1. *Framework for interdisciplinary and transdisciplinary co-creation of the knowledge castle.*

Source：Mauser et al. (2013). p.427.

On the other hand, the research community of Future Earth also gave feedbacks based on researches around the world and developed some practical guidelines. They pointed out that there are also some prerequisite factors that determine the results of knowledge co-production, such as the relationship within the team. This may include whether the members have previous cooperation experience, and whether the team actively builds trust, allowing members to talk about pressure or express expectations and so on. They found that the process of knowledge production usually depends on past experience. Meanwhile, researchers have also found empirically that when working with multiple stakeholders, a political window of opportunity or hooking point can specifically initiate a process of knowledge production. For example, various policy governance programs based on climate change provide a possibility to connect multiple stakeholders (Norström, et al. 2020).

Our research sets off from the above concepts, and it examines the team building, analyse the interaction between members in the process of knowledge creation, including how they understand the team's tasks, and accordingly adjust their own research proposal. We also analysed some prerequisite factors, especially the influence of organizational culture on the interaction process. Our integrated research project is still in its infancy, as the team work is now entering its second year. However, the periodical

review helps us understand the current progress, and based on that, we hope to contribute our case in the theoretical research of knowledge co-creation.

3. Case Background

3.1. The Ministry of Science and Technology solicits proposals

After joining the Science and Technology Alliance for Global Sustainability (STA) in 2014, the Sustainability School of the Ministry of Science and Technology of (Most) Taiwan took the international science project "Future Earth" promoted by the United Nations Sustainable Development Goals (UN SDGs) as the blueprint to review and revise related topics of Taiwan's local sustainable development, and completed its middle-range development plan. The main contents include: The three pillars of sustainable development: environmental protection, social equity and economic development, as the general goals for promoting research project and giving grants. Furthermore, it requires research projects to incorporate integrated knowledge by the process of co-design, co-production and co-delivery. In September 2019, the Sustainability School of MOST completed the revision of the fourth mid-range plan. This content is to strengthen the practice of Trans-Disciplinary Research (TDR) on sustainability issues, involve researchers in the natural, humanities and social sciences, and introduce stakeholders to participate together, and visioning through Knowledge to Action. The vision is to find a Pathway that can solve the needs of sustainable development through TDR.

Our team was formed at the end of 2019 and submitted a proposal to MOST with an integrated project "Design and Application of Smart City Planning Simulation Platform". The goal of this research is to integrate expertise from various fields to construct a smart city simulation platform based on transdisciplinary applications, and employ database resources such as BIM, GIS, and Open Data, to display city simulation results through information visualization so that it can assist the best decision-making. Our members come from multiple expertise such as urban planning, urban transportation, disaster prevention, ecological landscape, and energy management, working together to produce transdisciplinary knowledge. We believe that the establishment of this simulation platform will not only help stakeholders such as governance and investors in decision making, but also enable citizens to obtain a better urban environment. This study hopes to contribute to the research and teaching of transdisciplinary knowledge related to urban sustainability.

3.2. The team has undergone restructuring

However, the formation of our team is not all in place at the beginning, but the result of adjustments. Director Shang-Hsien Hsieh of the Civil Engineering Department of National Taiwan University saw the plan solicitation announced by the Ministry of Science and Technology in October 2019 and began to conceive a team based on the theme of "Smart City Planning Simulation Platform Design and Application" to jointly propose an integrated research plan. The backgrounds of the invited members

covered urban planning, civil engineering and transportation infrastructure, disaster prevention, information management, and digital simulation. From the perspective of the affiliated units, they included the National Taiwan University Civil Engineering Department, the Graduate Institute of Building and Planning, and the Horticulture Department, as well as National Center for Research on Earthquake Engineering, with a total of about ten researchers. Our team had two face-to-face meetings, several emails exchanges and then began document writing and integration through the cloud. Finally, at the end of 2019, an integrated research project of eight sub-projects for a three-year period was completed and submitted to MOST.

However, in June 2020, the results of the review by MOST were announced. In our team, only half of the sub-projects were passed, including proposals on urban planning, circular city, transportation, and information simulation. And about the budget, only the first year was awarded. Research budget. The reviewers' opinion is mainly that the integration between the sub-projects is not enough. Faced with this result, the team first launched the pilot project in August 2020. The core group was formed with the four sub-projects passed. We discussed intensively, with a purpose to understand better about each other's views, and accordingly develop and adjust our own plans to improve integration. The core members also participated in the project briefing held by MOST, observed relevant cases, and learned how to strengthen the co-design and co-production of knowledge.

At the same time, after discussing with the members, Prof. Hsieh, the principle investigator (PI) also decided to reorganize the team to prepare for another proposal summited at the end of 2020. The team referred to the period from August 2020 to July 2021 as the 0th year plan, and began to plan a new proposal for the next three years. Compared with the first year's plan, the team has added areas such as life-sustaining systems, building physical environment, and ecological water conservancy. The new members are mainly from the Civil Engineering Department, invited by Prof. Hsieh, the members are younger and the proportion of women has also increased. The new project members are quickly in place and frequently participate in team meetings to think about how their respective projects can be integrated with the first batch of projects.

This time the whole team will have about half a year to develop a proposal for a subsequent integrated plan. Finally, in December 2020, the team re-titled "Digital Governance Decision Support Platform for Sustainable Cities in Response to Environmental Change", continued the ongoing plan, and expanded and integrated it into 8 sub-plans to respond to the research theme of "E. Smart City Ecology" planned by the School of Sustainability for 2021 (as shown in Figure 2). The master plan sets out the contents of the work over a three-year period, including "Environment Construction and Model Design" for the first year, "Scenario Analysis and Simulation" for the second year, and "Application and Verification" for the third year.

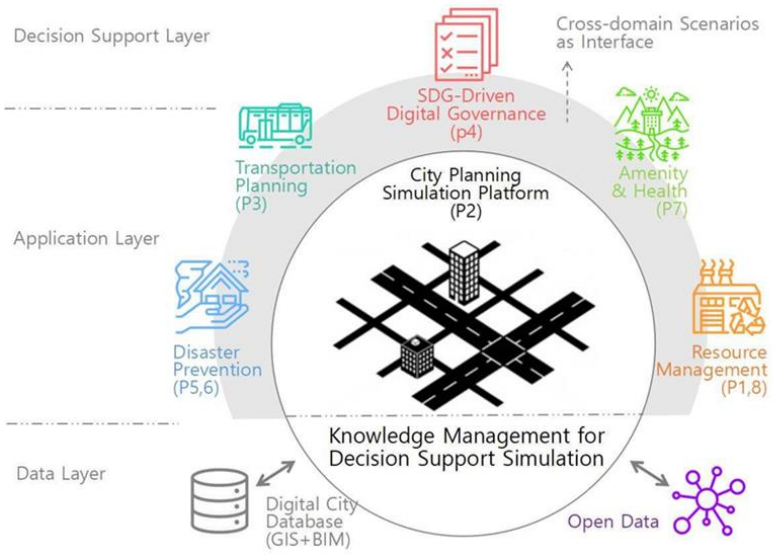

Figure 2. *The composition areas of our team.*

Source: authors

On the other hand, the team learned that identifying the "target" of the simulation (or "site", as urban planning professionals call it) early on can make the discussion more specific. At the beginning of this issue, there was a discussion on whether to take the hypothetical new town to be developed as a study object, so that various parametric models, such as demographic and social conditions, could be simulated. However, after several discussions, the team members decided to take Taipei, the city with which researchers with urban planning background are most familiar and have cooperative experience, as the main target, and then select the specific research scope from the perspective of sustainability. Considering the technical development and the time of team running-in, we decided to start with a small scale base, such as a district scale. In the second year to the third year to expand to the scale of the whole city.

On the other hand, we have gradually come to a consensus that the mission of the team is to "assist citizens and civic groups to jointly define the vision of the city through professional integration and big data analysis, and to use a visual simulation platform to visualize the impact of different development options to facilitate communication between the city government and the public". Therefore, if we can formally cooperate with the local government, we will be able to solve the data difficulties, and we can also get feedback through the discussions between the two sides, which will help us to develop the solution in the real situation.

During this period, we successfully received a positive response from TCG and held several working meetings. Our work has been set up as starting from a pilot project to develop and build a simulation platform in a specific area, and later to cover the entire city of Taipei. In this regard, after a few month of negotiation, our team finally complied with the needs of TCG, and took Shezidao and Guandu area

as the objects of our research and visual simulation. At the same time, our team will assist TCG to review and revise its vision for urban development within the framework of the United Nations Sustainable Goals SDGS, and to assist the public to communicate through the Smart City Simulation Platform. Our team has worked with TCG to integrate the work and professionalism of both parties, as shown in Figure 3 below.

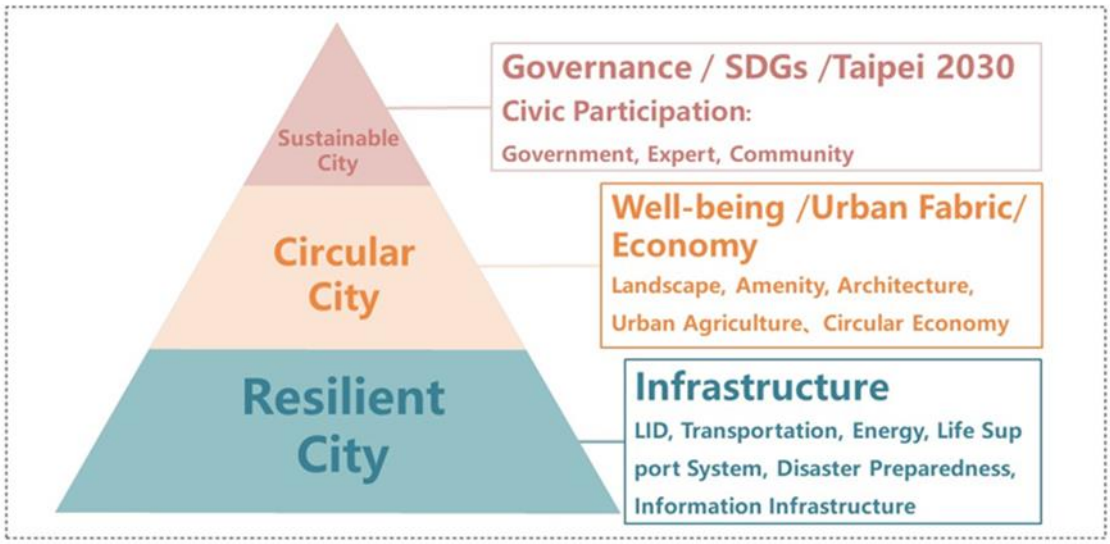

Figure 3. *The integration framework of our team and thein the smart city simulation plan.*

Source: Authors

This paper does not discuss the results of our simulation platform, but conducts a meta-analysis based on the working process of our research team to examine the process of transdisciplinary knowledge production and analyse the key factors affecting communication and integration. Research methods include:

(1) Joint discussion and review by the authors of this article. Our five authors, including the PI, co-investigator (CI) and three research assistants, reviewed the previous application and its following team rebuilding processes. We also conducted joint writing. In this way, it helps us not only to review our memories and sorting out details, but also interpreting interactions and works.

(2) The authors' semi-structured interviews with other team members. This part was designed by the CI of the team and carried out with the research assistants. The purpose of the interview is to understand whether the members have previous transdisciplinary interaction experience. If so, we also want to know how members view the difference between this experience and the previous one. We also asked members about their motivations to join the project team, and asked them to explain whether there is a gap between their current experience and their initial imagination. Next, we invite members to talk about their gains and difficulties encountered in transdisciplinary knowledge production. We have conducted interviews with four members so far, and we have not completed all the interviews, but we

have reached preliminary conclusions. In addition, this study has not conducted interviews with members of TCG. This will be done in the next phase to supplement the views of stakeholders.

(3) The observation and analysis of the first author and CI of this article. The first author participated in every meeting within the group from the first stage of the proposal to the second stage, and also participated in the liaison work and discussion meetings with the municipal government. She reviewed the contents of the two master plans, work records, meeting minutes, etc., and interpreted the group's data and work status from the perspective of humanistic and social analysis.

We understand that this version is a preliminary analysis of the team's interaction status in the first phase. However, recently the team's simulation plan has gradually taken shape and the platform has been initially completed. The interaction with TCG will also progress from internal discussions to communication meetings with citizens and the community. We will further deepen the current analysis based on progress in subsequent versions.

4. Backgrounds of the site

The main research object of this article is not the content of the smart city simulation platform, but the knowledge production process around it. However, because team members' internal communication and interactions with stakeholders are mostly carried out according to the issues related to the research sites, it is necessary to explain the characteristics of the site here.

The Guandu and Shezidao areas are located on the northwest side of the Taipei Basin. They are alluvial plains created by the intersection of the Keelung River and the Danshui River, and occupy the key geographical location before the convergence of the Taipei City water system arrive at coast with the Taipei city boundary (Figure 4). Shezidao covers a total area of 294 hectares and has a population of approximately 11,000 people. Due to its low terrain and the early flooding of Shezidao, it was designated as a flood detention area by the Taipei Flood Control Plan in the 1970s, and has since faced a construction ban. As a result, the construction of public facilities there lags far behind other areas in Taipei City. As the government has failed to properly supervise, many buildings in the area are also built and used in violation of regulations.

Figure 4. *The research scope of the project-Guandu Shezidao area,*
Source: National Land Surveying and Mapping Center, Taipei City Government and rearranged by authors

In recent years, with the completion of the flood control plan and the protests of some residents, the main plan of the Shezidao urban plan was passed under the authority of Mayor Ko Wen-Je in 2016, and the whole district was transformed into a residential and commercial area. However, the new plan caused social disputes about its large-scale landfilling, general and expropriation, and over-scaled flood control, which leading to a suspending in Environment Impact Assessment.

The Guandu Plain to the north of the Keelung River covers an area of 707 hectares. It is the only large area of agricultural land in the Taipei City Planning Area, accounting for 90% of the city's agricultural area. The main agricultural product is rice. In 1991, typhoon Hsiangshen caused great flooding in the Keelung River Basin. The government restricted the development of agricultural areas and protected areas within the urban planning area, and the Guandu Plain has since been listed as a prohibited area. In 2019, due to the completion of the Yuanshanzi Flood Diversion Channel and the passage of the Water Conservancy Law, President Tsai Ing-wen lifted the ban on the Keelung River Basin, which also puts the Guandu Plain currently facing tremendous development pressure from the land owners.

A large agricultural area in an urban area such as the Guandu Plain is very important to Taipei City under the urban transition of climate change. It can serve to mitigate the urban heat island effect, enhance agricultural transformation and food self-sufficiency, and function as renewable energy experimental sites. issue. In the Guandu Plain, the Guandu Natural Park is located on the west side, which is an important waterfowl protection area in Taipei City. However, in the area, public land

accounts for only 7%, and the rest are private lands. Some landlords put pressure on the city government through councillors. They look forward to deregulation of agricultural development and changing land use zoning for high-intensity development. Over the past two decades, a part of the Guandu Plain has changed to provide office spaces for significant emerging industries, including media, high-tech and automobile industries, and has become a development area for specific strategic industries in Taipei City.

Shezidao and the Guandu Plain are located on both sides of the Keelung River, facing each other. This area is the windward side of the northwest monsoon in Taipei City, and its development will affect the microclimate of the entire Taipei City. However, their possible changes in land use have also triggered controversy over the sustainability of nature and society, which can be said to have evolved into a wicked problem in urban planning. Under these circumstances, TCG urgently needs a long-term vision plan to meet the challenges of current urban changes. Therefore, this plan takes the sustainable development goals of the United Nations 2030 SDGs as its vision, and uses scenario simulation to promote digital governance in smart cities. We formed a cross-disciplinary team of experts to cooperate with the TCG, hoping to help to revise the urban plans and promote the sustainable urban transformation of Taipei City. Also due to the selection of the site, the approach of the team has gradually moved from modelling to problem-solving.

5. The characteristics of knowledge production

The content of the following section is mainly compiled from the interview data, and added the opinions obtained from the observation and discussion of the authors of this article. The two verify each other to develop an overall analysis.

(1) Leadership and Organizational Culture

The appeal of the team leader is very important. In the interview, almost all members of the Civil Engineering Department first pointed out that they joined the team because of the invitation of the department head, and they also expressed their trust for him. Almost all members have participated in other integrated projects before, but they consider the degree of integration has improved significantly this time. Some members pointed out that when joining an integrated project, his consideration is whether the topic closely related to his own research interests and whether the goal of the project is clear, but above all, if the principal investigator is unreliable. He identified that PI's ability in project management and control in timescales is most important.

In fact, the integration of the team is also the result of the PI's planning. From an interview with Prof. Hsieh, he mentioned that in June 2020, when the team had to be reorganized, he adjusted his strategy. He invited two researchers from his former students to join the team, but he and other members have not previously collaborated on research. Before invitation, he will assess if the researchers are in line

with the research field required by the master project, and whether they can flexibly adjust the content of their project in order to strengthen the integration with others. For example, some researchers are not suitable for this integrated project because they are specializing in research in a very specific field. In contrast, what he looks for are researchers willing to invest in research for public domain. On the other hand, he also targets at some young researchers who would like to expand their research fields based on this project.

Prof. Hsieh explained that his role as the PI of the master project is to provide support and assist to other team members. In this, we found that leadership and team culture have a complementary relationship. The researchers observed that there is an atmosphere of openness and innovation in the team, which supports communication between members. This culture may come from the following factors. The first is the PI's previous experience in cross-disciplinary research and teaching. Prof. Hsieh's current main research fields are BIM and smart cities. He also offers the "Innovative Social Design Engineering", a cross-disciplinary co-teaching course in the D-school of NTU. Therefore, social design is already his educational practice. In addition, the organizational ecology of the Civil Engineering Department of NTU has inherent cross-disciplinary characteristics. The faculty of the whole department is divided into seven research groups, with distinct individual fields, but there are also co-teaching courses, usually provided by young teachers. In addition, the Civil Engineering Department has also coincided with the retirement of a large number of teachers in recent years. The characteristics of new teachers are young, more women, and broader fields. On the other hand, the Graduate Institute of Building and Planning to which the three of the authors of this article are affiliated has emphasized cross-disciplinary training in research and teaching since its inception. Therefore, our team members have a certain foundation in teaching and training regardless of whether they have participated in integrated research projects before.

(2) Individual's scope and interests

In the interview, the team members' answers confirmed the moderator's strategy in team reorganization, that is, they are interested in transdisciplinary knowledge production and look forward to breaking through the original research framework. For example, S, who specializes in water conservancy, pointed out that he had often cooperated with researchers in the ecological field before, but most of the locations were in non-urban areas. The purpose of joining this time is to study the status of drainage in urban areas. He believes that water conservancy issues in urban areas need to consider complex urban development and social factors, which can develop new aspects of research.

K, who specializes in the field of transportation, pointed out that transportation planning should be very related to land development, but he often sees that in his field, policies and research are done separately. Therefore, he joined the team, hoping to examine the connection between transportation and urban planning from the research. On the other hand, in personal experience, he also mentioned that his home

right in the region across the river from the site, but he never gets to know the place before. Now he not only visited the site but takes the students to the site for Investigate.

Members Z and L are young female assistant professors, with professional backgrounds in building physical environment and urban life support systems. They are new members of the team. Although their research projects are still under review from MOST, they have participated many times in group meetings. They believe that participating in this project is an opportunity to further establish their research interests and expand their fields.

(3) Adaptability

In the production of transdisciplinary knowledge, we often face the problem of dealing with uncertainty. Therefore, the psychological preparation of members before participation and the mutual adjustment in the process are critical. The key is whether the members can adjust their own research fields and invest time. For example, in the first stage of the team's initial formation, some of the more senior researchers were less willing to adjust because their research interests were more fixed, so the connection with other programs was weak. In addition, some senior researchers withdrew because of being busy, and suggested that the team find relatively junior members to join. S mentioned that about the long run-in period, "I don't feel particularly surprised. Knowledge communication would have taken time." In addition, he also mentioned the importance of planning to set clear goals. Especially after deciding site, the focus of the master project became clearer, and the communication between members from different expertise also accelerated, and the mutual learning proceeds faster.

Sustainability research emphasizes the cooperation between multiple stakeholders. But we also found that after introducing the main stakeholder, disturbances of project goals occurred. The project rapidly evolved from an experimental scheme into a task of problem-solving. This decision has a huge impact, because the researchers of each sub-project also needed to adjust their project content accordingly.

Although the research plan awarded by the Ministry of Science and Technology allows for some adjustments in the process, for researchers, the main task is to overcome psychological barriers, including their original professional setting of problems and time schedules, and their cognition of research methods. The team’s timescale must be reorganized. For example, Z pointed out that the original plan's working method was to select a smaller site such as a street profile for architectural modelling in the first year, and then add parameters and expand to complex systems year by year. However, after the team decided to choose the Guandu and Shezidao areas, and to cooperate in the second half of 2021 to conduct professional and public participation communication, she will need to quickly deal with the scale of the entire region. But L’s plan is just the opposite. Originally, her proposal was based on the entire City, but now she has to start from the selected site.

When the site has obvious social issues to be solved, the "instrumental rationality" originally set by some members as research assumption is no longer sufficient, and the thinking of "communicative

rationality" needs to be further incorporated (Habermas, 1984). For example, in our case the team originally hoped that the selection of the site could develop year by year, with the geographical scale from small to large; accordingly, from a relatively simple topic to a more complex case. However, after several discussions with the officials from TCG, the team decided to follow their wish, taking the Guandu and Shezidao areas where they most need professional support and assistance in public communication. K is a member who joined in the first stage of the project. Although he often said that after the planning issues decide, his transportation modelling can be coordinated. But later, his research focus has also been hugely revised. For example, the original plan was to study the needs of self-driving cars and the transportation needs of the elderly. However, after the master project determined that the research site will be Guandu and Shezidao, he adjusted the research topic to be urban capacity under the TOD (transit oriented development) to address the issues in debate among the current several competing development plans. K also mentioned that previously the role of a site was to him mainly "a place for collecting data", and the focus of his research was how to improve the rationality through the analysis of modelling. But this time, after deciding the site, he has a gain a better understanding of the different views toward a site from urban planning.

We have found that when faced with a high degree of uncertainty, the original relationship and trust of team members can help individuals prepare for adjustment. For example, soon after the two new members, Z and L, joined the team, they faced a situation where the team decided the site to be Guandu and Shezidao. Z said that that she felt the situation was changing from an experimental simulation toward a goal of problem solving. She was a little panicked at first. L also pointed out that through the project discussion, she will always need to think about how to change the parameters of her original design or simulation along, but she has not yet found a clear answer. They said that although there were some shocks, and the original plan and conception also needed to be adjusted significantly, but they were prepared for adjustment, and they can consult the PI, so that would not be considered as a hindrance.

(4) Translation and Bridging

Z mentioned that she had participated in transdisciplinary integrated projects before. At that time, each research member had to make a set of curriculum content, and finally participate in the integration through the final designed activities. She commented that its advantage is they have a higher sense of control, but there is a lack of knowledge integration. In contrast, this project requires a higher level of integration. However, how does transdisciplinary communication take place? we found that once members encounter content that they are not familiar with before, they often need to rely on the "translation' and even metaphors from the team members in the discussion.

For example, Z and L pointed out that in the team meeting discussion, a big obstacle is that they didn't even understand some professional terms at the beginning, such as script (or Scenario). H, one author

of this article, explained that the script is for substituting different parameters and writing into the situational simulation. And H's understanding of script writing is because in her related majors (architecture and planning and design), one method is to set hypothetical users, describe their behaviour and interaction with space, and then generate design guidelines.

But H, whose professional training is urban planning, didn't understand what is an information simulation platform or practices of information management at the beginning. Them, the PI used the production of a film to illustrate the division of labour, including the director, screenwriter, and producer, as a metaphor. In fact, later in the group meeting, the situation of mutual inquiring and translation among members like above appeared frequently. Members often add on to each other in discussions, helping each other to understand, and then guide to interpret, and further develop to be a team's consensus.

In addition, the network interaction between main assistants plays an important role. Their professional training backgrounds are different but related to each other, and this contribute to division of labour as well as collaboration. Assistant D is trained in landscape architecture, but after established a digital society and participated for years, his research field shifted to smart city and data application analysis. Assistant C also has a background in landscape architecture. And the theme of his project for bachelor degree happened to be the ecological design of Shezidao and Guandu, so he can help the team to grasp the general picture of the site. Assistant T is a doctoral student, whose research fields span architecture, urban planning and sustainability research. And she also actively participated in a student club for climate actions. The rich background of assistants contributes to the integration of knowledge production of the entire team.

As mentioned above, the open organizational culture and interaction mode of the team can also increase the enthusiasm of assistants, allowing them to actively participate in the management of team work and assist in the interaction with stakeholders. For example, in the initial stage when the research goals are still under adjusted, the data contents needed are also shifting. This cause confusion of communication between TCG and the team. In response, the assistants clarified issues and coordinated the division of labour through both official and private networks, which greatly reduces the time for administrative communication, and obtains more accurate data types to assist sub-projects in defining workable issues.

(5) Dynamic Management and Digital Tool

Assistants also play an important role in working methods and the use of digital tools. The assistants suggested that the project database should be established in the form of Google Cloud, so that the researchers of sub-projects can understand each other's knowledge background, project contents, and then develop the relevant themes to their own projects. It can also help manage the progress of various projects. On the other hand, the assistants established a messenger work group and Facebook internal

page in the mid period of the project to help team members share information in real time, quickly update the progress and identify issues for discussion.

At the beginning phase of the project, the assistants collected information of the site, and gave briefings to the researchers. However, it was later discovered that this method would become a unidirectional and lack of interaction among members, and it was difficult to advance the progress. Later, we found that good transdisciplinary knowledge interaction is like throwing and catching a ball, requiring a loop running back and forth. In that, actions including pre-data sharing and reading, developing comments and opinions, submitting questions, etc., will be useful to lead effective discussions in formal meetings.

We witnessed a constant situation of trial and error in the initial stage, and sometimes members even felt stuck. At this time, we initiated events such as site visits, lectures, and even informal gatherings to create interaction and maintain continuous motivation. We also found that semi-structured dialogue between team members outside of the meeting time helps members to get to know each other better, and they can plan for future collaboration. At the same time, it enhance a sense of teamwork.

6. Conclusion

This article summarizes the practice of transdisciplinary research (TDR) under the topic of sustainability, and uses the smart city simulation project of Guandu Shezidao in Taipei City as a case to explore the knowledge co-production process between the researchers of nature and social sciences and stakeholders. We found that transdisciplinary knowledge production is a dynamic process of continuous adjustment, which can be summarized from the following three aspects:

(1) An organizational culture that can accept change and innovation

We experienced a series of obstacles and adjustments in the early stage. Mauser et al (2013) mentioned that the co-design stage of knowledge production requires the translation, integration, adaptation and innovation of knowledge from all parties. However, at the early phase, a situation of knowledge lock-in is very likely to take place, as Carins (2014) addressed, and it requires researchers of various walks to break away from their original knowledge frameworks. This kind of groping process, which hardly exists a path to follow, requires sufficient time for translation and self-positioning. Upon it, it may make the project looks as if there is no progress at all. In order to accelerate communication and knowledge production, we have tried formal and informal ways of communication to maintain the momentum of the group dynamics. However, compared with the aforementioned tools, we found that the most important thing is to be equipped with an organizational culture that welcome changes and innovation to overcome the obstacles.

(2) Site decision and the establishment of a common goal

In the interview, we found that set up a goal after deciding the common site is a key step, which responds to the concept of "goal-oriented" proposed by Future Earth. Taking this project as an example, the initial

goal was to build a smart city simulation platform, and lack of actual site and real research challenges, resulting in the lack of specific knowledge dialogue and difficulty in converging opinions. After establishing the Guandu and Shezidao regions as sites, researchers began to propose simulation models from their respective professions, and then through display and translation, a series of transdisciplinary knowledge discussions were triggered. Thus, a clear goal and common site can be used as a medium for knowledge translation to help team members quickly grasp the overall situation, understand the roles of other professions, and then think about their own contributions.

(3) Site politics and social reality

Finally, the Guandu and Shezidao areas hold the most important location in the entire Taipei city's water system. In addition to economic benefits, their development must also respond to the goal of sustainable development. However, under the struggle between development and conservation, the development of this site is in a state of tension and change. At present, due to the ever-changing politics, the interaction between our team and the city government lead to continuous revision of the plan for the site. In response to Mauser's point of view (2013), in addition to the difficulties of knowledge translation, transdisciplinary knowledge production also needs to face the political process, which requires all stakeholders to work together to overcome rigid organizational, technical and cultural structures.

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Principals of Smart Growth and Land Use Planning for the Cities with Multiple Nuclei Model of Development: the Case of Juybar City

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Abstract

This study tried to test, analyze, and develop the multiple nuclei model principles in a city located in another geographical location with entirely diverse spatial, demographical, and social-economic structures. The type of this study is fundamental basic or pure research and accompanied by fieldwork, examination, and comparison. Analyzing the multiple-nuclei model considering motorized private transport, regardless of the geographical location and social-economic difference in this study, by practicing the Smart Growth theory principles, tried to enhance the efficiency of land uses concerning the spatial distribution of activities, facilities, and limitations. The collected quantitative and qualitative data types included geo data, development plans, scientific papers, and books. For analyzing the geodata and land use map used the Moskito GIS and Arc GIS software. Private car-based mobility created a multiple-nuclei structure of land use development in this city. It is one of the main factors that have escalated the city's physical growth horizontally. Mixed-use, compact development, high-rise building, increasing transportation options, improving public services and facilities for all families are the main strategies to control sprawl growth, reduce consumption of valuable agricultural lands, reduce environmental degradation, and realize a sustainable form of urban development in this city.

Keywords: Urban Smart Growth model, Multiple Nuclei Model, horizontal expansion, Juybar city

1. Introduction

The shape of a city can be regarded as a spatial model of human activities at a certain point in time (Pourahmad, et al. 1391). The physical growth and development of the city is a process that affects all systems and structures of a city directly and indirectly. Rapid urban population growth faced the world with many critical environmental challenges, including climate changes and air and sound pollution (Emami, 1389). Especially where the development of cities is car-based, it increases cities' physical growth through the destruction of valuable urban agricultural or barren land (Rabban Yig 1387). These challenges embrace the social and economic dimensions. Therefore, balancing between

spatial distributions of land-uses through a sustainable form of urban structure help to achieve sustainable development and increase the urban environment and life quality.

Acceleration of urban growth and population increases the need for more infrastructures, buildings, and roads. Consequently, it increases the pressure on the environment, natural resources, water, soil, forests, and agricultural lands.

Research Questions

How are the spatial structures of Juybar city, and what factors are involved in this structure?

How is the spatial distribution of activities in Juybar city?

How developed the multiple nuclei model in Juybar city?

The geographical location of Juybar city

Juybar city is a small city located in the middle of first Iran's Metropolitan area in the Mazandaran province Figure 1. From south and east is closed to the big city Sari and this city is the capital of this province and close to the other big city Ghaemshar. From the west closed to Babolsar city, and from the north is closed to the Kohikheyl (Sahraei, Ahmad, 1392). However, there are no network limitations to access the other cities through this city at the whole of this province.

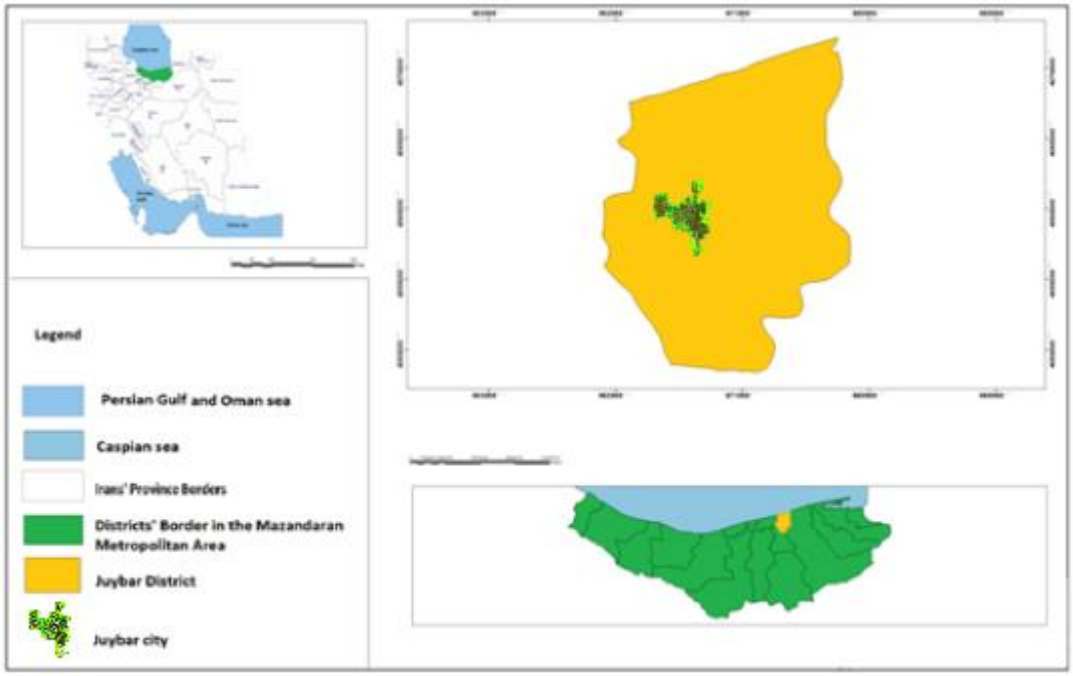

Figure 1. The geographical position of Juybar city in Mazandaran metropolitan area, by author, 2021

Mazandaran province is located on the north side of Iran and has a metropolitan area with more than 3,283,577 population within 62 cities Figure 2.

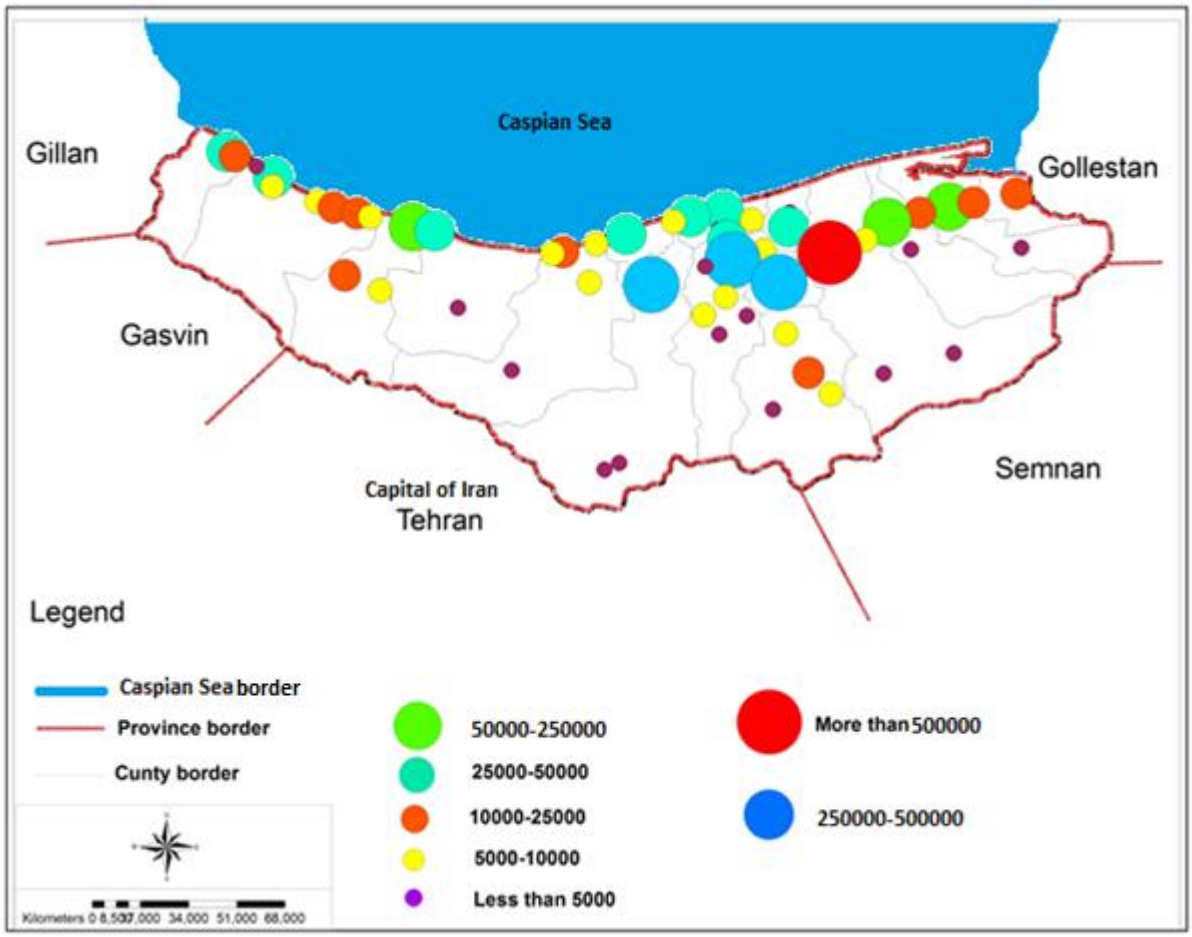

Figure 2. Geographical location and population size of cities in Mazandaran metropolitan area, by author, 2021

Urban Smart growth

The Smart Growth theory is an excellent practice to construct a city with bright integrated activities also be self-reliant to give service to the dwellers and even other cities at the regional, national, and global.

The English geographer Robert Dickinson believes that cities have four distinct areas during growth and development. One is the central sector, the second is the middle sector, the third is the outer sector, and the fourth is the suburbs near rural borders (Shamaei, 2001). No one can argue that the physical growth of a city is wrong or good. Also, the cities development cannot be prevented because of the new urbanization, developing public health system, population growth, immigration, or migration to the cities.

One of the main goals of this study is to know how was the physical development of Juybar city during the last decades, identifying the development pattern, and figure out how to plan and direct the physical development of the city to:

- increase the efficiency and compatibility of land-uses

- prevent the destruction of nonrenewable agricultural lands and gardens

- prevent unplanned and scattered development.

Hankey and Marshall said in 2009 that the shape of the city and the layout of the neighborhood play a significant role in choosing the type of vehicle, and the distance traveled, population density, land use, and mass transportation are related to per capita travel. The American Planning Association defines *smart growth* as the experience of planning, regulation, and development, which leads to optimal land use through dense building forms, developing spaces according to guidelines and standards. One of their goals is to reduce uncontrolled growth, land recycling, environmental protection, and, as a result, the emergence of compatible neighborhoods (Alia-Hesabi, et al., 2011).

The main principles of the Smart Growth theory:

- Mixed-use (multi-user)

- Using compact design in construction

- Creating a variety of housing opportunities and options

- Creating a walkable and safe neighborhood for pedestrians, especially for children and old groups

- Encourage the creation of distinctive and attractive neighborhoods with a strong sense of place

- Protection of open spaces, agricultural lands, beautiful natural landscapes, and sensitive environments

- Provide different types of transportation options

- Encouraging the local community and stakeholders to cooperate in the decision-making process (Kianfar, et al., 2011).

Classical Urban structure model

Multiple Nuclei Model

In 1945, Harris and Ullman have developed the multiple-nuclei model. They asserted that the Central Business District (CBD) was no longer the only center of an urban area or city Figure 3. In earlier models, the CBD was at the core of the urban land use model and was found at the heart of every older city. The CBD is the commercial and business center of the city, and in bigger cities, the CDB is often referred to as the "financial district." They were the first to consider the complexity of the city and its surrounding areas.

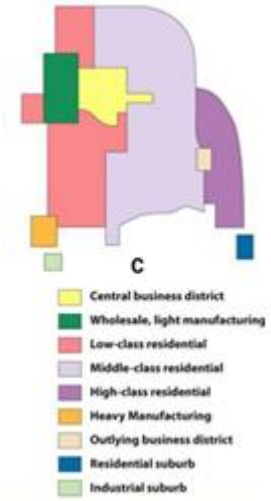

Figure 3. Multiple Nuclei Model developed by Harris and Ullman, 1945

Harris and Ullman claimed that, in newer cities, automobile-based intraurban dispersal created a multiple-nuclei structure of urban land use. This mobility allows for regional centers to specialize the businesses. In the multiple-nuclei, the "nuclei" are multiple smaller growth centers around the metropolitan area. These nuclei can be ports, universities, airports, parks, neighborhood businesses, and governmental centers. Their goal was to produce a more realistic model, even at the expense of being more complicated. This model aimed to move away from the concentric zones and better show the complex nature of large urban areas.

The multiple-nuclei model illustrates that even though an urban center may have been founded with a CBD, other more negligible CBDs evolve on the city's outskirts near the more high-class housing areas. This allows shorter commutes from the suburbs. This phenomenon creates nodes or nuclei in other parts of the city other than the CBD, thus the name multiple nuclei model.

As multiple nuclei evolve, transportation hubs are built, which allow industries to be established with reduced shipping costs. These transportation hubs have harmful by-products, such as noise pollution and lower land values, making the land around the hub cheaper. You will find hotels near airports because people who travel want to stay near the source of travel. Housing develops in sections and gets more expensive the farther it is from the CBD (Team, 2020)

2. Methods

The type of this study is fundamental to basic or pure research and accompanied by fieldwork, examination, and comparison. The fieldwork method helped to understand and analyze the city's

conditions in the following sectors: transportation, industrial activities, city center, sub-central business sectors, residential areas, suburbs, and natural resources. Also, was used the analytical and descriptive methods for the literature review. The quantitative and qualitative data types included geo data, development plans, scientific papers, and books. However, the time is limited to the seven decades of development of this city between the years from 1921 to 2013. Furthermore, the geodata included land-use maps of the city provided by the supports of the Urban and Road Development Organization in this province. For analyzing the geodata, which encompassed land use map used the Moskito GIS and Arc GIS software and tried to explore the city's physical growth concerning the size of the population, per-capita with respect to the principles of *Smart Growth* theory.

3. Results and Discussion

Geographical location, natural resources, and human potentials play an essential role in the growth and development of this city. Green land covers, many rivers, underground water resources, and ideal climate have provided a perfect condition for agricultural activities and developing industries especially relevant to these activities in this metropolitan area and of course for Juybar city.

Table 1. Juybar Population growth and migration size to this city and peripheries area (Babaei, 2010)

Decades	1956	1966	1976	1986	1996	2006	2021
Population of Juybar city	3405	12063	14251	18942	23909	27211	35023
Population Growth rate (Percent)		0.013	0.010	0.037	0.024	0.013	0.019
Migration to this city and peripheries area (Seasonal and nonseasonal)	3400	8000	12624	25231	32862	39025	53756

Physical growth of the city

Because of agricultural potentials, a cotton factory was established in the CBD in 1910 Figure 12. This factory at that time had provided many job opportunities and increased the gravity of CBD, the city's sphere of influence, economic development, and population growth day by day Table 1. Road connections and near to the capital of the province, also Ghaemshar the pioneer city in the textile industry at the national level, and of course close to the Babolsar city as one of the best tourist place at the national level have provided colossal potentials and significant market for this city's goods and activities. At that time, according to the results, the area of the city was about 32 hectares Figure 4, Table 2.

After establishing a municipality in this city in 1961, increased the quantity and quality of urban services, and as a result, the city became more populated Table 1. However, at this stage, the growth

of the city was scattered. At this stage, the main structures of the city were: 1- Parks for children 2- Cotton factory in CBD 3- Building new schools, shopping stores, health centers, industrial firms, etc. Figure 6.

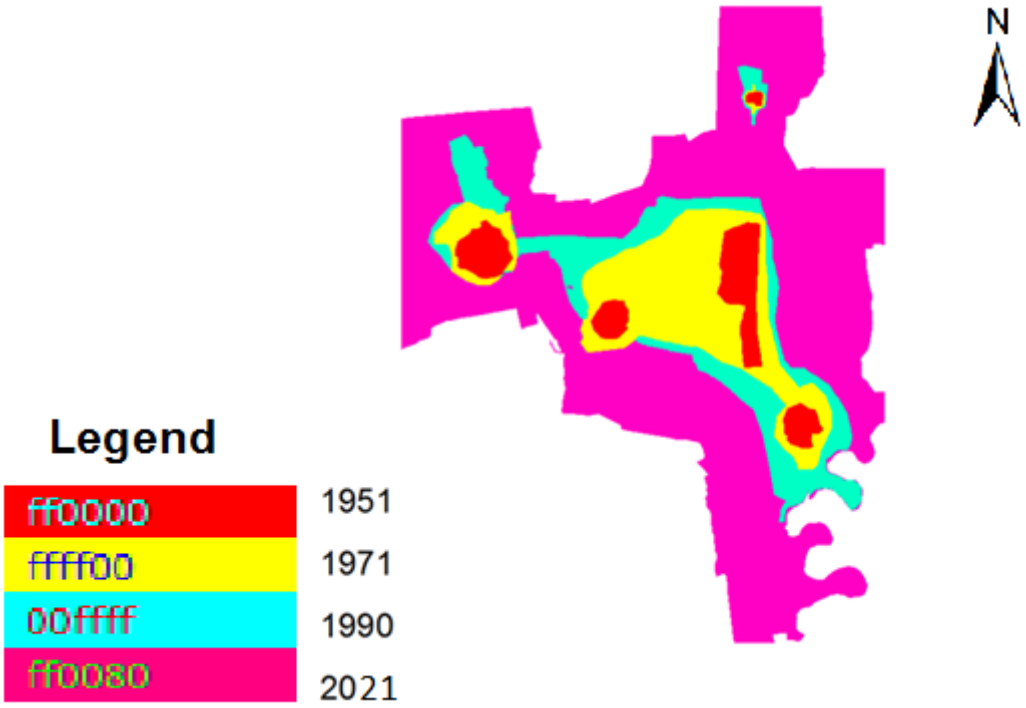

Figure 4. Physical growth of Juybar city between 1951-2021, by author, 2021

Table 2The areas of the city's physical growth between 1951-2021, by author, 2021

Decades	1951	1971	1990	2021
Area (Hectare)	33	186	376	1252
Growth (Hectare)		+153	+190	+876

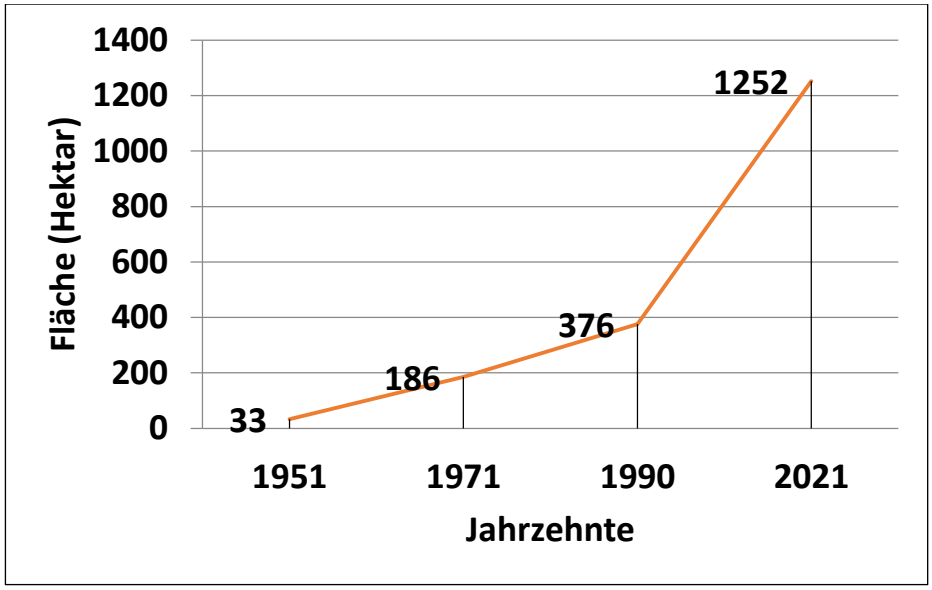

Figure 5. The graph of the physical growth of the city between 1951-2021, by author, 2021

Table 3. The ciy's land-use changes and growth between 1951-2021, by author, 2021

Decades	1951	1971	1990	2021
Land-uses	Area (Squar meters)			
Offices	7166.792	11947.63	16164.87	26887.43
Storeroom	1354.127	2787.615	6282.742	49865.63
Garden	2417.012	150716.5	270871.1	1273056
Vacant land	21439.85	126542.3	254458.5	596322.6
Health and Therapeutic	2994.5299	10091.667	11754.8751	22749.3451
Park and green space	49.76351	49.76351	178.2341	21776.86
Facilities and equipment	480.9147	1351.202	1402.963	24517.76
Commercial	22813.91	46621.9	85473.53	135799.7
kindergarten	1535.12	2412.597	2752.582	3781.466
Primary school	1491.632	7208.251	11482.09	23086.02
Middle school	1586.566	4312.192	7083.608	17123.64
Art school	-	-	-	14000.99
High school	596.7914	6124.031	7422.932	23343.2
Educational institutions	545.9243	1646.417	2758.01	11770.06
Under construction	7336.287	41641.03	87801.34	178354.5
Agricultural land	1208.856	84410.04	318411	5390668

Industrial	1016.36	7197.388	24058.5	56323.7
Tourism	38.8739	1356.471	4072.03	5750.542
Cemetery	1814.58	12633.07	41279.18	68246.54
Abandoned land	10776.73	16663.14	20333.56	34831.02
Mixed use	10485.02	22208.36	37156.24	46568.67
Religious	5363.035	10393.34	18734.33	32755.25
Residential	137822.9	836374.1	1634460	2722617
Roads	80912.21	364271.9	743339.1	1491194
Police stations	4485.901	5505.774	6128.739	6128.739
Sports	4108.436	5131.833	9266.088	25587.28
Cultural	-	1821.073	1821.073	2234.149
Residential garden	-	81419.88	128980.6	183624.5
Animal husbandry	-	2310.948	4369.428	34299.99
Parking	-	-	1814.29	1814.29
Transport stations	-	-	5011.79	27100.73
SUM	329842.1	1865150	3765124	12552179

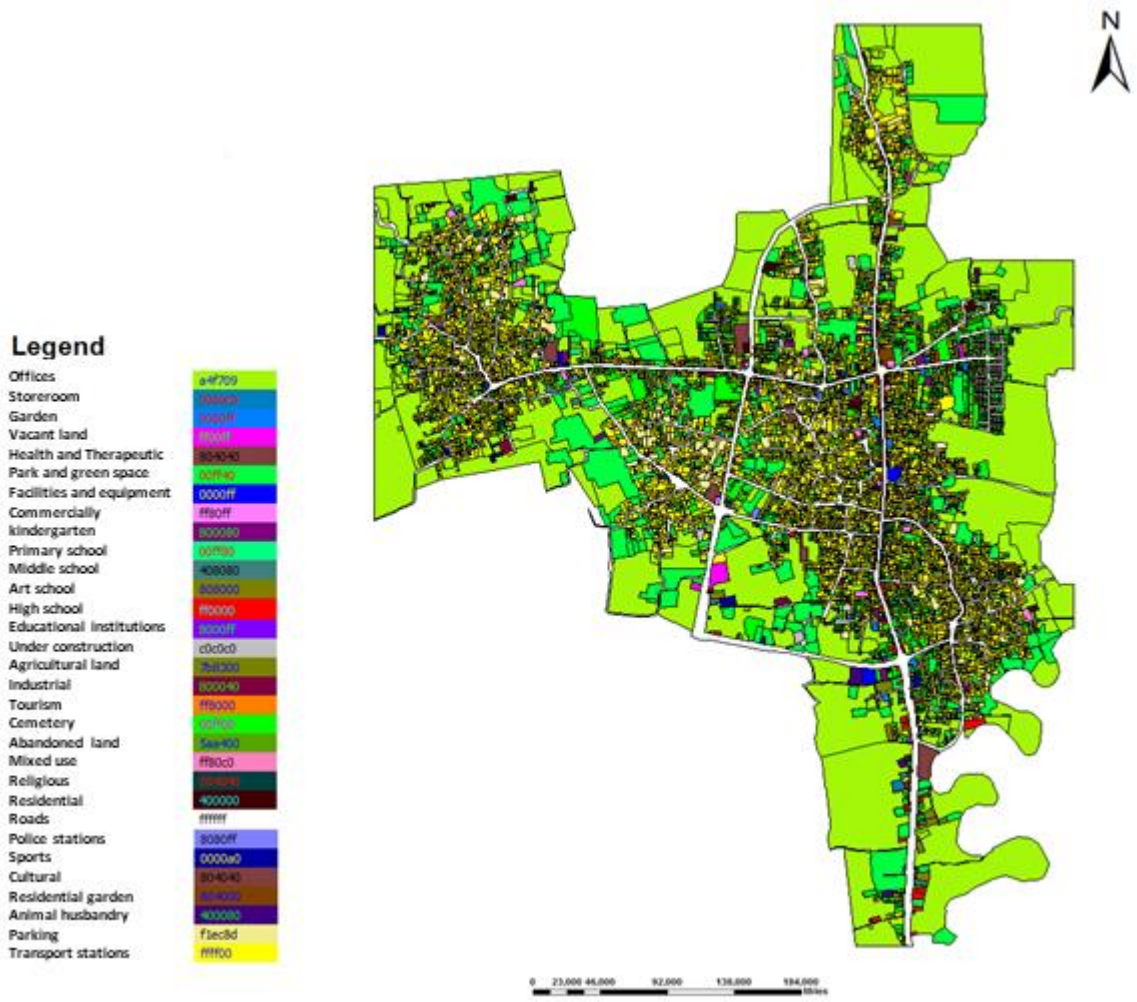

Figure 6. The land-use map of Juybar city, by author, 2021

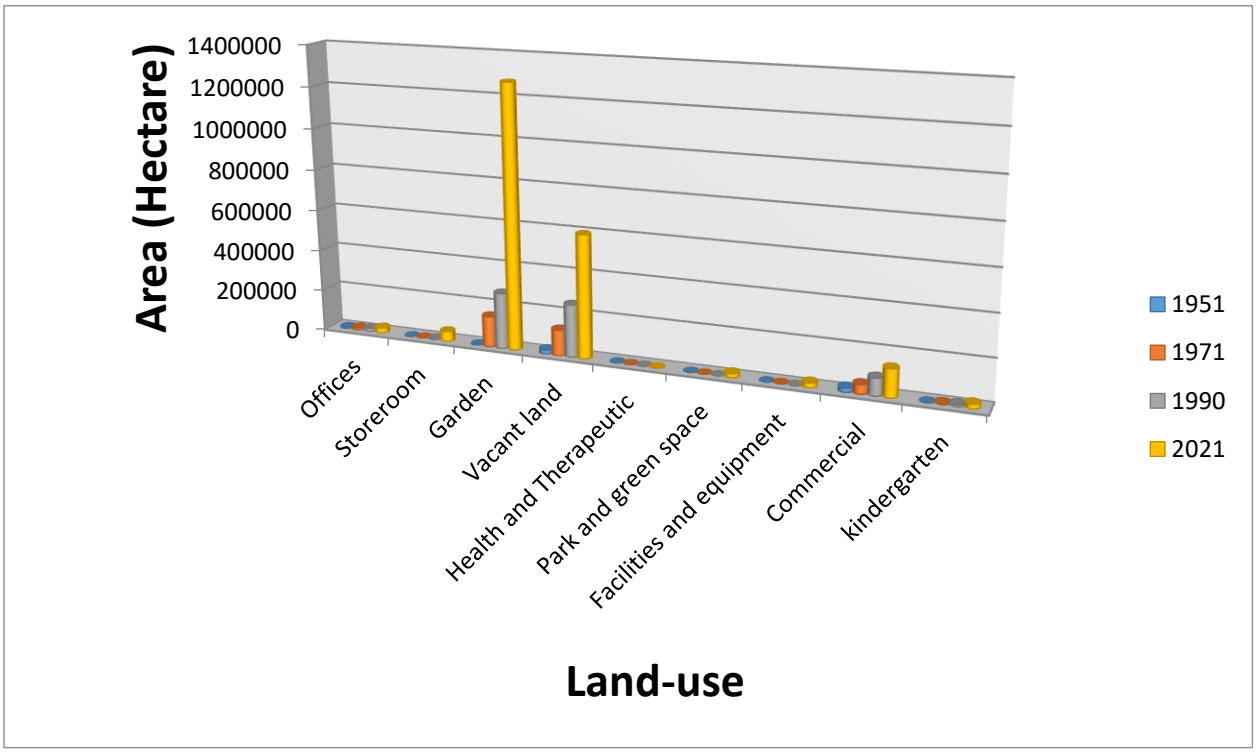

Figure 7. Most occurred land-uses changes between 1951-2021, by author, 2021

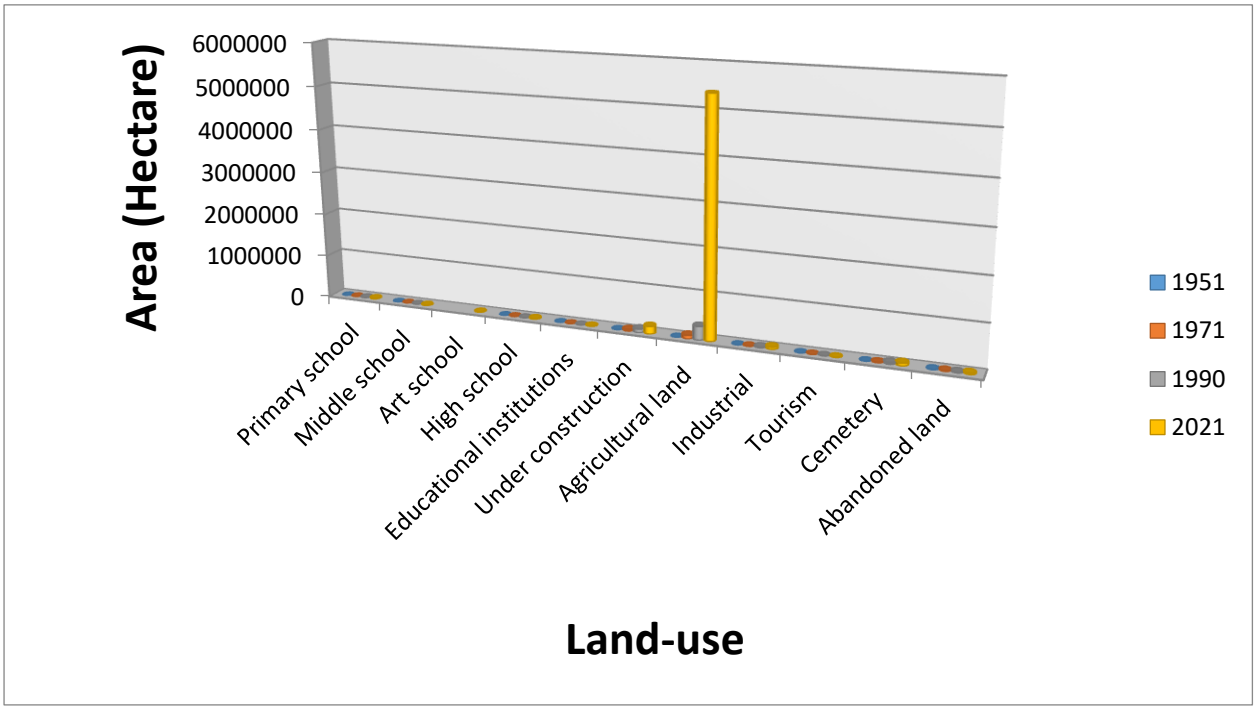

Figure 8. Most occurred land-uses changes between 1951-2021, by author, 2021

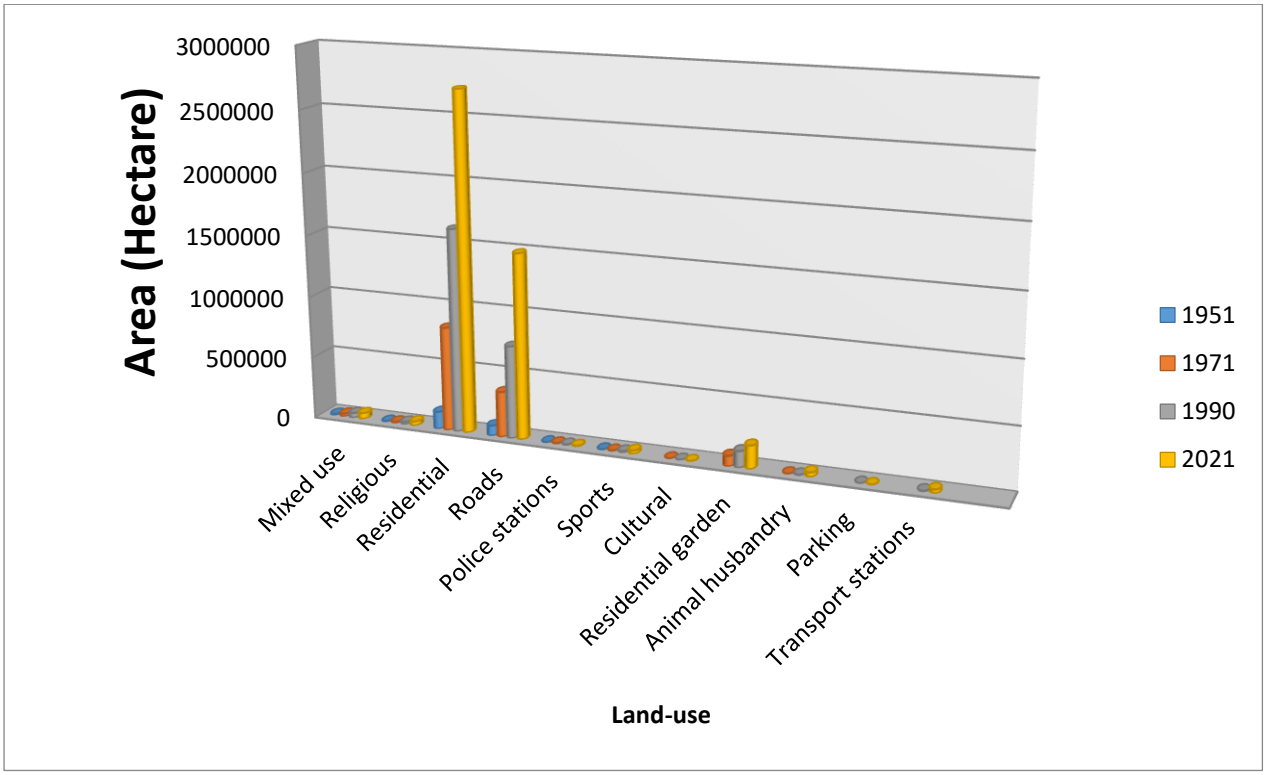

Figure 9. Most occurred land-uses changes between 1951-2021, by author, 2021

Figures Figure 7, Figure 8Figure 9 demonstrate that most land-use changes have happened in the **residential**, **streets**, **gardens**, **agricultural land**, and **barren land** sectors. A rise in residential, industrial, business zones, also roads means losing valuable barren and farming lands. During development, especially after the 1951s, the urban authorities had no particular plan to control and manage that. Adding a large part of agricultural land to the city for building new construction was the made-decision by authorities! The issue will face the city with many problems in the future because it increases the cost of services. However, even today, the municipality has many problems giving services to all the city's zones Table 3.

Transportation options

The foundation of the multiple-nuclei theory is based on the idea that people have more significant movement due to increased car ownership. This increase of activity allows for the specialization of regional centers (e.g., industries, businesses).

Road network increases the rate of interaction and activities at the whole of the city. By developing and growing the city, the road connections have been developed simultaneously and significantly Figure 10.

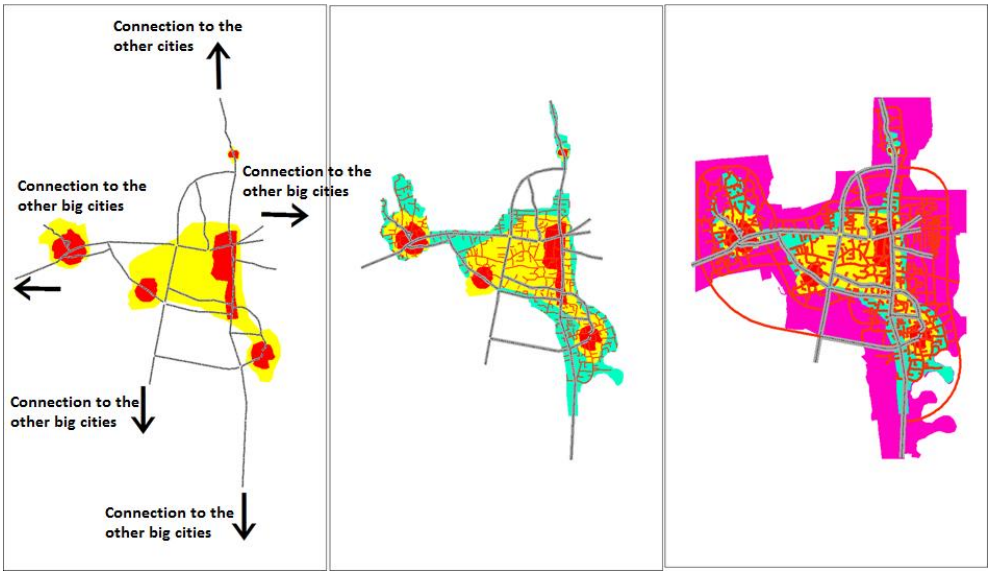

Figure 10. Developing road infrastructures by growing and developing the city simultaneously, by author, 2021

According to the results, the transmission options in this city are private-based. As shown in the figure, except for taxis, there are no more public transportation options in this city. Therefore, all people have to by car or other private vehicles Figure 11.

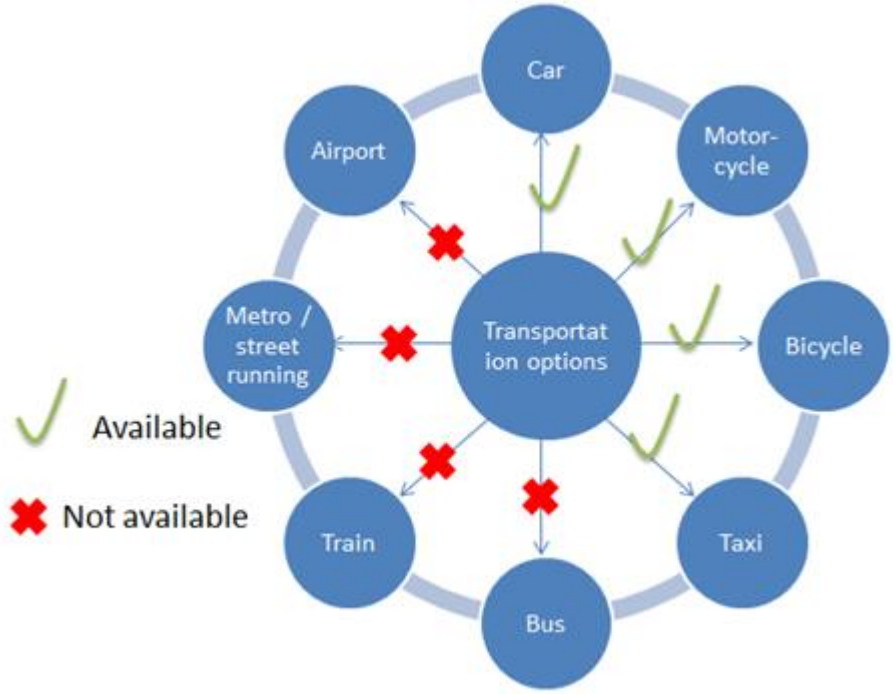

Figure 11. Available transportation options in Juybar city, by author, 2021

Structure of this city

According to the analysis results on land use and spatial distributions of activities, the city has a multiple-nuclei model of development Figure 12. It should be noted that the city was built not planned but has grown and populated during the time, especially after constructing the cotton factory in the city center. Agricultural and industrial activities are to main forces in emerging and developing this city. The city had just one center or core (old core); all main activities were in this zone, where the city has the oldest texture and buildings Figure 13. During developing and specializing activities, emerged two sub-central business cores in this city today Figure 13.

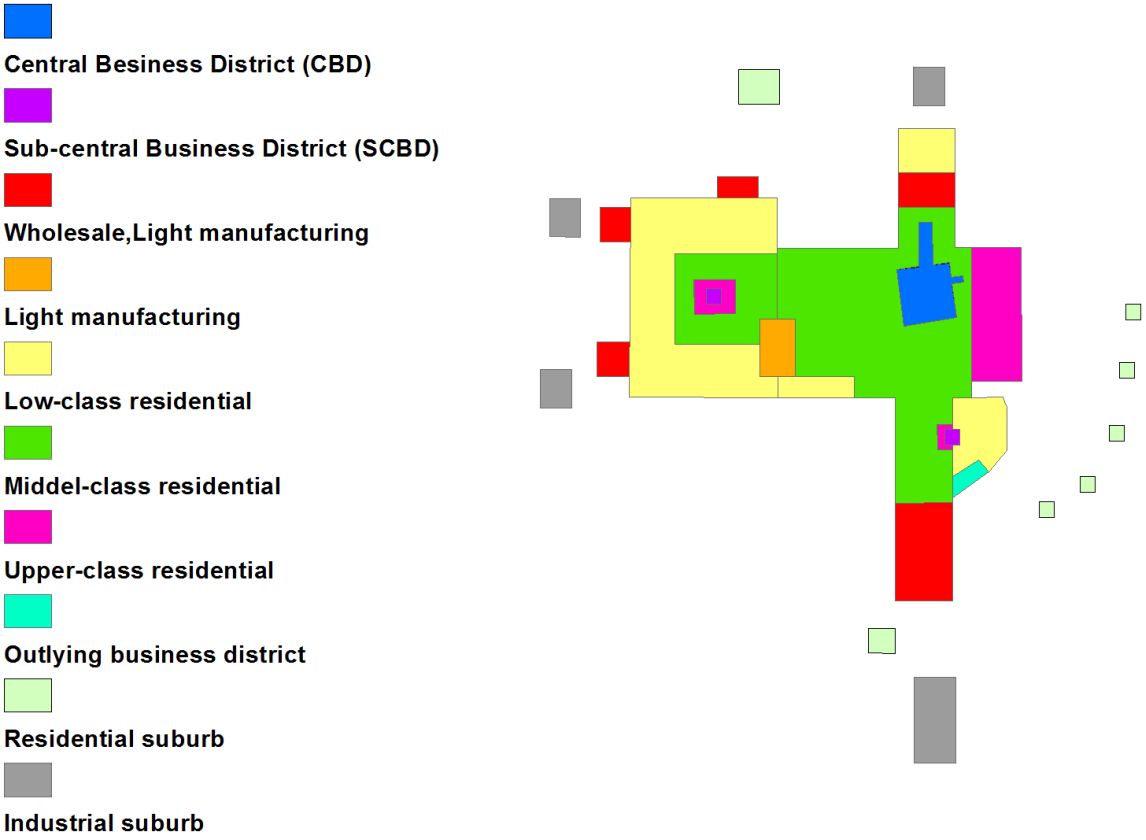

Figure 12. The Multiple-Nuclei Model of Juybar City, by author, 2021

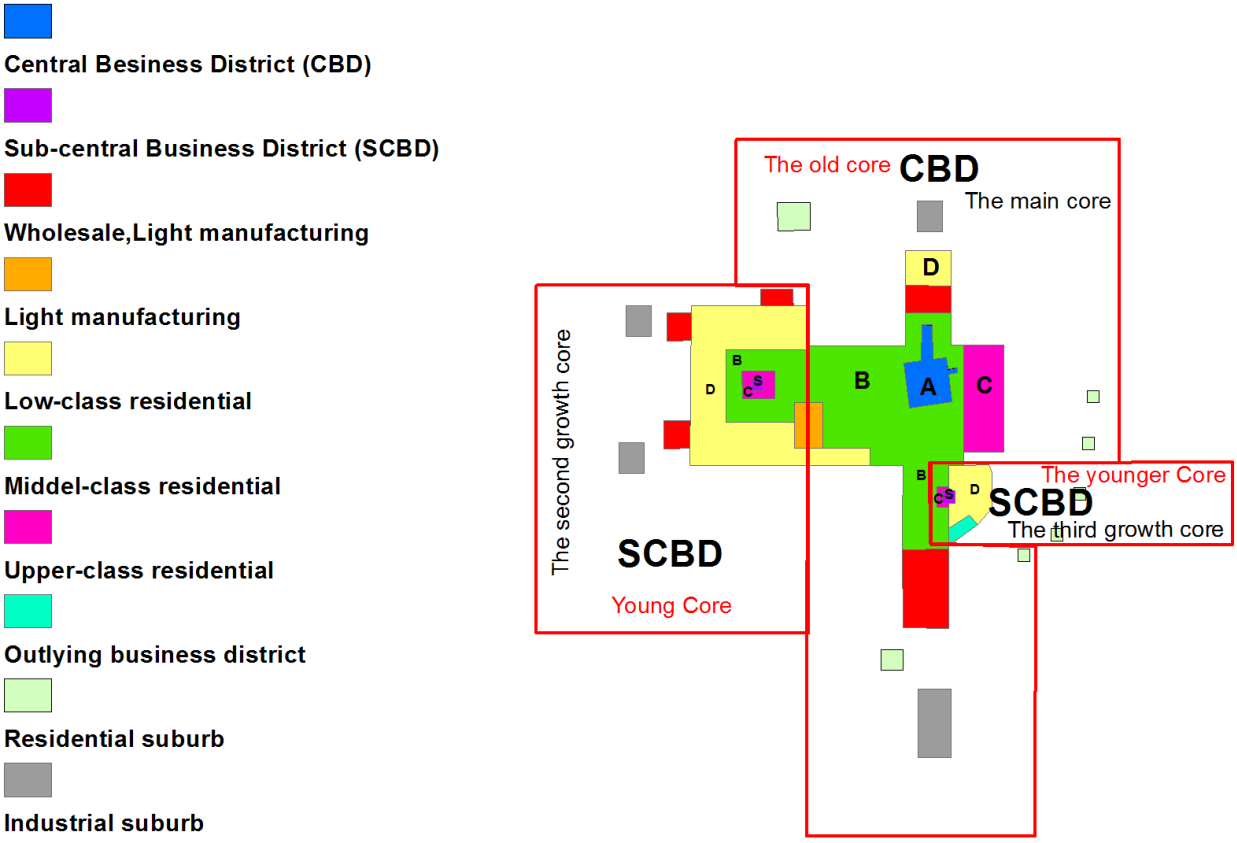

Figure 13. Geographical area of CBD and SCBD in the Multiple Nuclei Model of Juybar City, by author, 2021

Characters of the Central Business District (CBD)

What distinguishes the central core from the other sub-central cores are the population's size, type of activities, spatial emergence, and spatial distribution of activities Figure 13.

Spatial Emergence: Spatial emergence considers the developing process of activity between the construction time and its spatial evolution that will be able to service inside or outside cities' official borders and maintains inflow-outflow relationships. Analyzing activities and land-uses helps to determine the forces and functions of the central core.

For this part, the all main activities classified into the following two groups:

Large-scale activities

Small-scale activities

In this study, large-scale or small-scale refers to the quantity and size of activities and their sphere of influence at the local, regional, national, and even international levels.

The main core

The central core has increased influence in the social-economic sectors in recent ages due to its increased local, regional and national positions. Several large-scale and small-scale activities in various forms have taken place in CBD, with the latest examples including the SCBD at the local, regional, national, and international levels. These activities increase the city's attraction and bring considerable gains and result in opportunities and challenges Table 4, Table 5Table 6. However, large-scale activities held frequently in various forms improve infrastructure construction and affect and influence the city's physical growth. Therefore, developing a practical and effective development strategy to cope with large-scale and small-scale activities is essential.

Table 4. Main activitis around the CBD in comparison with the other SCBD, by author, 2021

Type of activity	Scale	Sphere of influence		
		local	regional	national
Produce and export agricultural machines	Large-scale	*	*	*
Packaging and processing industry for agricultural and animal products	Large-scale	*	*	*
Produce auto parts	Large-scale	*	*	
Government organizations	Large-scale	*	*	
Retails	Large-scale	*	*	
Offices	Large-scale	*	*	
Real estate	Large-scale	*	*	*
Finance	Large-scale	*	*	*
Insurance	Large-scale	*	*	
Judicial activities	Large-scale	*	*	
Social services	Large-scale	*	*	
Health service	Large-scale	*	*	
Tourism, Hotel, and accommodation	Large-scale	*	*	*
University and educational institutions	Large-scale	*	*	

Type of activities and spatial emergences of them, specialization, and geographical location are critical factors that have increased the attractivity and sphere of influence of both CBD and SCBD.

The other factor referred to the road connections. According to the results, the main activities and industrial zones have located near or closed the main roads, particularly among the significant rural and urban road connections that provide the highest accessibility to transport goods to other places at the regional, national, and international levels Figure 10, and Figure 15. Maritime transportation is the other way to connect this city to the neighboring countries of the Caspian Sea and Europa. As mentioned above, the city is closed to the Caspian Sea, and the industries have the possibility to

transport goods at the international level. Moreover, every year in the rural areas around this city, the people harvest rice and oranges more than 180,000 tons and flowers as well. That is a significant opportunity for developing produce and export agricultural machines, packaging and processing industry for agricultural and animal products, and agricultural services Figure 6, Figure 12. And that is the main reason that emerged many wholesale, light manufacturing, and outlying business districts in the three cores but especially around the old core and the younger Table 4 and Table 6.

The young core

Table 5. Main activitie around the young core in comparison with the other cores, by author, 2021

Type of activity	Scale	Sphere of influence			
		local	regional	national	Inter-national
The recycling industry included paper, plastic, metals, glass, electrical appliances, worn-out machines, cars, etc.	Large-scale	*	*	*	
Manufacture of plastic articles	Large-scale	*	*	*	
Manufacture of aluminum ingots	Large-scale	*	*	*	
Copper ingots and cast iron ingots	Large-scale	*	*	*	
Manufacture of agricultural machinery	Large-scale	*	*	*	
Agricultural services	Large-scale	*	*	*	
Meat industry	Large-scale	*	*	*	
Auto parts sales	Large-scale	*	*		
Rice and Orange goods	Large-scale	*	*	*	*
Other agricultural goods	Large-scale	*	*	*	
Art of pottery	Large-scale	*	*	*	
Retails	Small-scale	*	*		
Office	Small-scale	*	*		
Real estate	Small-scale	*	*		
Finances	Small-scale	*	*		
Insurance	Small-scale	*	*		
Judicial activities	Small-scale	*	*		
Health service	Small-scale	*	*		
Other social services	Large-scale	*	*		

The recycling industry and rice are one of the main activities of the younger core. It should be noted, this part of the city is the center of the recycling industry in this metropolitan area, and thousands of people are working in this sector. The recycling industry has provided valuable economic

opportunities for this city. And as a result emerged many wholesale, light manufacturing, and outlying business districts around the second core or young core Table 5, Figure 13.

The younger core

Table 6. Main activitie around the younger core in comparison with the other cores, by author, 2021

Type of activity	Scale	Sphere of influence		
		local	regional	national
Retail market	Large-scale	*	*	
Meat industry	Large-scale	*	*	*
Orange goods	Large-scale	*	*	*
Other agricultural goods	Large-scale	*	*	
Agricultural service	Large-scale	*	*	*
Office	Small-scale	*	*	
Real estate	Small-scale	*	*	
Finances	Small-scale	*	*	
Insurance	Small-scale	*	*	
Judicial activities	Small-scale	*	*	
Another social service	Small-scale	*	*	

4. Conclusions

This paper has simulated Juybar city's structure and analyzed the city's physical growth and land uses to figure out the main social-economic forces that have driven the city's development toward sprawl form. And finally, the paper proposed a development model considering the principles of Smart Growth.

Interestingly, Harris and Ullman developed the multiple-nuclei model for the big city Chicago with quite different social-economic conditions than this case study. Juybar city is a small Persian city in a metropolitan area with other social-economic structures and systems. But surprisingly, regardless of social-economic and demographic differences, the Juybar city's development follows the multiple-nuclei model. We can see this development model not limited to western cities, and it can happen for Persian cities. But, according to the results, the size of the population, geographical locations, or type of economic systems would not hinder the multiple-nuclei model of development for other cities in other places across the world.

Common points between Harris and Ullman study on the city Chicago with the results with Juybar city:

- ✓ For both cities, certain industrial activities require transportation facilities,
- ✓ Various combinations of activities tend to be kept apart
- ✓ Other activities are found together to their mutual advantage
- ✓ Certain facilities need to be placed in a particular area of a city like the CBD requires convenient traffic systems, and many factories need an abundant source of water
- ✓ Some events benefit from the adjacent distance like positions of factories and residence
- ✓ Those allow industries to be established with a reduction in transportation cost
- ✓ Some effects are noise pollution and lower land values, but in this model, despite some effects are noise pollution but land values are not low

Low Class: Low-class residential areas are closer to manufacturing jobs, which tend to be non-minimal skilled jobs. However, in Chicago, low-income people tend to have low earnings, which leads to low-class residents, but in Juybar city, they do not tend to have low wages. Because the demand for workers is high, and there are not enough workers in this city, Table 1, Figure 12.

Medium Class: Medium class residential area be wont to be close to the CBD. It also has more space to spread out to sustenance the population, doing the skilled worker professions, Figure 12.

High Class: High-class residential areas tend to be on the fringes of the average class residential area. But in this model, the place is not poignant the outlying business district. The jobs that the people in this district do are generally skilled works and have high earnings Figure 12.

Juybar city has been growing in sprawl form, especially in the last two decades Figure 4. Economic development, industrialization, locating in the metropolitan area, and valuable natural potentials are the main factors that have provided substantial economic potentials for this city. The emergence of the multiple nuclei model in this city resulted from specialized activities and private-based transportation Figure 15. As illustrated in Figure 14 and Figure 15, by growing the city, and developing the centers, at the same time, we are considering developing and growing the road networks across the city.

With the city's growth and the private transportation sector, get transport to any corner of the city easily and quickly. And that is one of the most critical factors that have helped to specialize the areas and support them to grow.

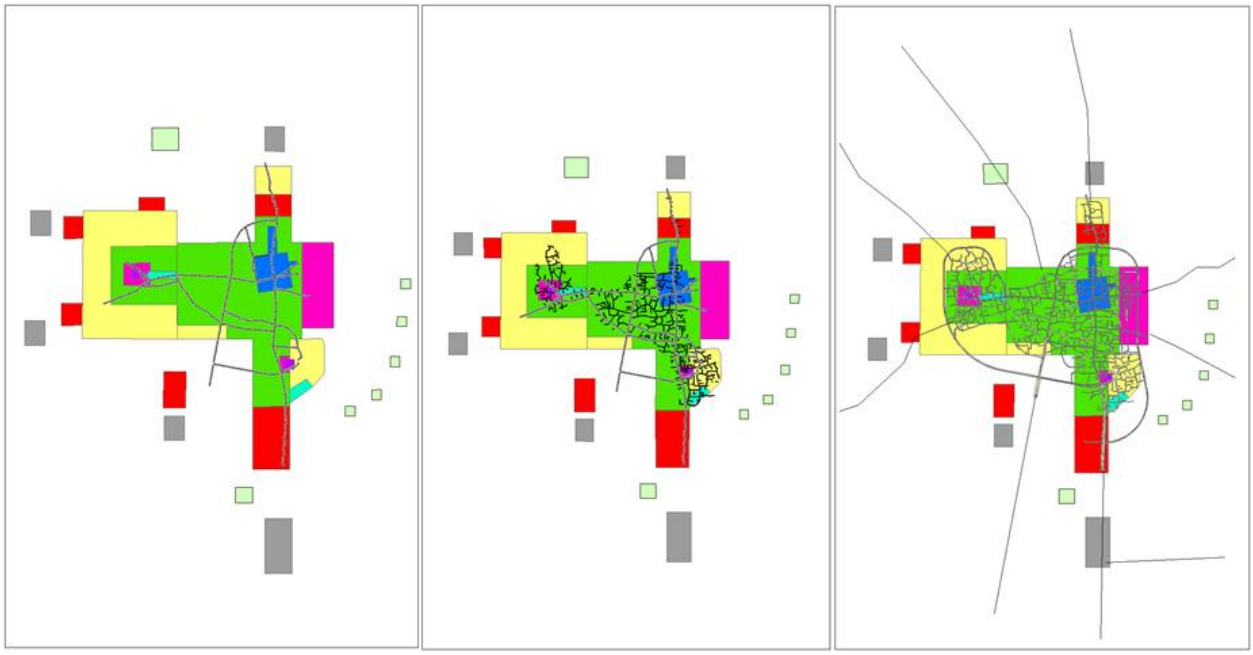

Figure 15, Physical development of roads in the CBD and SCBD, by author, 2021

The disadvantage is that this form of sprawl growth is not a sustainable form of development. As results have shown, more than 876 hectares of agricultural lands and gardens have been changed to construct new industrial firms, sorting, wholesaling or retailing, and residential buildings Table 2. So, according to the principles of smart growth, have to increase compact and high-rise building.

Also, have to increase mix-used activities to increase raw land consumption. It helps to give many services to the people and, consequently, reduces daily trips. Because generally to receive or buy some group of services or goods, they have to travel to the other sector of the city far away from where they live.

The privately based transport system is against climate protection, causes traffic jams, and requires more fuel and, of course, more CO2. So, providing many transport options, safe, comfortable and efficient helps to reduce the use of private cars encourages people to use public transport. Constructing specific roads for bicycles, more walkable neighborhoods with good accessibility to the needed activities for dwellers increases public health and decreases using private cars.

According to the results, about 56 hectares of old textures with thousands of old buildings are located in the old core. That's a great potential to reconstruct or revitalize and increasing the height of buildings. Moreover, it provides thousands of new apartments for citizens and reduces agricultural land consumption to buildup new houses on the urban edge.

Unfortunately, there is not enough compatibility between the activities. Because locating some industrial activities with more air and sound pollutions have encouraged the people to leave this area and build up a new house on the agricultural land in the urban periphery.

There are no enough parks and green spaces with facilities for all citizens where the middle-class and low-class families live. And the municipality has to provide that as soon as possible because it encourages families to don't leave this area and move to other places with better infrastructures and facilities.

Acknowledgment

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Sustainable re-use of spaces and buildings: application of the principles of circular economy to urban regeneration

Case study of the City of Prato, Tuscany (Italy)

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Abstract

Cities are complex systems subjected to continuous transformations. The changes in society and the different production requires the redesign of urban spaces, often favouring some areas and marginalizing others. As time goes by, buildings change their usefulness, remaining unused and abandoned. The consumption of new land for new buildings, together with the production of waste materials from the demolition, contribute to burdening the negative balance of the city system in consumption of resources and production of waste. With regard to the life cycle of a building, similarities can be highlighted with the life cycle of a commodity. In the current debate, production process are shifting according to sustainability criteria. By innovative solutions, it is possible to rethink production processes, enhancing for example the use of secondary raw materials and by-products, creating the conditions to minimize negative impacts, implementing recovery and reuse, as well as by the adoption of responsible solutions.

Today, public decision-makers must define urban planning policies capable to guarantee, in the long term, a sustainable development in line with the objectives of the United Nations 2030 Agenda. In doing this, policy makers could try to consider the city as a commodity, whose life cycle is made up of continuous use and transformation of flows of materials, energy and ideas. In fact, this approach could offer opportunities for improve the innovation and the sustainability of cities. More, by increasing the level of awareness at the urban level can push citizens towards more sustainable consumption models. Through working groups formed by qualified stakeholders, it is possible to highlight the barriers (i.e. technological, regulatory, and economic) that slow down the full application of circular economy principles. Through participatory processes of co-design, it is possible to assign new functions to unused buildings.

This paper aims to describe examples of urban regeneration based on a circular economy approach, taking into account the case of the city of Prato, Italy. In fact, within the city system, the integrated understanding of interconnection between inhabited areas, commercial, industrial areas, green, and agricultural areas, enables the implementation of good circular practices.

The paper mainly relates to SDG 11, target 11.3. Thanks to the adapting reuse and the transformation of existing buildings, cities will be more sustainable and resilient in the future, contributing to the increase in the well-being and quality of life of citizens, strengthening their identities, memories, cultures, respect for the environment, contributing to social inclusion and economic growth.

Keywords: Buildings, Urban regeneration, Selective demolition, Sustainable materials, Circular economy.

1. Introduction

Cities are dense and highly congested physical spaces that are prone to a myriad of challenges such as population growth, urban sprawl, climate change, environmental degradation (United for Smart Sustainable Cities, 2020). The strategies the cities must adopt to reduce the consumption of new exhaustible resources involves the shift from productive systems to generative systems (Latour, 2017). Urban regeneration policies should provide adequate solutions for each phase of the city's transformation, exploiting the opportunities and strengths that can potentially make them key players in the transition to more sustainable solutions. Indeed, cities are increasingly moving to actions aimed at reconsidering settlement models based above all on the re-use, recycling and development of creative economies. The sense of physical community that exists within cities facilitates people's engagement in political change, compared to the regional or national level. Thus, participatory processes must contribute to regeneration, it is up to public administrations to decide and facilitate re-use within a more comprehensive design based on medium-long term policies.

In 2015, the European Commission adopted the "Circular Economy Package" in order to stimulate the transition from a linear economy to a circular economy. The "Roadmap to a Resource Efficient Europe" sets the goal to achieve zero net land take by 2050. Thus, an important aspect required to make efficient use of soils within a circular economy, is the clever use of space (Breure et al., 2018). Even if the package has represented a significant development in EU policies, land itself is rarely viewed as a resource on its own. The main reason for that might be the fact that it is not easy to include land into consumption and production loops and, even more importantly, the EU has less direct influence on urban development and planning issues than on more concrete environmental factors (Urban Agenda for the EU, 2019). According EU policies, cities play a central role in the development of a circular economy. They act as test-beds of potential measures, by which transition can be achieved. This has also been emphasised in the United Nations agreements of the New Urban Agenda and the 2030 Agenda on Sustainable Development and is now more relevant due to the effects of the Covid-19 pandemic

crisis (Feeleki, 2021). However, this is not a process without obstacles. In fact, the transition depends not only on strong commitment of local policy makers, but also on overcoming constraints that mostly depend on higher levels of decision-makers than urban ones.

The application of the circular approach within a territory (e.g. urban area) involves municipalities, production activities, relevant stakeholders and citizens, in order to create opportunities lowering the depletion of new resources. The model for circular city, proposed in figure 1, aims to describe a holistic and systematic governance, bringing together public authorities, universities, enterprises, NGOs and citizens. The system includes three areas within the city, each interconnected: residential, industrial, and agricultural land and forestry.

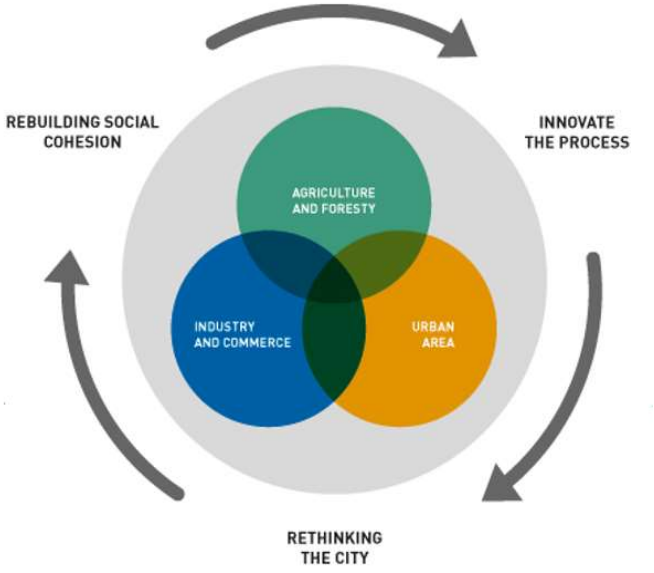

***Figure 1**. Circular city model (Source: authors)*

For the public sector as well as enterprises, the transition to circular economy requires innovation in order to adequate technologies and processes (*"Innovate the process"*). Therefore, new challenges are the ones of re-use and transformation of existing buildings, in particular the unused ones (*"Rethinking the city"*). The aim is to create new economic and social opportunities without consuming new land, and at the same time to improve the environmental performance of buildings and infrastructures in their entire life cycle, proposing new urban scenarios and solutions (Borsacchi et al., 2019). Beyond the environmental aspect, the challenge of the sustainability within a city entails as well economic and social facets. New policies have to take into consideration, involving both citizens and entrepreneurs, in order to reduce issues about a bad waste management and to reinforce the social cohesion (*"Rebuild Social Cohesion"*). In particular, through the construction of an inclusive and supportive community, based on the principles of sharing economy and by the adoption of creative re-use practices (i.e. innovative driving forces for business activities, social purposes and charity) (Borsacchi, et al., 2020).

At the European level, there are many positive experiences of effective temporary or permanent employment of certain previously abandoned or unutilized spaces and buildings enabled through participation and active citizenship. Participatory processes must contribute to regeneration, however, it is up to public administrations to decide and facilitate re-use within a more comprehensive design based on medium-long term policies. In fact, compared to new extensions and new constructions, which usually depend only on the decisions of developers, re-use offers a greater possibility of transforming and reinventing the city according to one's desires and through forms of social and civic activism (Scandurra, Attili, 2013).

2. Methods

Within a city, it is possible to implement good circular practices, but at the same time, there are barriers that slow down the fully application of principles of circularity in the reuse of buildings and spaces. Considering that, this paper aims to describe examples of urban regeneration based on a circular economy approach, taking into account the case of the city of Prato, Italy, focusing in particular on the following specific objectives: i) To understand the main relations among local stakeholder (both public and private) in the building sector. In fact, developing partnerships involving local authorities (including different departments within the local administration), beneficiaries/ users, NGOs, public agencies, the private sector and the civil society has proven to be a key component in the design and implementation of efficient urban policies. ii) To explore the main issues and barriers that affect the transition to the adoption of circular principles in the building sector. iii) To collectively identify and suggest potential initiatives and proposals. In order to achieve the above-mentioned objectives, the study has adopted a participatory methodology based on the active involvement of local stakeholders. In particular: a) Desk-based analysis of official reports released by relevant government institutions, sector authorities and private organizations. b) Conduction of semi-structured interviews with representatives of local institutions and stakeholders, ranging from the Municipality of Prato, production categories, professionals and associations. c) Facilitation of focus group discussions with local stakeholders, to discuss collectively the main needs concerning the building sector (i.e. materials, regulation, standards, awareness) and the relations with relevant value chain actors, paving the way for an open brainstorming on potential solutions. Interviews and focus groups were organized in the framework of the activities foreseen by the URGE - URBACT project and in those organized in the framework of the local strategy "Prato Circular City".

URGE (standing for "circUlaR buildinG citiEs") is an Action Planning network on circular economy in the construction sector, bringing together nine cities and their stakeholders to inspire and learn from each other in developing their integrated urban policy. This supports integration of circularity in the construction tasks, thus contributing to sustainable cities. Prato has been selected to contribute to the

definition of an action plan together with the cities of Utrecht, Munich, Copenhagen, Kavala, Granada, Riga, Oeste and Nigrad. Every city partner is required to set up an URBACT Local Group (ULG) that bring around the table all relevant stakeholders, representing different interests and perspectives, to frame problems, agree policy priorities and design concrete solutions. In this context, partners' ULG are expected to co-produce city strategies, Developing partnerships involving local authorities (including different departments within the local administration), beneficiaries/ users, NGOs, public agencies, the private sector and the civil society (citizens and inhabitants) has proven to be a key component in the design and implementation of efficient urban policies.

Prato Circular City is the strategy operates to overcome the barriers that slow down the transition to the circular economy. For this reason, Prato Circular City focuses on better regulation, better funding and better knowledge. Organised as a living lab, it works as follow: 1) Identification of relevant stakeholders, according the topics, and willingness to participate in meetings. 2) Organisation of thematic working tables in the identified areas and for specific topics. 3) Focusing on specific topics, chosen and validated by the participants. Discussion of the specific topics in working groups. 4) Presentation of the proposals for action to others outside the working group and collection of feedbacks. The defined actions are compiled in an operational plan containing implementation modalities and timing. Group participants are invited to identify and share initiatives; good practices and existing networks (knowledge); relevant legislation (regulation); relevant funding calls (funding). Based on the information gathered, a hypothesis of action is formulated, which is then evaluated through criteria and by a decision tree. Specifically, the working groups that discuss issues related to the construction industry are the Operational working group on circular public procurements and the Crosscutting working group on municipal regulations.

The novelty of the study, and in the approach, consists in the adoption of an integrated approach that consider: 1) the legislative framework at European, national and city level; 2) the discussion and the share of best practice about circular reuse of buildings at different levels and involving multiple stakeholders. This harmonic range of different inputs has allowed diversifying the sources of information, digging deeper in the topic and crosschecking findings and results, in order to obtain a comprehensive and consistent picture about the main issues affecting the building sector and the application of circular principles. The flexibility of the selected method has been crucial to tailor them to the relevant target (e.g. different interviewees or group participants). In addition, the focus group discussions have represented crucial occasions for participatory collective brainstorming, leading participants to openly recognise the need for a more frequent interaction (both within and between cooperatives) to discuss relevant needs and potential solutions.

3. Results and Discussion

In Prato, the concept of re-use is part of the genetic heritage of the city and its inhabitants. Prato, with its almost 200,000 inhabitants is the second largest city in Tuscany and the third largest in central Italy in terms of the number of residents. Famous worldwide for its textile district, it has over 3,500 companies. Textile production in Prato has historically based its fortunes on the reuse of textile waste from manufacturing, and used clothing from all over the world. The application of circular economy principles to the textile chain has also created over the years virtuous symbiosis phenomena. Alongside the textile district, since the 1990s the fast fashion district has grown, with a sector of over 4,000 companies, mainly conducted by ethnic entrepreneurs. The availability of disused industrial buildings no longer in use due to relocation to more modern and functional ones, together with the gradual closure of certain activities, has led to a succession of public and private initiatives to recover and rehabilitate buildings and space. In fact, the City of Prato's approach to sustainability also includes issues such as modular and flexible building design; efficient, resilient and renewable energy systems; production systems based on the recovery, recycling and reuse of materials and energy. This approach is part of an integrated short- to medium-term plan based on digital and ecological transition, as well as on regeneration and inclusive policies. This vision of local public administration is pushed mainly by three conditions: 1) The presence of a homogeneous production district (i.e. textile) in which common interests and knowledge converge. This allows policies to be targeted. The textile sector is also a sector where innovative and sustainable production solutions can be introduced. At the same time is possible to cooperate in order to overcome regulation barriers, as well as to favours symbiotic phenomena among different materials chains (i.e. *innovation*). 2) The relocation of numerous production activities from the previous areas in new ones. This emptied numerous buildings in various parts of the city. By means of urban *regeneration* processes, the disused buildings can be rethought in terms of their functions and destinations. 3) The presence of a multicultural society on the territory represents a fertile ground for innovative solutions to strengthen social *cohesion*.

These conditions, together with Prato's experience within the European Partnership on Circular Economy (among the outputs produced by Prato in this frame were a position paper about the reuse of treated wastewater in agriculture and a Handbook on sustainable and circular re-use of spaces and buildings), led to the definition of Prato’s strategy on circular buildings. More specifically, Prato has promoted a general vision on environmental issues that has configured the “Prato Green Deal 2050”, in the logic of promoting healthy lifestyles, improving people's physical health, their relationships and the ability to take care of the quality of public places. As part of this overall strategy, a series of steps have been undertaken and a variety of programs have been and are still in progress. Over the years, there have been numerous initiatives to recover and reuse spaces and buildings. In many cases, the initial function of the building has been changed. This responded to emerging new needs of citizens. In general, in fact, regeneration interventions have involved the conversion of buildings previously used

for production that have become places with recreational and social purposes. At the same time, in some abandoned spaces have been created the conditions for a newfound sociality. In Table 1 a selection of interventions are explained:

Table 1. *Example of reuse of spaces and buildings in Prato (Source: authors from Urban Agenda for the EU, 2020)*

Location	Previous function of the building/space/area, and main regeneration activities	Results
Textile Museum and Lazzerini Library	The Municipality of Prato purchased the area of the former factory at the end of the 1990s. In the first restored portion, the Prato Textile Museum (the largest of its kind in Italy) is located. The restored spaces of the remaining portions are home to the new public library inaugurated in 2009.	Conversion of a former textile factory into a museum and library (completed).
Officina Giovani	In 2005, after the closure of the Macelli Pubblici (public slaughterhouses), the Municipality decided to dedicate the entire area to projects and functions linked to the world of youth, creating Officina Giovani. The intervention has preserved the original appearance of the building. In the following years, various interventions have taken place in the other buildings, which have gradually become theatrical spaces, places of dissemination and exhibition, points of cultural exchange and study.	Transformation of the former slaughterhouses into a place for youth participation and culture (completed).
Bisenzio river banks	Prato has a strong historical bond with the Bisenzio, the river that flows through it. Riversibility is a scientific project, which promotes health and wellness. The design and functional choices arise from needs highlighted in a participatory process with citizens. Along the banks of the Bisenzio have been organized equipped areas for sports, recreation, socialization, in addition to the bike path.	River park for the promotion of sustainability, health and wellness (in progress).
Old hospital area	No longer used since 2014 following the construction of the new hospital in Prato and the subsequent transfer of all departments, the municipal administration has considered the possibility of returning the area to the old "Podere dello Spedale" to create an equipped urban park. Through selective demolition, the old hospital building was completely demolished in 2020, managing to recover and send to recycling and reuse chains more than 90% of the materials	Creation of a new large public urban park (in progress).
Mountain village of Mezzana	On the Calvana mountains, in the surroundings of Prato, a small village of a dozen houses has remained uninhabited since the 1970s. The project to restore the village is being carried out by the religious community of “Ricostruttori nella Preghiera”. Monks and numerous volunteers work to recover all the buildings through a faithful reconstruction. The intervention is inspired by the idea of integral ecology and the values of solidarity and hospitality.	Recovery of an abandoned mountain village for spiritual activities (in progress).

In this context, it is interesting to focus and discuss more in deep the process of regeneration of the area called "Macrolotto 0" is being carried out. Among the planned interventions, there is the reconversion of an old disused textile factory into a covered space for the short chain food market. The space also integrates interventions of urban forestation and the promotion of social inclusion activities. The

creation of the first permanent and covered food market in Prato willing to be a driver to attract and boost initiatives, including private and rethink other specific parts of the city. Moreover, together with the market, the regenerated area also includes a medialibrary and coworking space and the requalification of an open area into playground, equipped for outdoor sports. The so-called "Macrolotto 0" area, located just outside the city walls, was characterized by a multitude of textile companies and workshops in the 60s and 70s. With the relocation of textile activities to another area of the city, nowadays is the place where one of the largest Chinese community lives. In the intentions of the municipal administration, the idea is to transform the area into a creative district. The aim is the creation of an area with new functions, more technological and more contemporary. The intervention was funded through two projects: "PIU", co-financed by the Tuscany Region, and "Prato Urban Jungle", within the framework of Urban Innovative Action. One intervention interested a former textile industrial building, transformed into a market of short chain agri-food products and street food, in a permanent and covered space of 900 m^2.

In the same building, there is the idea to create the largest Italian so called "air factory" in Italy, increasing the environmental and social value of the place. In the renovation, the original building has been completely preserved. With its high energy efficiency qualification and by the use of certified environmentally friendly materials for the flooring, the building has been regenerated with the intention to have fully recyclable components at the end of its life. Renovations were completed in December 2020 and from May 2021 it has been hosting the "Terra di Prato" short supply chain farmers' market. The intervention represents a best practice of circular reuse of the industrial heritage, by the promotion of urban ecology, social interaction, cultural exchange, creativity, creation of value for the city. The main challenge was to preserve a building of the industrial heritage by regeneration, giving it a new function according environmental, social and economic principles. Good environmental practices have been adopted by the use of recovered and recycled materials. On the one hand, for the external walls, use of about 650 m^2 of insulating panels, made of secondary raw materials derived from the recovery of textile wasted material from the Prato district. On the other hand, for the 1,100 m^2 large roof were used various insulating elements not derived from the local textile chain but still with a high content of recycled materials. Moreover, the insulations have been assembled with system which can be easily disassembled, with the possibility of recovering most of the materials used. Among the difficulties encountered, there was the adoption in an old building of current regulations (i.e. structural, seismic and sanitary). The topic of the reuse of buildings is debated: preserving and regenerating a historical and/or industrial building is important because it allows us to maintain the memory of a previous productive structure and the tradition of a place, of a city. However, it is essential a strong commitment and vision by the local public administrators. Replicating this type of initiative without the intervention of Municipality could be problematic in terms of cost/benefit and technical aspects. The lessons learned during this experience can be summarised as follows:

- This kind of public interventions represent an element of urban and functional requalification that acts as a best practice to drive and push private interventions;
- The fragmentation of ownership in a specific area (i.e. buildings of former factories) can make it difficult to implement larger-scale, integrated regeneration projects;
- It is requested to conduct the analysis and classification of the industrial heritage by identification of unused buildings and their properties.

With the above-mentioned examples of urban regeneration, the city of Prato demonstrates that collaboration through public-private partnerships is crucial for the implementation of circularity, strongly based on three pillars: innovation, cohesion, regeneration.

Findings and lesson learned emerged can be consider also in general terms about the application of circular economy principles at the construction sector. In more general terms, during the interviews and the focus group, the main barriers and the related action needed have been identified, as reported in the following table 2:

Table 2. *Main barriers and action needed in the application of circular economy at the construction sector*

CHALLENGES (i) Material reuse and transformation of existing unused buildings (and spaces); (ii) Improvement of the environmental performance of buildings and infrastructures in their entire life cycle; (iii) To boost the circularity of materials and the industrial symbiosis phenomena.	
BARRIERS	ACTION NEEDED
Minimum environmental criteria in public procurement inflexible and difficult to apply in the case of products made from recycled materials.	Increase the awareness of minimum environmental criteria among civil servants. A guidance is needed on their application to ensure their positive environmental impacts.
Lack of knowledge among professionals (e.g. architects) about new materials made from recovered or recycled materials.	Targeted training activities for professionals and technicians of the building sector. Organization of specific workshops on circularity criteria destined to construction companies. Targeted training activities destined to civil servants on sustainable materials and circular economy concepts.
Building materials made from secondary raw materials and from recovered materials may encounter standardisation and certification issues. Problems are largely due to the variability of recovered materials, also depending the chain.	Selection of secondary raw materials and definition of critical aspects (i.e. protocol of reuse) by definition of quality characterization, traceability and standardization.
Lack of knowledge regarding the availability of sustainable materials at local level.	Creation of local platforms to increase awareness about “short chain” recoverable/recyclable materials.
The construction sector has not invested enough in the reuse of materials.	Enable conditions to increase demand for recycled materials, starting with interventions on public buildings.

The barriers identified insist on legislative aspects, the lack of knowledge and the need for funds for the sector innovation. In the regeneration process of a building, by considering its life cycle in a similar

way to the one of a commodity, it is possible to apply circular principals regarding economic, environmental and social aspects.

At the local level, it is advisable for the municipality to create an inventory of vacant buildings. Keep the inventory of unused entities constantly updated in the form of due diligence (property, type, reusability). There are several ways to inventory vacant properties, including through urban agencies, computer platforms or by checking consumption on households. Being aware of the availability of certain unused buildings in certain areas can direct towards the definition of regeneration strategies (i.e. coordinate, intercept, aggregate and promote the formation of demand for unused spaces and buildings). In this sense, specific requests can also come from citizens. In any case, using participatory processes it is possible to rethink collectively new functions and destinations of buildings, spaces, areas (i.e. harmonize the forms of active participation in the territory. Promote and develop appropriate communication strategies). The interventions of recovery and renovation of the building should be done as much as possible with environmentally sustainable materials and components. On the one hand, the use of building materials made from recovered materials. On the other, the importance of having recyclable materials at the end of the life of the building. In this sense, by innovative solutions, it is possible to rethink construction processes, enhancing for example the use of secondary raw materials and by-products, creating the conditions to minimize negative impacts, implementing recovery and reuse, as well as by the adoption of responsible solutions. This will be increasingly possible as knowledge barriers and constraints on regulations and standards are overcome.

Following the above listed flows, it is possible to elaborate the idea of circular economy approach. Goods placed on the market, after a longer or shorter period of use, turn into waste. These material flows contribute to a waste count whose upward trend must be reversed. Cities experience similar processes, albeit more complex and large-scale. The recovery and redevelopment of unused spaces and buildings, urban regeneration policies, and the rethinking of places where people live, do business, and live together, all redesign cities over time, using transformations that maximise their usefulness for those who live, work and travel in them. Today's public decision-makers must have the farsightedness to define urban planning policies capable of guaranteeing, in the long term, sustainable development in line with the objectives of the United Nations 2030 Agenda. In doing that, the idea of a “city as a commodity”, by following circular economy principles, can contribute in minimize waste in building sector.

Figure 2 summarizes the circular process of urban regeneration and assigning a new function to a building.

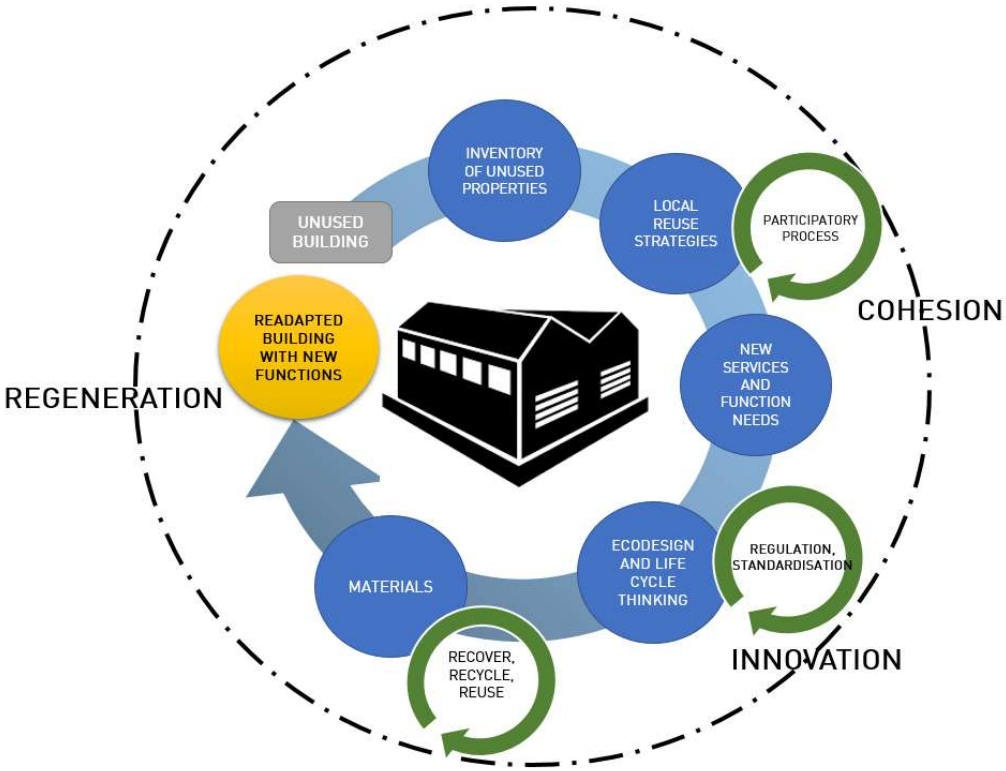

***Figure 2**. Circular economy principles in urban regeneration and building restoration (Source: authors)*

The circular model proposed in figure 2 can be replicate in other cities that are already in place similar platform like "Prato Circular City". Thus, open discussion environment where local policy makers are able to discuss and share good practices with local stakeholders, as well with upper level or policy makers. This approach can offer great opportunities for innovation and sustainability in cities and production systems. It also means enhancing virtuous initiatives by transferring and exploiting them in a wider system capable of fostering symbiosis phenomena. It is also possible at urban level to help, motivate or push citizens towards more sustainable consumption models.

4. Conclusions

Nowadays, circularity can be extended beyond solely economic activities and production processes to other social and environmental areas. Thus, the application of the circular approach within an urban area involves all stakeholders in order to create opportunities lowering the depletion of new resources. Circular actions within a city minimize the quantity of waste, contributing to reduce resources consumption by extending their lifetime. The successful implementation of circularity actions still require to overcome barriers. The case of the city of Prato demonstrates the successful circular initiatives carried out, and how collaboration through public-private partnerships is crucial for the

implementation of circularity. Thanks to the adapting reuse and the transformation of existing buildings, cities will be more sustainable and resilient in the future, contributing to the increase in the well-being and quality of life of citizens, strengthening their identities, memories, cultures, respect for the environment, contributing to social inclusion and economic growth.

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Disclaimer

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Degrowth – characteristic elements and strategies

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Abstract

The negative aspects of economic growth as a policy objective and target for future development has historically been suppressed by a general belief in its superiority. Degrowth confronts the core logic of growth and pinpoints where it is failing as a system. The academic field of degrowth is relatively young but is attracting more attention and has its own research network. With the aim of identifying characteristic elements and strategies, a literature review were performed. Degrowth can be described as a frame or an umbrella keyword that connects different types of actors, initiatives, goals, strategies, and policies. It derives from multiple academic fields stretching from bioeconomics to justice and its main goal is a future guided by ecological sustainability and well-being for all. It is defined by what it is against such as the capitalistic system, GDP and development, but also by what it advocates such as equality, democracy, localization, and sufficiency. Strategies involve sharing in different forms, economic instruments such as taxation of harmful activities, restriction of advertisement and strengthening of the commons. Degrowth envisions an altogether different society consistent of new institutions that is guided by alternative values such as altruism, respect, sufficiency, and solidarity.

Keywords: transition, transition movement, downscaling, sufficiency

1. Introduction

The classical definition of growth is economic growth, measured in Gross Domestic Product (GDP). GDP measures the economic activity in a nation, or region and an increase of GDP has over the last century become the single most important policy goal across the world (Jackson 2009). Jackson (2009) refers this to the belief that a rising per capita GDP is equivalent to increasing prosperity. In the introduction to the research collection 'The costs of economic growth', is stated that during the era of economic growth there has been little attention given to the costs of economic growth (Victor 2013). With a few notable exceptions, the focus has been on what benefits society will gain. However, the costs are becoming more prominent. Prevailing environmental problems such as climate change, pollution, resource depletion and loss of biodiversity can be seen as a result of the current economic

system that requires a steady rise in the throughput of raw materials (Maxton and Randerts 2016). Additionally, prosperity in the shape of economic growth has been distributed unevenly, concentrating wealth among the rich and leaving the ones who need it the most behind (Jackson 2009).

Economic growth is a structural feature of capitalism as a social system (D'Alisa et al., 2015). At a first glance, capitalism is a highly productive system, but unchecked it will lead to planetary overshoot (Pirgmaier and Steinberger 2019). This core logic needs to be confronted if any serious transformational changes are to be laid out (ibid.). It is here degrowth departs. It can be put under the banner of transition discourses, which are characterized by "their call for significant or civilizational transformation" (Escobar 2015, 451). Degrowth is most prominent in the North, whereas in the Global South other transition discourses such as postdevelopment are more common (ibid). Behind degrowth is the belief that the socio-ecological crises of today are built-in features of capitalism (Escobar, 2015). A qualitative content analysis of degrowth literature reveals three central themes in the 21st century growth critique: growth as a phenomenon, growth as an institution and growth as ideology (Haapanen and Tapio 2016). Jackson (2009) refers to the 'the dilemma of growth', which is that growth is unsustainable due to increased negative effects while degrowth on the other hand, would lead to instability under present conditions. This realisation is at the core of the degrowth movement and therefore degrowth is calling for a restructuring of society at large.

Influential pieces in the relatively short history of degrowth as an academic field are e.g. Meadows' et al. (1972) use of computer simulations to show the limits and possible outcomes of economic growth, Georgescu-Roegen (1975) who introduced the term 'bioeconomics' and stressed the importance of resources and sinks availability, and Daly's (2001, 2008) concepts 'uneconomic growth' and the idea of a steady state. The list of influential writers can be made long as degrowth is rich in its meaning and embraces different philosophical currents (Demaria et al. 2013).

Degrowth has attracted more attention in the past decade and has grown as an academic field through international conferences and the creation of research networks (Escobar 2015). Several special issues on the topic have been published in academic journals (Kallis, Schneider, and Martinez-Alier 2010; Cattaeno et al. 2012; Saed 2012; Sekulova et al. 2013; Kallis et al.2012). Non-academic events are of high importance for the movement as it started out as a voluntary project and is even described as an activist-led science (Demaria et al. 2013).

The focus of this paper is on academic contributions from the field of degrowth. The purpose is to give a comprehensive overview of the theoretic field of degrowth with a focus on identifying significant features of the concept.

The objectives are: 1) What are the characteristic elements of degrowth? 2) Which strategies are proposed as an alternative to economic growth within the concept of degrowth?

2. Methods

A literature review with the geographical range of the published material from the whole world, but limited to the languages English or Swedish, due the authors' capabilities.

For the selection process, the following inclusion criteria were used: 1) Texts where degrowth is the main focus for the article, 2) Texts that include a description of degrowth and some characteristic elements, 3) Texts that include strategies for degrowth. The exclusion criteria were: 1) Texts that does not have degrowth as its main focus, 2) Texts that mention degrowth without giving an explanation of the term, 3) Texts that use degrowth as a contrasting view or a supporting view of what they are investigating: Example, degrowth in the context of sustainable consumption.

3. Results

Degrowth is described as many things: utopian, subversive (Kallis and March 2015), a decolonization of the imaginary (Latouche 2009) an economic concept and a social movement (Demaria et al. 2013). It is all of these things, simultaneously. The word is a direct translation of the French world 'Décrossiance', meaning reduction (ibid). D'Alisa et al. (2015) as well as Kallis (2011) describes the framework as an 'umbrella keyword' that connects different policies and citizen initiatives. The exchange between researchers and activists is important (Demaria et al. 2013). It confronts dominant social paradigms such as neoclassical economics, but it is not a paradigm itself in a traditional meaning (ibid). Kallis (2011) compares it to normative concepts like equality or liberty that holds different interpretations and are hard to capture in one single measurement. The diversity is demonstrated in the different ways that the authors define the concept, see Table 1.

Degrowth draws inspiration from different intellectual sources; ecology, bioeconomics or ecological economics, democracy, meaning of life and culturalist (Schneider et al., 2010). Demaria et al. (2013) add wellbeing to the source 'meaning of life' and refine the culturalist source by calling it 'critiques of development and anti-utilitarianism'. Further on they add the source of 'justice', leading to six main sources for degrowth. Other important stems of thought for the degrowth movement come from feminist economics (ibid). The theme of justice is made apparent through the commitment of redistribution both within and between countries. A common goal is to secure basic access to ecosystem services in poorer parts of the world through degrowth of resource exploitation (ibid).

Characteristic for the movement is the critical standpoint it takes against a wide array of societal phenomena and concepts that has become the norm in modern society. The economic system based on growth is viewed as the core problem creating social and environmental crisis (Demaria et al. 2013).

Table 1. *Definitions of the term degrowth given by the different authors.*

Author	Definition
Latouche (2009)	"Degrowth is a political slogan with theoretical implications" p.7
Schneider et al. (2010)	"This is [degrowth] defined as an equitable downscaling of production and consumption that increases human well-being and enhances ecological conditions at the local and global level, in the short and long term" p.511
Kallis (2011)	"Sustainable degrowth can be defined from an ecological-economic perspective as a socially sustainable and equitable reduction (and eventually stabilisation) of society's throughput" p. 874
Sekulova et al. (2012) (definition from Schneider et al. 2010)	"[Degrowth] a collective and deliberative process aimed at the equitable downscaling of the overall capacity to produce and consume and of the role of markets and commercial exchanges as a central organising principle of human lives p.1
Demaria et al. (2013)	"Degrowth challenges the hegemony of growth and calls for a democratically led redistributive downscaling of production and consumption in industrialised countries as a means to achieve environmental sustainability, social justice and well-being" p.209
D'Alisa et al. (2015)	"Degrowth signifies, first and foremost, a critique of growth. It calls for the decolonization of public debate from the idiom of economism and for the abolishment of economic growth as a social objective. Beyond that, degrowth signifies also a desired direction, one in which societies will use fever natural resources and will organize and live differently than today." p. 3
Kallis and March (2015)	"[degrowth] a project of radical socioecological transformation calling for decolonizing the social imaginary from capitalism's pursuit of endless growth"

Other centres of gravity is the critique of capitalism as a social system, of GDP and commodification (the process where social products and socio-ecological services are given a monetary value) (D'Alisa et al., 2015). All authors emphasize that that the goal of degrowth is not to achieve negative GDP growth, however this is a likely outcome of the actions promoted within the frame of degrowth since a reduction of throughput is incompatible with further economic growth (Kallis 2011). Throughput refers to the material and energy society uses in the entire value chain, from extraction to waste (Herman Daly 2001). A reduction of throughput can also be called dematerialization, meaning an absolute reduction in energy and material use (D'Alisa et al., 2015).

The vision of degrowth entails a society with a leaner metabolism where wellbeing no longer depends on material wealth and instead originates from equality, simplicity and relation (Kallis 2011). However, it is also a future of process and conflict, not a blissful end state (Kallis and March 2015). Degrowth is subversive in the way it calls for "an altogether new and qualitatively different world that will evolve through confrontation with the existing one" (Kallis and March 2015, 362). Indirectly this means that degrowth is not a call for less of the same, a negative GDP growth in a growth economy. This already has its own name: recession or if prolonged, depression (Kallis 2011; D'Alisa et al., 2015). Degrowth focuses on how the inevitable reduction of GDP can be made socially sustainable and to avoid the

deterioration of social conditions such as poverty and unemployment that comes with depression (Kallis 2011; Schneider et al., 2010).

Latouche (2009) talks about a selective degrowth, describing what needs to degrow and what needs to grow. Renewable energies, shared transportation systems and other small/medium scale economic activities along with certain social qualities may still need to grow. D'Alisa et al. (2015) prefer to use the term 'flourishing' to signal the qualitative aspect of the change. It is also recognized that there must be space available for impoverished groups or regions to grow (Schneider et al., 2010). Degrowth in the North is a precondition for any form of alternative for the South to be successful. Latouche (2009) gives the example of the northern livestock production and its growing implication on deforestation in the Amazon rainforest and on local food production in different African countries. There is also a need for redistribution within countries as well as between present and future generations (Demaria et al. 2013). The difference in lifestyle and wealth is the key question that needs to be addressed. Because of this, the question of population growth is mostly avoided by the scholars. Neither Demaria et al. (2013) or Latouche (2009) are concerned over the amount of people.

The capitalistic system is condemned to grow and when growth slows down or comes to a halt, there is a crisis or even panic, followed by the remedy of more growth (Latouche 2009). Being tied up in a system that is based on accumulation of this sort creates problems. A GDP growth rate at 3 percent will multiply GDP 20 times in 100 years, 40 times in 200 years and 8000 times in 300 years (ibid). He concludes that if growth automatically generated wellbeing, we would all live in paradise by now. The reason why it is not so, is supported in the literature on happiness economics, which show that happiness does not increase with national income in the long run (Easterlin et al. 2010) Wealth and well-being do correlate to some extent, however. At an individual level it has a connection, possibly due to positional consumption and because certain welfare goods are expensive in market economies. A sudden loss of income does negatively affect the level of happiness and this has to do with how high the initial material aspirations are (Easterlin et al. 2010; Matthey, 2012 in Kallis et al. 2012).

The choice of the word degrowth comes with a bad aftertaste for some who claims that it is unfortunate to use a negative word to signify desired changes (D'Alisa et al., 2015) but according to Latouche (2009) the purpose of using a negation for a positive project is to overcome fear. Degrowthers see a need to confront the fear of a future without growth in order for a discussion of a future outside of capitalism to open up. They acknowledge a lack of political debates surrounding topics of economic development, growth, technological innovation and advancement. (Demaria et al. 2013). Re-politicizing, decentralization and deepening of democratic institutions are prime goals within the movement (Schneider et al., 2010).

3.1. Degrowth, Sustainable Development and Green Growth

Degrowth is a critique of development and an agenda of imagining and enacting alternative visions to modern development (D'Alisa et al., 2015). According to Latouche (2009), the word development is toxic regardless of which adjective we use to 'dress it up' as it suggests an unfolding towards a predetermined end. Degrowth challenges sustainable development by claiming that it gives a false promise of win-win solutions and everlasting development without environmental harm (D'Alisa et al., 2015). The rhetoric differs from that of sustainable development since it claims that throughput cannot be reduced with a growing GDP (Kallis 2011). Although many agree with the ideas behind degrowth and see the impossibility and unsustainability of continuous economic growth, there is a lack of attention among politicians and even mainstream environmental NGOs for these questions. One explanation for this is the taboo around discussing any future that deviates from the norm of growth and development as we know it (Sekulova et al. 2013).

D'Alisa et al. (2015) refers to Ariés (2005) who claims that degrowth was thrown as a 'missile word' to, among other things, end the depoliticizing consensus on sustainable development. However, Demaria et al. (2003) adds that degrowth does not aspire to replace sustainable development as a common goal within international organs such as the United Nations, the OECD or the European Union. According to Latouche (2009), some try to place degrowth under the banner of sustainable development in an act to neutralize its subversive potential. However, there is no denying the revolutionary aspects of degrowth in its aspirations for cultural change and the transformation of the production system (Latouche 2009).

The critique extends to ideas of green growth (D'Alisa et al., 2015; Demaria et al. 2013). According to Schneider et al. (2010), a greening of the economy is simply a disguise that does not address problematic industries or the type of production in the sense that "green cars" will still consume energy and "green bulldozers" will still extract natural resources.

3.2. Limitations and relative scarcity

Well-being, ecological sustainability, and social equity are the goals pursued and the emphasis is on qualitative aspects. The capacity of technology to solve the ecological crisis and overcome biophysical limits are heavily questioned (Demaria et al. 2013). They do not refrain from technological progress altogether, but there must be a shift from more to better (Schneider et al., 2010). The critique of ecological modernisation is compensated by a favourable attitude towards many non-technical proposals for reducing material and energy flows (Demaria et al. 2013). Part of this critique comes from the longing for autonomy, which is central for many degrowthers (D'Alisa et al., 2015). The use of 'convivial tools', inspired by thinkers such as Ivan Illich (1973), that are manageable, understandable and controllable by their users are favourable (D'Alisa et al., 2015).

Limitations and scarcity are prominent features of the degrowth debate. Following the reasoning of Sahlin's work in Latouche (2009), scarcity can be understood as something that is socially produced. It is a relation between means and ends. Seeing it this way scarcity is not necessarily a result of not having enough, rather a product of unlimited wants. Kallis and March (2015) describes how capitalism, through enclosures, positional inequalities and the promise of unlimited choice, produces relative scarcities. By framing scarcity as a universal, production-related problem, capitalism is naturally seen as the system best suited to deal with this problem and expand the means of production. Refraining from capitalism dissolves scarcity. Not in absolute terms, there will still be periods of plenty and shortages but it will not be 'a generalized sense of scarcity' (Kallis and March 2015). In the same spirit, crises are described by Matthey (2010) in Sekulova et al. (2013) as a mismatch between what we want, and the limits to perform these activities (such as buying, producing, building, employing, borrowing). Given the ecological and biophysical limits of the planet and the continuously higher material aspirations, future crises are expected to be prolonged, deepened and accelerated. Avoiding the mismatch between desires and tighter limits is one way to stay away from a possible crisis.

Demaria et al. (2013) argues in favour of different actors and strategies to be compatible and complementary to each other, using degrowth as a common thread. Actors with different purposes such as activists against cars or advertisement, bicycle campaigners, solar energy promotors, organic farmers etc. have started seeing degrowth as a common frame, representative of their world view (Demaria et al. 2013). Below follows an overview of the most prominent strategies suggested for achieving a sustainable degrowth.

3.3. Strategies

For many degrowth scholars the changes needed cannot come about in a capitalist market economy. A sort of consensus forms around the need for reformist institutional and policy changes (Kallis 2011). They focus on social security, a gradual decentralization and relocalization of the economy and emphasize redistribution within different areas such as work and leisure, natural resources and wealth (Demaria et al., 2013: Latouche, 2009). This is seen as ways to reduce throughput and to adapt to a smaller economy (Kallis 2011). Concrete, this translates into policies of reducing working hours, minimum health and security for all in the form of basic income (Schneider et al., 2010) and salary caps (Latouche, 2009). Other macro-interventions include caps on CO_2, energy and resources (Kallis et al. 2012). Additional proposals include community currencies and alternative credit institutions, including time banks (Schneider et al., 2010). Such radical changes in the basic institutions of work, property etc. will result in a system that is no longer identifiable as capitalism (Kallis 2011).

Degrowth will not come without resistance from those who have economic and political power since this is likely to shrink the surpluses and profits of private enterprises (Spangenberg 2010 in Kallis, 2011). Conflict is considered by some to be a constituent element of degrowth transitioning (Kallis and

March 2015). It is even occurring within the degrowth movement as strategies differ between two main approaches (Demaria et al. 2013). Oppositional action strategies entails building of new alternatives and establishing new institutions. Creation of different types of cooperatives (living, farming, consumer, credit, renewable energy), eco-villages and promotion of local, decentralised solutions are part of the oppositional approach. A main focus is on shifting personal values and behaviours and to highlight the positive effects that less time spent on formal work and consumption will have on wellbeing (ibid). Another branch is oppositional activism, such as campaigns to stop environmentally harmful activities, demonstrations, boycotts, protest songs (ibid) or civil disobedience (Demaria et al. 2013; D'Alisa et al., 2015).

The other approach is described as reformist, where focus lies on changing existing institutions (Demaria et al. 2013). Examples of this is the debate on democracy where degrowthers defend democratic institutions but work towards developing more participative ones. Radical organic farmers that challenge capitalism but still organise their lives around cars and computers can be described as reformist (ibid). Yet some strategies can be thought of as combinations; reforms of current institutions that pushes the limits for the established system. Among these, suggestions of a basic income or strengthening of the commons can be counted (ibid).

Sekulova et al. (2013) notes two important approaches needed in the transition to a sustainable degrowth in practice. The first approach requires a reduction of the level of social and economic complexity and this entails things like re-localization of production, reducing the intermediaries, introducing simpler technologies and a total reduction of the number of appliances and throughput of goods in households. The other one concerns how to manage and respond to the existing complexity and influencing the societal context on a higher level. This entails adaptive and widespread macro-level measures such as regulation of advertising, facilitating work-sharing legally, redirecting investments towards slow-mode transportation, non-tradable caps on extraction of natural resources and strengthening social and ecological standards.

Efficiency improvements are not seen as the sole answer to current socio-ecological-economic problems. Especially the macro-rebound-effect is identified as problematic (Schneider et al., 2010), meaning the process in which gains from efficiency is translated into new physical consumption elsewhere in a growing economy, also known as Jevons Paradox (Polimeni et al. 2009). To deal with this a future degrowth needs to involve local and global redistribution (Schneider et al., 2010). There is also a need for limitations and reductions in total terms when it comes to the scale of production and consumption to ensure a future of low material use (ibid).

Although limitations is often mentioned in the degrowth literature, it is put forward as a 'social choice' or 'voluntary simplicity' (Schneider et al., 2010) or as 'self-limitation' (D'Alisa et al., 2015). The question is then how a society can limit itself. A lot of the degrowth literature is occupied with

suggestions on how to achieve this. Sharing is a keyword with propositions including the sharing of work, living space, public space, cars, and bikes. Regaining the collective control of water and energy and the reclaiming of old – and creation of new – commons, are others (Latouche, 2009; D'Alisa et al. 2015).

Employment is an important part in the degrowth discussion, and scholars try to challenge the common conception of growth being indispensable for full employment. One example is the job guarantee that is put forward as a permanent supplement to private employment to decouple jobs from economic growth and to ensure job security (D'Alisa et al., 2015). Work sharing is discussed as a complement to a job guarantee (Sekulova et al. 2013). Others focus lay on changing the character of our worklife towards more convivial, voluntary, non-formal or household work and what consequences this will have. Many degrowth proponents believe that diminishing energy supplies due to peak oil, will lead to a shorter work week (Latouche 2009) whereas others (Sorman and Giampietro in Sekulova et al. 2013) believe the opposite will happen. However, a distinction must be made between productive labour/paid work and unpaid or voluntary work. A degrowth society is expected to consist of less 'formal sector work' and to become more self-managed, care-intensive (rather than energy intensive) and to result in more durable goods (Sekulova et al. 2013). This might imply an increase of non-formal, unpaid work such as household/community work, but this does not necessarily equal sacrifices. Increasing time spent on leisure and on more meaningful activities could increase well-being in the sense that more time could be spent on social relations, political participation, physical exercise, spirituality and contemplation (Demaria et al. 2013). In addition, it could also save energy if the energy intensity is kept low (Norgard in Sekulova et al. 2013). Household work is proven to have a much lower energy intensity compared to the paid-sector delivery of the same services. This type of work entails important social values and especially the logic of care in non-market contexts can be understood from an anti-utilitarian perspective. However, the authors stress that this type of work remains unrecognized and undervalued and that women does a disproportionally large part of it (D'Alisa and Cattaneo in Sekulova et al., 2013).

Social enterprises are put forward as prime candidates for a sustainable degrowth by Johanisova et al., in Sekulova et al. (2013). They distinguish from traditional corporations by their democratic ownership and decision-making process and through the positive social externalities, which is often their main goal. They struggle in the market driven economy since they rely heavily on non-market capital and would likely benefit from the structural changes proposed by the degrowth movement.

Turning towards economic instruments, Schneider et al. (2010, 516) points towards a reform of financial institutions. They want "to stop the financial floor of the economy from growing without reference to the underlying physical realities". Taxation is another key strategy. Things like redistributive taxation, higher control on tax havens and taxes on international capital movement are ways of securing public investments in community education and health as well as new public spaces (squares, open spaces, community gardens) (Latouche, 2009). Schneider et al. (2010) calls for resource

extraction to be taxed at the origin and Alcott, (in Kallis 2010) talks about systemic interventions such as taxes on environmental damages, CO_2 and nuclear energy. Latouche (2009) goes even further, seeing that very harmful activities, such as nuclear energy or resource extraction in frontier areas, will be put under regulatory bans. These measures are seen as ways to help finance an environmentally sustainable society.

Some of the areas under research within the degrowth literature are specifically dedicated to the psychological and sociological aspects of transitioning to a degrowth society (Matthey and Hamilton in Schneider, 2010). Findings show that consumption has become part of our identity and that today's high reference level of consumption will inevitably create strong feelings of loss in a degrowth society. They recognize the difficulty in reversing the aspiration for consumption, but the role of advertisement and state policies are seen as important (Matthey in Schneider et al. 2010). In line with these discussions, Lorek and Fuchs in Sekulova et al. (2013) states that consumers face serious structural obstacles even with the best intentions due to the lack of easy and socially acceptable alternatives that are more sustainable. They conclude that sufficiency would have to be the organising principle of the entire society to perform the radical changes needed to achieve ecological sustainability.

Although it is difficult to change, Schneider et al. (2010) points towards the adaptive nature of humans and how history has shown that aspirations can readjust quickly under changed external conditions. How to facilitate less social comparison is discussed by Demaria et al. (2013). Proposals like setting a maximum income or maximum wealth or opening borders are thought to reduce envy as a motor for consumption and to reduce means to keep inequality between poor and rich countries. Latouche (2009) talks about forbidding advertisement altogether. Policies that are directed towards a more equal distribution of wealth and public investments in services that produce a higher quality of life can have greater effects on welfare then generalised growth (Easterlin et al. 2010). The diversity of strategies points towards an awareness that action must be taken on all levels (Demaria et al. 2013).

3.4. Defending degrowth

Putting forward degrowth as a frame, with its multiple dimensions, can be hard to communicate and overwhelming for people searching for a single guide (Demaria et al. 2013). Demaria et al., (2013) stresses the importance and the strengths of this set up. They claim that all its sources (ecology, bioeconomics, meaning of life and wellbeing, anti-utilitarianism, justice, democracy) must be taken into account simultaneously to be compatible with the ideas of degrowth. Differences in strategies and political proposals maintains a constructive tension that enables an open movement with continuous improvements at the theoretical and practical level, and should therefore be recognised and valued as strengths. On the same note, Sekulova et al., (2013) proclaims that a combination of actions and dimensions is critical to reach lasting ecological sustainability in a complex society like ours. Critique has been put forward (Van den Bergh 2011) that the propositions as to how a post-capitalistic alternative

will look like are too vague, but Kallis (2011) does not believe that this is a reason to discard the diagnosis made by degrowth nor the relevance. Although being a 'normative concept', he still stresses the importance and the usefulness of the concept. In the same way that we can sense what a breach of liberty is, degrowth is no different. Kallis claims that there are advantages in keeping the options open for how a post-capitalistic alternative could look like and to let it emerge from a bottom-up perspective.

There is a fear that a degrowth transition will turn into an authoritarian state intervention characterised by rationing and prohibitions unlikely to be accepted by people (Van den Bergh 2011). However, there is an awareness among scholars and a genuine dislike for any type of authoritarian degrowth transition (Kallis and March 2015). It is a common view within degrowth that social change does not take place by appealing to those in power. For many it is of high importance that change needs to come from grass-root movements that challenge established paradigms (Latouche 2009; Kallis 2011).

Van den Berg (2011) has raised critique regarding the feasibility of the voluntary simplicity advocated by degrowth. He finds it unlikely from a pure biological point of view where strong human instincts such as greed, selfishness, aggression and competition will stand in the way. Kallis (2011) responds to this critique by acknowledging that social positioning might be programmed in our genes but states that this does not necessarily have to manifests itself in endless rivalry for material accumulation. Although we are conditioned by genes, cultures decide. The capitalistic culture strives for material possession, but it is not driven by genes, rather by the structural compulsiveness of the system to grow or die. He ends the statement by concluding that people were allright before shopping malls entered our reality and that we will be allright even if we have to live without them in the future. These lines of thought stem from the anti-utilitarian sources of degrowth that criticises the theoretical approaches that presume every human action as departing from the individual and for being oriented towards self-satisfaction (D'Alisa et al., 2015).

Kallis (2011) explains that there are possible variables that capture sustainable degrowth, such as CO_2 emissions, total km travelled by food from source to consumption, equality indicators and self-reported happiness. He sees no obstacles for working out indicators that facilitate measurability, but he does not see it as something essential. One example of an attempt to measure degrowth is described by Schneider et al. (2010), in the form of Roefie Hueting's environmentally sustainable national income (eSNI). This is defined as 'the maximum attainable production level which allows vital environmental functions to remain available for future generations' (2010, 513). Estimations show that world eSNI is at 50% of the actual world national income, which implies that a sustainable level can be reached only if production is reduced by half, although the authors state that these are rough estimations.

One difficulty with analysing degrowth (Kallis and March 2015; Demaria et al. 2013) is that there is no 'degrowth world' to study. The theory exists and there are small experiments across the world (Buen vivir, Ubuntu) but the movement is far from coordinating actions to achieve the goals of a reduction in

absolute consumption of energy and materials at the national or global scale (Demaria et al. 2013). Often the existing examples take place at the 'fringe' of the market economy where they still enjoy benefits from public good infrastructures (Schneider et al., 2010).

Creating new institutions is important to facilitate a degrowth society. Latouche (2009) describes how a degrowth society would have to build institutions that collectively decide how to use resources to fulfil basic needs but also how to use the surplus. "Even in a society of frugal subjects with a downscaled metabolism, there will still be a surplus that would have to be dispensed if growth is not to be reactivated" (D'Alisa et al., 2015, 218). Kallis and March (2015) talks about creating institutions that will allow enough to be the new normal which indirectly means leaving capitalism behind. This can only be made possible in a society premised on collective self-limitation and sharing of commons (Kallis and March 2015).

Although degrowth favours a convivial, simpler life there are no aspirations to turn back the clock to an idealized past that may never have existed (Latouche 2009; Kallis and March 2015). Kallis (2011) makes it clear that the hunter-gatherer is not the ideal human subjects of degrowth. It is described as a mobilization of elements from the past (Kallis and March 2015), about using the developed capacities we have to create a mature future where relational goods are abundant and little material is enough (Latouche, 2009). This is manifested in the innovative way that degrowth combines already existing strategies and political proposals as well as looking upon the established sources that it draws upon (Demaria et al. 2013).

D'Alisa et al. (2015) believe that people find the meaning of life together with others and that the individual quest for finding meaning is heavy due to the 'unbearable weight of unlimited choice' (ibid, 220). Degrowth leaves behind the idea that we need to develop to get enough, as it is already here (Kallis and March 2015). According to Latouche (2009), the first step to leave the growth society is to offer an alternative way of life and this is done through the utopia of degrowth. It is necessary to open up space for creativity and imagination that has been blocked by the totalitarianism of economy, development and progress.

4. Discussion

Degrowth is about an absolute reduction of energy and material throughput but it is also much more. It is about envisioning a completely different society altogether guided by alternative values and objectives. It is not easy to pinpoint exactly what the degrowth movement is as it is many things. The variety of sources and strategies contributes to the difficulty to easily describe degrowth. Characteristic elements are defined by what it is against; economic growth (green growth), capitalism, GDP, development (sustainable development), the political process. However, it is also defined by what it advocates as replacement of the above mentioned; equality, justice, redistribution, democracy, conviviality, commons, care, wellbeing, localization, sufficiency. It stands for an alternative to the

hegemony of growth and should be created together from the bottom up. They emphasize the need to reconnect with each other and with nature. The extension of the change is widespread because capitalism as a system is flawed. That is why there is such an emphasis on the fundamental reworking of institutions and a completely new imaginary.

The discussion about degrowth opens up a lot of questions. How? Who? When? It is not hard to imagine why not even environmental NGOs are dealing with questions opposing growth, even though aware of the severity of the state of the planet and what is causing it. We are trapped in the economic system and it is hard to imagine a way out, or an alternative future. These questions are critical to ponder upon if we want a different future and maybe it is precisely that they mean with decolonization of the imaginary. We must break down the walls built during the last century. The community of degrowth have done a good job here and it is not productive to be stuck on the fact that they do not have it all figured out. Critique is an important part however, and it is needed as the relatively young scientific field is emerging.

The reason why it is so hard to envision a future without growth is because it permeates most parts of society, having been the dominant paradigm since 1945 (Schneider et al., 2010). The majority of people alive today were born and raised as consumers in a growth society and know nothing else. That is why some of the changes put forward by the degrowth movement are met with immediate rejection or disbelief. It is easy to discard it as an absurd strive for a hunter-gatherer society, but that would be yet another way to avoid responsibility.

It does not discard all modernities but realises that the future must be one with significant reductions of energy and material throughput. This line of thought welcomes efficiency but is also clear on the fact that this alone will not be sufficient. Instead, sufficiency is what needs to guide society. Another enlightenment is that the world is an unequal place that is a result of past development patterns and colonization's and that this has to be dealt with openly and responsibly.

Degrowth is rather uncomfortable in the way it goes straight for the elephant in the room. It challenges power structures, inequality, justice and points towards some of the more unpleasant features of humanity such as selfishness and greed. Things do not happen for a reason; it is decided by people and it can be readjusted or decided differently once more. The focus of the discussions should be on the positive image of how a degrowth future could look like even though it is easy to get stuck on the things they dislike. It is their firm belief that a degrowth society will lead to a more just world where ecological sustainability and wellbeing are prime features, which most people would probably like. It depends of course, because a degrowth future is less about personal gain and more about making a better place for all. The role of biology or utilitarianism is an interesting thing to discuss. The danger is that if there is something to gain from using people or nature, people will take advantage of this. Therefore, incentives

like salary caps and high taxation on extraction of natural resources or pollution are appealing. This will help eliminate or at least reduce the profitability of using nature unsustainably.

There is a discussion to have about what the impact on salary caps would have on development or aspiration, as acquiring wealth can be thought of as a driving force. To be remembered is that degrowth envisions an altogether different future where accumulation and growth are not part of the equation and where development in the sense that we know it today is not an aspiration. Probably one of the harder aspects of degrowth is the strive for enough and it will take some readjustment before this could be the lead word.

Degrowth wants to reclaim work's role as a social value. Thinking about the core function of work as a social value, different things comes to mind. To feel needed, to interact with other people, to feel that you are contributing. These values are fulfilled by the future work-life envisioned by degrowth rather than how the current work market looks like, which has become more stressful and more insecure. For some people, a career might be an important part of their identity but perhaps this does not have to disappear although it might not look like it does today. An attractive alternative is that of social enterprises which has the potential to be a real positive feedback loop. They would benefit from a degrowth transition and at the same time their business-model benefits the degrowth transitioning.

4.1. Growth in the North and South

Reducing production and consumption is seen as a way to relieve pressure from the biosphere but also as a way to give space for the South to grow. But not growth as it has been for the past centuries. They cannot aspire to have the same material wealth and throughput as the Western countries have and although this is evident when thinking about the current state of the planet, it might be tough to convince the countries in question. This is of course unfair at a first glance but what the degrowth movement is saying is that the way the global north has been living is not something to strive for. It does not provide higher levels of measurable happiness; it creates the feeling of relative scarcity and it leaves people with so much choice that it has become a burden. Work and productivity have become such a big part of people's life that it has turned into something negative. The literature points towards a loss of togetherness, which can be explained by how the capitalistic system rewards hard work, competition, and independence. Thinking of it this way, the degrowth movement is not seeing it as a punishment that the South should avoid the same trajectory of growth and development as the North, they are offering a way to avoid the negative side-effects described above. The 'truth' that money leads to happiness and freedom, is hard to get rid of. Degrowth wants everyone to have the basic ecosystem services needed to be fed, clothed and housed and they want people to have meaningful activities to fill their time with, partly meaning work although a strong emphasis is on relationships and informal work. It is the inequality of wealth that they want to do away with.

4.2. Scale

One problematic area, however, is the matter of scale. As many of the suggestion's circle around the local context one cannot help but wonder what a degrowth society would look like if it was scaled up? What are the obstacles and dangers? For a degrowth transition to work on a larger scale, the world would need to come together around a shared vision, a common goal, but a completely different one than what is driving the present state of affairs. However, there are some large obstacles; globalisation being one, unequal power relations another and of course capitalism with the free trade and market forces. None of the authors specifically addresses free trade as an issue but with the aim of localizing markets and creating local currencies, these two are clearly at odds.

4.3. Future

What speaks in favour of a development in favour of the degrowth movements ideas is the growing grassroot movements seen across the world. The clearest example that comes to mind is 'Fridays for Future' that has taken thousands and thousands young (and old) people to the streets protesting for the environment. However the outcome, this can be expected to bring a surge of new research areas for the future within the scientific field of degrowth as the current pandemic is thought to be the worst economic crises in modern times. This will be an opportunity to study good and bad examples of how countries have dealt with it. Other interesting areas of research would be to investigate how a salary cap would work in practical terms and what number it should be. Topics concerning voluntary simplicity or values would also be of interest, specifically to look at the people that have already made the transition. We have a lot to learn from these people regarding how and why they chose to live their lives in this way out of free will.

5. Conclusions

The questioning of growth as a system and an objective is the key feature of degrowth. The overall goal is to achieve wellbeing and social justice for everyone on Earth and to reach environmental sustainability. This will be achieved through the reduction of production and consumption and should be done in an equitable and democratic way. The restructuring that is required involves financial institutions such as banks, the legal system, the social security system, and work but it all starts with the restructuring of our values. The values needed in the degrowth society are dependence, altruism, respect, sufficiency, and solidarity. The degrowth toolbox extends from old proven strategies, actions and policies in different settings to altogether new and innovative suggestions. Some resides on a macro-level but a big emphasis is put on the individual. Perhaps even more weight is on the collective, what smaller groups of people can achieve together.

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Posters

The 27th International Sustainable Development Research Society Conference
13–15 July 2021
Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis
Mid Sweden University
Virtual Conference, Sweden

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Smart Villages: A review of the state of the art

Introduction

- Over the last two decades, communities have faced many challenges.
- Environmental concerns, economic recession and the recent Covid-19 pandemic crisis are threatening both urban and rural societies.
- Technological innovation/ICT is often seen as a mean for facing these challenges by boosting "smarter" communities.

The "Smart Village" notion

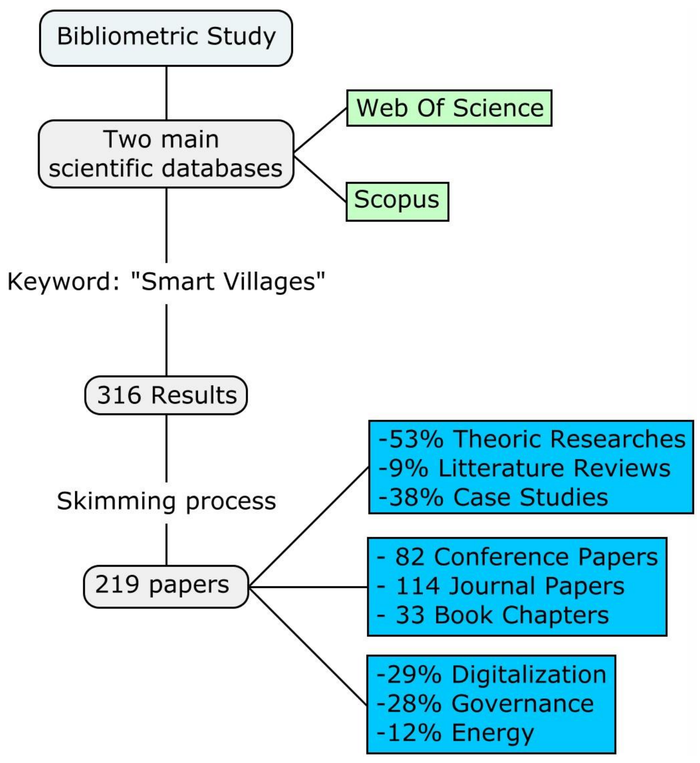
- In the European Union, the Smart Village Initiative was launched in 2017.
- "*EU Action for Smart Villages*" was the starting point to define the conceptual framework for defining what and how to apply smart solutions in rural contexts.

Aim of the study

- This study aims at presenting the upgraded state of the art of the scientific research on Smart villages.

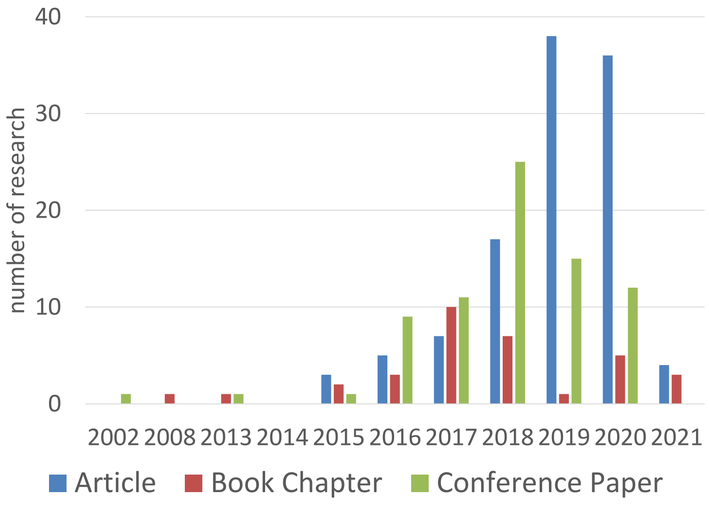
Methodology

- A bibliometric analysis has been carried out by questioning Scopus and Web of Science databases, using "Smart Villages" as a key word (last update: 20/01/2021).

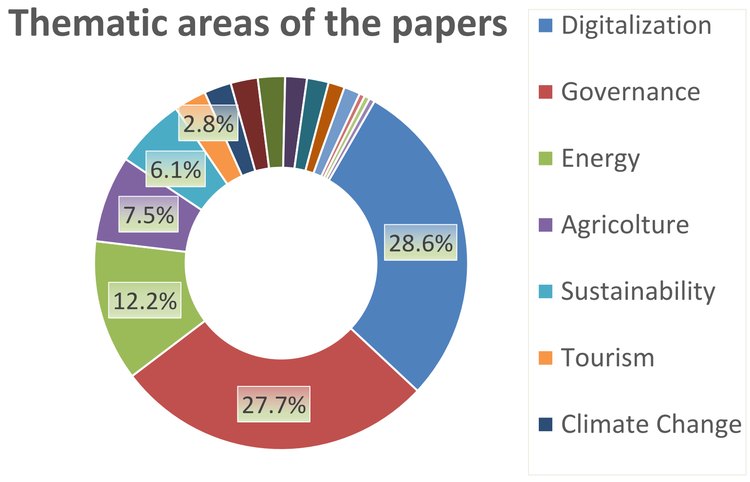


Preliminary results

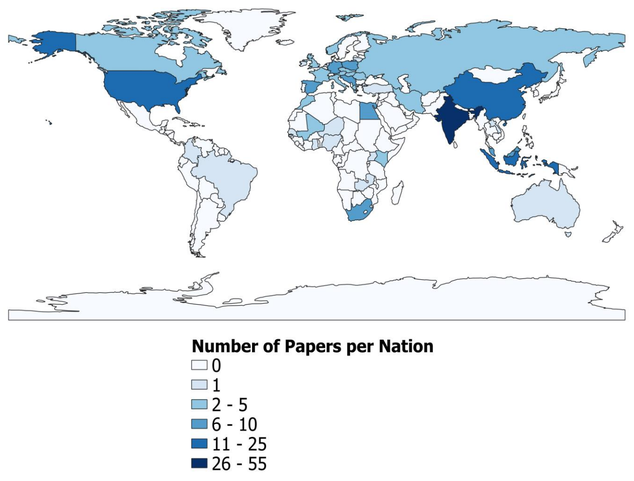
- The research yielded 319 results
- After refining the research 219 papers have been selected.
- Approximately 87% of the papers were published starting from 2017 (55 papers in 2020).



- The survey has listed 104 articles, 33 book chapters and 82 conference papers.
- 120 out of 219 contributes deal with theoretical research, 80 describe case studies and 19 are literary reviews.
- Around 29% of the articles focus on digitization and 28% on governance.



- In terms of "First Author's origin", the majority of the contributions comes from Asia and North America (55 and 14 respectively from India and the US).



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SUSTAINABLE RE-USE OF SPACES AND BUILDINGS: APPLICATION OF THE PRINCIPLES OF CIRCULAR ECONOMY TO URBAN REGENERATION

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INTRODUCTION

The strategies the cities must adopt to reduce the consumption of new exhaustible resources involves the shift from productive systems to generative systems (Latour, 2017). **Urban regeneration policies** should provide adequate solutions for each phase of the city's transformation, exploiting the opportunities and strengths that can potentially make them key players in the transition to more sustainable solutions. Indeed, cities are increasingly moving to actions aimed at reconsidering settlement models based above all on the re-use, recycling and development of creative economies. Thus, participatory processes must contribute to regeneration. It is up to public administrations to decide and facilitate re-use within a more comprehensive design based on medium-long term policies. The application of the circular approach within a territory (e.g. urban area) involves municipalities, production activities, relevant stakeholders and citizens, in order to create opportunities lowering the depletion of new resources. At the European level, there are many positive experiences of effective temporary or permanent employment of certain previously abandoned or unutilized spaces and buildings enabled through participation and active citizenship. In fact, compared to new extensions and new constructions, which usually depend only on the decisions of developers, re-use offers a greater possibility of transforming and reinventing the city according to one's desires and through forms of social and civic activism (Scandurra, Attili, 2013).

1. MATERIALS AND METHODS

This paper aims to describe examples of urban regeneration based on a circular economy approach, taking into account the case of the city of Prato, Italy, The study has adopted a participatory methodology based on the active involvement of local stakeholders. Interviews and focus groups were organized in the framework of the activities foreseen by the URGE - URBACT project and in those organized in the framework of the local strategy "Prato Circular City". In particular, **URGE ("circUlaR buildinG citiEs")** is an Action Planning network on circular economy in the construction sector, bringing together nine cities and their stakeholders to inspire and learn from each other in developing their integrated urban policy. **Prato Circular City** is the strategy operates to overcome the barriers that slow down the transition to the circular economy.

2. RESULTS AND DISCUSSION

In Prato, the concept of re-use is part of the genetic heritage of the city and its inhabitants. The application of circular economy principles to the textile chain has also created over the years virtuous symbiosis phenomena. The vision of local public administration is pushed mainly by three conditions: 1) The presence of a homogeneous production district (i.e. textile) in which common interests and knowledge converge. This allows policies to be targeted. The textile sector is also a sector where innovative and sustainable production solutions can be introduced. At the same time is possible to cooperate in order to overcome regulation barriers, as well as to favours symbiotic phenomena among different materials chains (i.e. innovation). 2) The relocation of numerous production activities from the previous areas in new ones emptied numerous buildings in various parts of the city. By means of urban regeneration processes, the disused buildings can be rethought in terms of their functions and destinations. 3) The presence of a multicultural society on the territory represents a fertile ground for innovative solutions to strengthen social cohesion. These conditions, together with Prato's experience within the European Partnership on Circular Economy (among the outputs produced by Prato in this frame were a Handbook on sustainable and circular re-use of spaces and buildings), led to the definition of Prato's strategy on circular buildings.

Among the different projects, a process of urban regeneration of the area called **"Macrolotto 0"** is being carried out. The planned interventions consists in the reconversion of an old disused textile factory into a covered space for the short chain food market. The space also integrates interventions of urban forestation and the promotion of social inclusion activities. The creation of the first permanent and covered food market in Prato willing to be a driver to attract and boost initiatives, including private and rethink other specific parts of the city. Findings and lesson learned emerged can be consider also in general terms about the application of circular economy principles at the construction sector. In more general terms, during the interviews and the focus group, the main barriers and the related action needed have been identified, as reported in table 1. Thus, Figure 1 summarizes the circular process of urban regeneration and assigning a new function to a building.

CHALLENGES: 1) Material reuse and transformation of existing unused buildings (and spaces); 2) Improvement of the environmental performance of buildings and infrastructures in their entire life cycle; 3) To boost the circularity of materials and the industrial symbiosis phenomena.	
BARRIERS	**ACTION NEEDED**
Minimum environmental criteria in public procurement inflexible and difficult to apply in the case of products made from recycled materials.	Increase the awareness of minimum environmental criteria among civil servants. A guidance is needed on their application to ensure their positive environmental impacts.
Lack of knowledge among professionals (e.g. architects) about new materials made from recovered or recycled materials.	Targeted training activities for professionals and technicians of the building sector. Organization of specific workshops on circularity criteria destined to construction companies. Targeted training activities destined to civil servants on sustainable materials and circular economy concepts.
Building materials made from secondary raw materials and from recovered materials may encounter standardisation and certification issues. Problems are largely due to the variability of recovered materials, also depending the chain.	Selection of secondary raw materials and definition of critical aspects (i.e. protocol of reuse) by definition of quality characterization, traceability and standardization.
Lack of knowledge regarding the availability of sustainable materials at local level.	Creation of local platforms to increase awareness about "short chain" recoverable/recyclable materials.
The construction sector has not invested enough in the reuse of materials.	Enable conditions to increase demand for recycled materials, starting with interventions on public buildings.

Table 1. Main barriers and action needed in the application of circular economy at the construction sector

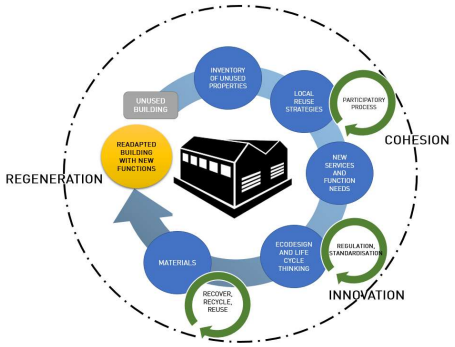

Figure 1. Circular economy principles in urban regeneration and building restoration (Source: authors)

3. CONCLUSIONS AND FUTURE PERSPECTIVES

The successful implementation of circularity actions still require to overcome barriers. The case of the city of Prato demonstrates the successful circular initiatives carried out, and how collaboration through public-private partnerships is crucial for the implementation of circularity. Thanks to the adapting reuse and the transformation of existing buildings, cities will be more sustainable and resilient in the future, contributing to the increase in the well-being and quality of life of citizens, strengthening their identities, memories, cultures, respect for the environment, contributing to social inclusion and economic growth.

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DISCLAIMER The views expressed herein are those of the authors and therefore not necessarily reflect the official opinion of the European Commission and URGE – URBACT project.

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Degrowth – characteristic elements and strategies, and two practical examples from Sweden

Introduction

The academic field of degrowth is relatively young but is attracting more attention and has its own research network. With the aim of identifying characteristic elements and strategies, a small literature review were performed. Additionally, two interviews with actors in the mid Sweden region that operate within the frame of degrowth have been conducted for an insight in the practical reality.

Definitions of degrowth:

- "…an equitable downscaling of production and consumption that increases human well-being and enhances ecological conditions at the local and global level, in the short and long term" Schneider et al. (2010:511).
- "Sustainable degrowth can be defined from an ecological-economic perspective as a socially sustainable and equitable reduction (and eventually stabilisation) of society's throughput" Kallis (2011:874).
- "…a collective and deliberative process aimed at the equitable downscaling of the overall capacity to produce and consume and of the role of markets and commercial exchanges as a central organising principle of human lives" Sekulova et al. (2012:1)
- "Degrowth challenges the hegemony of growth and calls for a democratically led redistributive downscaling of production and consumption in industrialised countries as a means to achieve environmental sustainability, social justice and well-being" Demaria et al. (2013:209).
- "…a project of radical socioecological transformation calling for decolonizing the social imaginary from capitalism's pursuit of endless growth" (Kallis and March, 2015).

Demaria, F., Schneider, F., Sekulova, F., Martinez-Alier, J. 2013. "What Is Degrowth? From an Activist Slogan to a Social Movement." *Environmental Values* 22 (2): 191–215.; ● Kallis, G. 2011. "In Defence of Degrowth." *Ecological Economics* 70 (5): 873–80.; ● Kallis, G., March, H. 2015. "Imaginaries of Hope: The Utopianism of Degrowth." *Annals of the Association of American Geographers* 105 (2): 360–68.; ● Schneider, F., Kallis, G., Martinez-Alier, J. 2010. "Crisis or Opportunity? Economic Degrowth for Social Equity and Ecological Sustainability. Introduction to This Special Issue." *Journal of Cleaner Production* 18 (6): 511–18. ; ● Sekulova, F., Kallis, G., Rodríguez-Labajos, B., Schneider, F. 2013. "Degrowth: From Theory to Practice." *Journal of Cleaner Production* 38: 1–6.

Jörgen Andersson, Fjällbete and Regenerative Agriculture

Andersson, partly in reaction to farming based on cheap fossil fuels, founded 'Fjällbete' with focus on the vitality of the ecosystems and of the surrounding local community. Though changing between organisation form – individual firm, economic association, today a stock company – the aim has been the same; to develop models for stronger local economies. One of these models are Regenerative agriculture, part of 'Holistic management', which can be described as a framework for decision making when it comes to *complex systems* such as nature or life.

Regenerative agriculture can be defined as a way of enabling the highest possible vitality in an ecosystem while simultaneously satisfying human needs, leading to a strong and healthy civilisation in a strong and healthy biosphere (J. Andersson, pers. comm. 11 May 2020). Andersson is convinced that a growing measure of interactivity between the ecosystems and the people supported by the land is the way forward. The more people know about what they need and what they could have, the more they can affect what should exist on the land and this will influence which bushes, animals and watersheds are there, adjusting it more and more to the people living in the area and vice versa. For him it is a farmer's responsibility to make sure that people can connect to the land they are living from, to be the link between society and the ecosystems.

Local capital is another important part for Andersson. It is crucial that capital is made available for small, local companies so that they are not omitted to credits. A local venture capital market is needed in order to create self-reliant societies. An additional means to this end is to set up a local currency. This requires a new mindset which is guided by transparency.

Some of the difficulties or obstacles that Andersson sees is the alienation from nature that people are experiencing, enhanced further by the intermediaries in the food chain, for example the commercials from food companies.

Andersson talks a lot about the importance of grass-root movements and the possibilities of creating together. He emphasizes that everything of importance happens around the kitchen table and in local contexts where people come together. The best protest is to find your people and to make sure that your life and your health are taken care of. This way there is no need to convince others, it speaks for itself. People and policymakers will come to you to see what you are doing. This attractiveness will be the driving force of the local movement that is global.

Peo Eriksson, Transition Network:

Peo Eriksson runs a local transition group and is also part of the board of the national Transition Network, an NGO that aims to facilitate different transition initiatives around Sweden. Transition is an umbrella concept that involves many things, how to farm, which type of farming (permaculture, agroforestry etc.) and solar panel associations among others. What permeates all of the initiatives is to become more local and to come together, "think global, act local".

Eriksson (pers. comm., 14 May 2020) describes how this in practice means to get to know your neighbours and the people living in the community and together see what you can do as a group. It is their belief that by starting locally and helping each other out, the whole world can become more sustainable step by step. "There is a longing for fellowship or a sense of context. Many wants to live together with others, farm together, to come up with something." He mentions initiatives that does not refer to themselves as transition initiatives but holds the same spirit, Fjällbete is one example. Another example is a group interested in self-sufficiency that wants to live off their own animals and grow food. This fits under the concept of the transition network but many seem unwilling to call themself 'transitioners'. Ericsson believes that maybe it is because people do not yet see the bigger picture. "They are occupied with the idea of cooking food with ingredients they have grown themselves, better and safer food, but do not think about that what they are doing at their farms is helping society at large to transition". Eriksson has a background from different environmental organisations such as the Swedish Society for Nature Conservation and Greenpeace. While these organisations work with one question at a time, the Transition Network holds a holistic perspective and also has a focus on the inner transition. That is, the need to change mindset and values simultaneously as society transitions. When Ericsson thinks about the great transition needed, he sees a future of degrowth. "If we are to remove fossil fuels there will be a deficit in the energy system in the world. At least I think that this will lead to less consumption". Degrowth will be an automatic consequence.

Conclusions

Degrowth can be described as a frame or an umbrella keyword that connects different types of actors, initiatives, goals, strategies, and policies. It derives from multiple academic fields stretching from bioeconomics to justice and its main goal is a future guided by ecological sustainability and well-being for all. It is defined by what it is against such as the capitalistic system, GDP and development, but also by what it advocates such as equality, democracy, localization, and sufficiency.

Strategies involve sharing in different forms, economic instruments such as taxation of harmful activities, restriction of advertisement and strengthening of the commons.

Degrowth envisions an altogether different society consistent of new institutions that is guided by alternative values such as altruism, respect, sufficiency, and solidarity.

Both of the organizations in the mid Sweden region, represented by the inteviews, can be argued belong to the degrowth movement. Neither of the two interviewed persons identified themselves as 'degrowthers' as such but there are definitely some common reference points and strategies. The strong emphasis on the many values of localization is one. To establish this there are some common strategies such as the promotion of local capital. Another common reference point is the emphasis on the individual and the power of grassroot-movements. There is a lot of power given to the individual but also a lot of responsibility.

6. Sustainable Cities and Communities

6b. Urban and regional resilience

Abstracts

19

Perspectives of sustainability and resilience in the context of the UN Agenda 2030: food supply in urban conglomerates

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Luiz Henrique Maisonnett

Abstract

Urban conglomerates have faced a large number of challenges in recent years, perhaps the biggest one of them is the sustainability and resilience of cities in dealing with the food supply to the population. The complexity of the topic addresses adequate management of cities to guarantee economic, social, and environmental sustainability, contemplating the production of food within the urban space and the use of innovation and technology. This study aims to present and discuss how the UN Agenda 2030 can be an answer to the complex challenges imposed by life in cities about food supply, challenges that are amplified with the Covid-19 pandemic, and other phenomena, such as global warming. The methodology of this research is a systematic review of the literature, that aims to identify the existing scientific studies on the topic, evaluate the results and proposals presented, and create strategies that can support decision-makers in the development of policies for urban and regional sustainability and resilience. It is clear that despite the efforts of Agenda 2030 and government agencies to achieve the objectives of this ambitious plan, there is still a gap in specific, and practical action goals for cities and regions, which shows that there is a long way to go. It is concluded that local and regional actions, such as urban agriculture, for example, specific training for public agents and the population, with an emphasis on education and popular participation, would be something possible for the effective implementation of the UN Agenda 2030 SDGs.

This summary especially reports to SDG + Target: 2.1, 11.a, 11.b, 11.6, 11.7, 12.a, 12.1, 12.3, 12.7, 12.8, 13.b, 13.3
The proposed contribution reports to the topic of the Conference, regarding the resilience and sustainability of cities, food supply, and the existing global crisis, which was amplified and intensified with the Covid-19 pandemic.

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Transforming urban water resilience through household action: an analysis of practices from Lagos, Cape Town and Windhoek.

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Abstract

Understanding the interplay between individual choices and the cumulative resilience of urban areas, and their wider communities, is one of the least explored areas of resilience research. This paper addresses that gap by exploring the interface between individual resilience actions and collective approaches in three cities in sub-Saharan Africa. By examining household responses to water shocks it also promotes a new understanding of urban water resilience with lessons for governance and practice.

Water shocks and water stress stretch the ability of governmental authorities to respond, leading individuals to take action for themselves. Individual actions can be a positive element in building collective resilience but may equally undermine collective provision or lead to inequitable outcomes. Through a comparative assessment of responses to water shocks/stress in three cities in sub-Saharan Africa: Cape Town, Lagos and Windhoek, the paper provides novel insights into the role of households in urban and regional resilience.

Utilising qualitative and quantitative approaches the paper contrasts the actions taken by individual households to ensure their own resilience when faced with water shortages, their motivations for action and the consequences of this for collective resilience outcomes. Combining data from interviews with households and stakeholders in each of the cities the approach provides a novel insight into the framing of individual actions as part of a wider resilience strategy, and some of the challenges encountered.

The results provide important insights for building urban water resilience. The three cities demonstrate different modalities of water supply. In Lagos, there is a long-term practice of households sourcing their own water supplies, notably through commissioned boreholes, to offset limited municipal supplies. In Cape Town, responses to the 2018 drought led to a rise in households augmenting municipal water supplies, including an increase in private boreholes. In Windhoek, municipal water remains the dominant water supply.

The paper highlights the complex motivations of household actors, combining self-interest and altruism. Protective motivations are dominant, and secondary social or environmental impacts are rarely considered in the procuring of personal water supplies. The paper highlights the potential for maladaptive practices to produce secondary cascade effects with possible adverse impacts for social and environmental justice, both now and for future generations.

The results develop our knowledge of urban water resilience by demonstrating the complex interplay between municipal and household strategies for securing resilience to water shocks, the interface of agency and structure within this and the implications for governance. The paper develops our understanding of how water shocks can induce transformations in urban water supply structures. The

results also highlight the specificity of place when designing resilience strategies and illustrate the significance of considering the distributional consequences of cumulative individual actions.

The ability of cities in sub-Saharan Africa to achieve SDGs 6.1 and 6.4 lie at the heart of this paper. Water shocks and water stress not only challenge achievement of these targets but also raise questions as to the means by which these targets are achieved, and the wider implications for sustainable development and urban resilience.

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A resilience approach to stabilize the market economy in the post pandemic era: Case of metropolitan cities in India

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Mr. Rubaid Naskar

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Abstract

Resilience has many definitions and implications referring to regaining of the prior situation. In general engineering concept, it adheres that to bounce back to its original state or shape. The application of resilience can be found in the urban and regional social context, where livelihood is affected by natural calamities and hazards, especially affecting on the economic front. For cities and urban areas, shocks are not always adjusted and counter back to its original state instead, structural transformations and adaptations are found. Subsequently, people in urban and regional sectors establish new mechanisms to adapt in environments to sustain. The paper outlines the case of three metropolitan cities in India- Kolkata, Delhi, and Mumbai highlighting the post-pandemic COVID-19 scenario to understand the disability in economic fiscal-scale. In a developing country like India, marketplaces are often found in two distinct arrangements- formal market and informal vendorship. The COVID-19 pandemic pierced the life of shopkeepers in both the market sectors. The distribution management system became disrupted with less supply in urban marketplaces to leave them paralyzed in these cities. The paper focuses on the post-pandemic case scenario to highlight how the different merchant owners in both markets started to initiate their marketing strategy alternatively to broaden their customer chain. This paper aims to comprehend how a resilience concept can be applied in diverse scenarios. The results showed that

informal vendors started to visit the local communities to sell the daily commodities and goods, door to door. Moreover, people were reluctant to visit the marketplaces to avoid contagiousness. The marketplaces portrayed a distinctive image, showcasing the rise in the business of online giants and e-commerce platforms, ensuring safety protocols and hygiene. The findings of the research present the different market strategies and how they heal their economy by adopting numerous techniques with the given constraints.

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DIFFERENT CLASSIFICATIONS OF THE REGIONAL AND URBAN LOCATIONS UNDER IMPACT OF THE DISASTERS: THE CASE OF COVID-19 PANDEMIA

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Abstract

Regions and cities are usually under the classifications according to different criteria such as population, economic conditions, managerial conditions, migratory conditions, etc. However, approaches affect definitions and classifications as well. Thus, there are labelings such as ecological cities, healthy cities, resilient cities, slow cities (cittaslow), rebellious cities, bad and good imaged cities, closely knitted relation cities, culture centers, World capitals, cities under the risk so on. However, these classifications are usual approaches of the regular times. However, ongoing conditions (social, economic, political, disasters, crises, health, etc.) at the societies' fabrics alters our city and urban location, regions, and country definitions and classifications. These classifications find reflections at permanent and/or temporary levels. These classifications are present since the earliest examples from the civilizations in Mesopotamia, Nile, and Latin America. Disaster and growing sustainability issues, energy production, and consumption issues increase the necessity of examining the resiliency of settlement locations and the communities. There are certain classifications about different disaster types and processes. However, lockdown and COVID-19 pandemia injection priorities and limitations force us to face other decisions (International, national, local, individual) and related conditions of our settlement locations and community conditions to do revisions on definition and classifications. This paper will be elaborating varieties of the city, urban areas, and communities at the time of disasters in four sections. Exceptional cases will be derived through comparative scrutinization of examples from the World and about COVID-19 Pandemia. Sustainability will be examined within cultural, social, ecological, economic, political, and health conditions. The findings related to classification and resiliency issues will be evaluated in the light of SDG's, especially Goal 11 a and b articles. Methodologically sources of the study are literature reviews of hard copies and digital platforms. Formally applicable statistical findings will be scrutinized as well. Besides this, global and local observations will be taken for granted as well. The results reveal differences in definition and classifications on differing grounds (managerial, international, local decisions) and differing time sequences (short, medium, long term, and temporary-permanent). The findings of Turkey will be evaluated as a case study as well. Findings will be elaborated formal definitions and cases of crossing borders of these limitations under the conditions of community networks and relations. Cross-section of community, region and settlement definitions at the time of disasters will be discussed. Conclusion will be final section. Global, national and local findings will be evaluated under the light of disasters and the specific case of COVID-19 pandemia.

Key words: Resilience, Urban, Community, Disasters, COVID-19

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How does resilience planning impact vulnerability to flooding in coastal cities?

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Dr. Sara Meerow

Abstract

The risks and costs of flood damages for coastal cities are increasing. Resilience planning is an increasingly popular framework for coordinating hazard mitigation and planning more generally. Research suggests that concept's malleable meaning allow resilience to function usefully as a "boundary object." As such, resilience planning is theorized to help increase collaboration and avoid counterproductive outcomes that arise from treating interrelated problems in isolation. Many cities are now ostensibly engaged in resilience planning, however the extent to which resilience is actually transforming planning processes, stakeholder collaboration, or mitigation of long-term flood risks is unclear. This study seeks to fill this gap, empirically examining how resilience is conceptualized by different organizations involved in flood planning, whether it does, in fact, seem to bring together different stakeholders and lead to more integrated plans and policies that are likely to reduce physical vulnerability to flooding in the built environment. We combine findings from a stakeholder survey, social network analysis, and various methods of plan analysis in four different U.S. coastal cities (Fort Lauderdale, FL, Baltimore, MD, Boston, MA, and Seattle, WA). As one of the first studies to use network analysis to assess conceptualizations of resilience across a governance network, the coordination of organizations engaged in resilience planning, and to evaluate the influence of coordination on plan integration and quality, this study will test existing theories on resilience, urban governance, and planning. This work is most closely aligned with SDG 11: "Make cities and human settlements inclusive, safe, resilient, and sustainable," especially specifically disaster risk reduction.

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Assessing Seismic Resilience of School Educational Sector. An attempt to establish the initial conditions in Calabria Region, Southern Italy

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Abstract

School education constitutes one of the strategic functions to be recovered in case of an external shock, such as a major earthquake. The structural improvement of school buildings together with the strengthening of the administrators' capacity to react positively and keep the school community cohesive following a strong seismic event are key factors that contribute to the reduction of social vulnerability, both before and after the earthquake. Nevertheless, in Italy, except for some virtuous regional cases, the issue of seismic prevention and risk reduction policies related to the school sector has not yet been consolidated in the national and local institutional agendas.

Observing the major Italian earthquakes of the last century, among the most evident aspects, what keeps being predominant is the degree of buildings damage with consequent interruption of functionality of the urban system. School buildings are not excluded from this general picture. Among the causes of the massive physical damage, some structural ones emerge, such as the vulnerability of the building heritage, but also other causes that depend mainly on governance and institutional capacity: lack of risk mitigation policies and lack of effective and shared cognitive tools, capable of drawing a clear recovery framework and building a more resilient community to tackle future possible earthquakes.

Although it does not represent an a priori solution, that of resilience has been considered a relevant paradigm to address the issue of how to strengthen the capacity of the school system to ensure the physical safety of the buildings and to guarantee the maintenance of the school function, both looking at pre and post-event phases.

The paper proposes a set of indicators and a methodology for a preliminary assessment of the educational sector's seismic resilience, in terms of initial conditions. Starting from the literature, the method has been set up and tested on a first pilot case study: Calabria Region in Southern Italy. The results show that spatial differences in the educational sector's seismic resilience are evident. Except for some large urban areas, the less resilient areas are grouped mainly in the southern part of the Region, while the most resilient ones are located mostly in the central-northern sector. The goal is to identify a repeatable approach, useful as guidelines for school seismic prevention policies.

The proposed abstract is related to SDG 11 "Make cities and human settlements inclusive, safe, resilient and sustainable". Target 11b.This research contributes to the Conference topic because it stresses the importance and the urgency for governments (both nationals and locals) to adopt comprehensive disaster prevention policies and actions, proposing a repeatable operational method to assess the earthquake resilience of the school education sector in specific urban or regional systems.

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Rivers as contributors to urban resilience. Analysis of their potentiality in European cities

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Abstract

Urban rivers are a key part of the blue-green infrastructure systems, providing valuable ecosystem services to residents (Bae, 2011; Everard & Moggridge, 2012). Despite the fact that open spaces are common along urban riverfronts, land uses on riverbanks vary a lot from one city to another (Durán &

Pons, 2021). Anthropic uses on the riparian corridor do not only affect the ecological state of the river system, but they also condition the quality of life of citizens as well as the resilience of the city (Ahern, 2013).

In this research we analyzed the land uses around the urban rivers of three hundred European cities. This analysis evaluated the distribution of land uses that are compatible with the creation of a green infrastructure (gardens, parks, natural areas, agricultural areas, etc.), identifying those cases with more green spaces adjacent to the waterways.

For this purpose, we used the cartography developed under the framework of the Copernicus Programme of the European Environment Agency (EEA). We first build an updated map of Urban Morphologycal Zones (UMZ) from the European Urban Atlas. Secondly, we clip the resulting UMZ layer with a high-resolution land use and land cover dataset of Functional Urban Areas. Finally, we cross Potential Riparian Zones (DPRZ) with the layer resulting from the previous step.

The result is a ranking of European cities based on how their green river infrastructures can contribute to urban resilience.

This proposal relate to several SDG+Targets: 6.6; 11.5; 11.7; 11.a; 13.1

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Heatwave vulnerability and sustainability assessment in the case of Hungarian large cities

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Abstract

Nowadays, more than half of the world's population lives in cities, and this number is even higher in the EU and Hungary. Climate change causes extreme weather events and related adverse socio-economic effects in cities; however, improving adaptive capacity can help to reduce these consequences, and thus the need for sustainable city management is crucial. The analysis of urban sustainability and climate change-related concepts are in the focus of current scientific debates.

The number of urban sustainability literature strongly increased in the past 20-30 years; meanwhile current studies tend to move toward climate adaptation or vulnerability analysis. Cities have an unquestionably important role in sustainable transition by reason of occupying more and more areas, and thus the complicated relationship between broader urban sustainability and related climate change issues, such as adaptation and vulnerability, are strongly reasonable to understand and analyse.

Numerous studies on climate adaptation and sustainability issues focusing on sectoral dimensions have been published in academic journals; however, far too little attention has been paid to revealing spatial trends, i.e., regional comparison of different urban areas is a much less actively studied area. It should be noted that many Hungarian scholars regularly publish papers concerning climate change issues; however, a wide range of Hungarian scientific backgrounds are missing in terms of climate change, urban sustainability and related principles, spatial comparisons, and inter-urban analysis, so the expected results of the current research are unique and can expand the knowledge base available. In the current analysis, the aim of the temporal and spatial analysis of urban sustainability and climate adaptation capacity is to reveal the regional patterns and processes through Hungarian largest cities' example, which are still a white spot in Hungarian urban studies. The examined cities are Budapest, Győr, Miskolc, Nyíregyháza, Debrecen, Szeged, Pécs, Kecskemét and Székesfehérvár with a population exceeding 100,000. Since Hungarian case studies currently lack the literature regarding the regional comparison of these aspects, therefore submission of a paper on this topic contributes to widening the existing literature with a strong emphasis on Hungarian cities.

The analysis strives to reveal what spatial patterns can be defined and mapped regarding urban sustainability and heatwave-related adaptation of these cities from the early 2000s to nowadays and in the near future, and thus a comparative analysis can be performed. Regarding the method quantitative analyses are projected to be conducted in the study. The focus is on the use of widely available statistical data set, which can be downloaded easily from open data sources. The data collected will be used for both the sustainability and adaptation analysis by applying adequate indicators. As it was previously mentioned, the Hungarian context related to the topic is not well researched and therefore this analysis will fill a gap in the domestic and international literature.

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Assessment of socio-economic and livelihood vulnerability relevant for climate adaptation: A district-level analysis of the Indian Himalayan Region

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Abstract

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change defined the 'risk' of climate change at the intersection of "Hazard", "Exposure" and "Vulnerability" (IPCC-AR5, 2014). While mitigation of climate hazard and reduction of exposure are relatively long-term goals, the governments and development agencies can address climate adaptation most effectively by reducing vulnerability in the short and medium-term. Mountain regions tend to be severely affected by the risk stemming from climate change and variability. These regions are largely characterized by complex biophysical and marginal socio-economic conditions that significantly contribute to vulnerability. Identifying and supporting vulnerable regions along with the implementation of adaptation and mitigation measures are crucial for achieving the 13th Sustainable Development Goal (SDG-13). A systematic understanding of the vulnerable locations and drivers of vulnerability at the current climatic condition is the first step towards adaptation planning.

The present study employs an indicator-based approach based on the modified risk assessment framework proposed by the fifth assessment report(AR5) of IPCC 2014 for conceptualizing vulnerability and geospatial analysis for identifying the vulnerability-hotspots, considering 132 districts in the Indian Himalayan Region (IHR). The research objectives are to 1) identify the most vulnerable districts using Composite Vulnerability Indices (CVI), based on a set of 14 common indicators (such as poverty rate, dependence on natural resources for livelihood, the prevalence of rainfed agriculture, alternative livelihood schemes, and other institution and infrastructure-related indicators, 2) identifies the hotspots

of vulnerability based on spatial autocorrelation (Moron's I and Local Geary), and 3) identifies the drivers of vulnerability. The results revealed that the Composite Vulnerability Index (VI) ranges from 0.75 (Goalpara in Assam) to 0.35 (Kolasib in Mizoram). The districts have been categorized in four quartiles of 33 districts each, viz., Quartile I (0.62 to 0.75), Quartile II (0.54 to 0.62), Quartile III (0.48 to 0.54), and Quartile IV (0.35 to 0.48). Around 78% of districts in Assam and 36% of districts in Jammu and Kashmir fall in the highly vulnerable cohort (Quartile I).

Spatial analysis revealed concentrated vulnerability hotspots (high-high CVI clusters) are dominated by the hazard-prone regions of Jammu and Kashmir (in the western IHR) and the '*char*' belt of the Brahmaputra river basin (in the eastern IHR). The outcomes of the study may prompt effective and targeted policy interventions in the vulnerability hotspots by the rational allocation of adaptation resources. The study may assist in prioritizing, designing effective adaptation strategies and stimulate the coping mechanisms to strengthen the resilience of the communities/sectors.

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Context-dependent Nature of SDGs at the City Level

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Abstract

As we enter the Decade of Acceleration for UN 2030 Development Agenda, one of the bottlenecks to progress can be our limited understanding of the interconnectedness of targets and indicators of Sustainable Development Goals (SDGs). The call for understanding synergies and trade-offs among SDGs has been emphasized both in academia and among practitioners. Consequently, using network analysis,

LeBlanc (2015) provides a mapping of 17 SDGs and 169 targets that had been suggested by the Open Working Group to be adopted at the UN General Assembly Meeting in 2016. Recognizing the knowledge gap in our current understanding of co-benefits and tradeoffs between SDGs, the literature on this topic has grown since the announcement; most of the literature focuses on the national level indicators. However, contingent upon the resources of the national statistical office, the scope of data collection for SDGs varies from country to country, which hinders thorough monitoring and evaluation of the progress.

Since 2008, more than half of the global population lives in urban areas, and by 2050, additional 2.5 billion people are expected to live in those areas, most of which will be in developing countries (UN, 2019). Thus, considering the anthropogenic influence on the sustainable development pathway, how to translate the current national-level context of SDGs to the city-level context will be crucial so that reliable data is collected by cities as well. Using network analysis of a database of city-level goals, targets, and indicators suggested by international organizations and coalitions on sustainable urban development, we find that the climate action goal (SDG 13) is the gatekeeper of all SDGs in the city context, connecting various goals, ranging from sustainable urban development to inequality. Meanwhile, there are goals that exist as stand-alone communities in the overall network, namely zero hunger (SDG2), water and sanitation (SDG 6), responsible consumption and production (SDG12) and life below water (SDG 14) and on land (SDG 15). Going forward, we suggest potential scenarios on how these isolated goals can be achieved in conjunction with other networked goals in the context of cities.

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Innovations from urban margins, the southwestern bow of Stockholm: a research agenda.

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Abstract

The Nordic countries, and Sweden particularly, have been praised by scholars and commentators for their combination of high living standards, low income disparity and economic growth. The picture is strengthened by statistics and rankings presented on various occasions by International organizations, thinktanks, editorials and op-eds in major international newspapers and magazines. In a report by Development Finance International champions Sweden the index on the Commitment to Reducing Inequality (CRI). The Sustainable Developing Report 2020 ranks 192 countries in the world according to a country's total progress towards achieving all 17 goals of the Agenda30. Not surprising, Sweden tops the list.

Meanwhile, inequalities have grown during the last decades even in Sweden and in big cities got obvious spatial imprints as social and economic inequality has to a large degree been transformed into segregation at the level of the city. Researchers at the Södertörn University´s Reinvent Centre have identified a sustainability deficit in the area at southwest parts of the region of Stockholm. In the same area several precarious areas are located, unemployment is higher, political participation, feelings of social isolation and marginalization prevail and health inequalities are apparent.

Meanwhile, huge investments currently directed or announced, investments that will radically change the infrastructural nerve and transform the region of Stockholm from a monocentric to a polycentric city.

The Reinvent center together with actors involved is currently planning a long-term research program using the interventions of the participating actors in the suburban space as cases of study. Three empirical referents in the area have been identified as they confront different challenges: new emerging regional centers, neighborhoods and neighborhood centers.

Research is organized in the thematic areas:

1. Home, trust and belonging, mainly a search for more innovative and sustainable solutions and perspectives that can assist with knowledge of how and what contributes to the creation of trust and feelings of belonging in the neighborhood. Marginalized groups are the foci of the theme.

2. Sociability and practices of culture, the theme is planned to study the co-creation of common places and spaces in and around the emerging regional metropolitan centres, and how this knowledge can be implemented in different types of interventions (e.g. in planning, building, governing, management of the city.

3. Economic sustainability and resilience in non-core metropolis, mainly a search of a deeper understanding of what consumers, retailers, employers of office workers and their employees will demand in the future as office work, retail and wholesale trade that have constituted a significant and critical part of the fabric of the modern city, bringing people together are currently challenged by technological innovations.

Based on previous research in the area the paper discusses the empirical challenges and the theoretical rationale of the planed program.

This study relates to SDG 11, 11.3. and SDG 10, particularly 10.2, 10,3 and 10.7, as well as SDG 16 and particular 16.6 and 16.7.

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From intrinsic values to strong sustainability in the Industrial Ecology: a case study analysis from France.

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Abstract

The development of the concept of Industrial Ecology (IE) is at the heart of the Circular Economy and sustainability studies. Born as a technical strategy to minimize the environmental impact of industries, IE has evolved to becoming a much more complex strategy that aims to deliver more comprehensive solutions to the unsustainable practices of industrial activities. Using an interdisciplinary lens to conceptualize and operationalize the complexity of industrial systems, IE has been a useful and powerful tool to describe, analyse and explain the impact of industrial activities in very specific geographical areas (e.g., industrial clusters and industrial parks). However, the study of IE nowadays is not limited to the industrial parks and the activities within them, it has grown beyond those physical boundaries, and the whole of industrial activities is being analysed in relation to the urban and regional development of the area where those industrial activities are anchored.

In France, Industrial Ecology or Écologie Industrielle et Territoriale (EIT) in French, places the concept of territory at the heart of critical analysis of industrial ecology, allowing the concept to go further into the analysis and development of networks of stakeholders involved in sustainable territorial development. Such an approach has produced a better understanding of how territorial governance processes align with the deployment of strategies of industrial ecology. Nevertheless, EIT's contribution to the sustainable development of the territory is assumed (theoretically) but has hitherto not really been the subject of critical analysis. However, academics such as Nicolas Buclet and André Torre have studied the activation and mobilisation of various territorial capitals and capabilities as a result of IE processes. Developments on that area have shown that the use of such capitals and capabilities can produce more attractive (economically speaking) territories, and generate more innovative activities (not just industrial innovation but also social innovation). This article will build upon those findings with the purpose of describing which capitals and capabilities could potentially deliver larger sustainable territorial development.

Using a larger geopolitical scale (e.g., city, region), rather than just the analysis of industrial parks, this article will take the reader on a journey to discover how IE can enable the development of more comprehensive sustainability strategies using the local capitals and capabilities already in place. It will describe the results of a case study analysis in Strasbourg, France, to illustrate its methodological framework. The researcher uses the theory of relational values, and highlights the importance of understanding the intrinsic values of EI processes in order to reflect and implement (further on) local and regional strategies towards a strong sustainability for the chosen territory.

SDGs related to the article: 11.a, 11.4, 12.6, 16.7, 9.4 and 9.2

This research is of great relevance to discover, manage, develop and enhance the local capabilities of territories towards a strong sustainability paradigm. All sectors of society are able to make the best decisions when they are best informed, this research brings in the local expertise, motivations, values and practices to the centre of the discussion.

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ADVANCING CLIMATE EQUITY UNDER LAW

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Abstract

Climate change presents immense and far-reaching risks to virtually all aspects of society. Impacts are increasingly felt throughout the world and affect the natural systems, built environment, and financial structures that undergird modern life. Climate change has or is expected to deplete water supplies, increase transmission of disease, damage infrastructure, reduce crop yields, and devastate coastline. Left unabated, climate change could inflict over $200 billion per year in economic losses in the United States by the end of the century. Consequences of climate change are occurring with increasing frequency and intensity, and as a "threat multiplier," disproportionately affects frontline communities.

Action is urgently needed to better understand, actively reduce, and fairly allocate the harms and costs associated with growing climate risk. This is not to suggest that progress isn't underway; climate science is produced with increasing precision, financial actors are beginning to recognize linkages between economic stability and climate change, and state and local governments are beginning to order climate resilience planning. These activities to further climate resilience are critical. More is needed, however, and in particular, scholarship illuminating best practices and legal implements in advancing equitable, durable, and holistic climate resilience planning is critical.

This project seeks to address this need. It contemplates a manuscript that would identify best practices and potentially available legal tools to advance those best practices. In particular, resilience planning would be considered in the context of how best to:

Consideration 1 - Ensure that recommended action does not lead to outcomes that contribute to climate change;

Consideration 2 - Embed equity in design, process, and implementation; and

Consideration 3 - Premise recommendation upon a clear assessment of risk, prioritization, and capacity.

Project Objectives:

1. Producing a jointly authored manuscript that considers climate harms and the best legal tools in advancing equitable, durable, and holistic climate resilience planning.
2. Providing a sample jurisdiction with equitable climate resilience strategies that they can implement.

Full papers

Small destination entrepreneurs' adaptation to changed circumstances caused by the pandemic 2020-2021

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Abstract

Purpose: This article explores the adaptation of small tourist entrepreneurs to the Covid-19 pandemic. Methods: A qualitative approach is used in this study. Eleven destination entrepreneurs in Gotland, Sweden, responded to an online survey. The survey guide contained questions about entrepreneurs' backgrounds, the business's art, experiences over the challenges pandemic has caused, and solutions used to tackle the situation. Analyse these responses were made using theoretical concepts such as change- and crisis management and skills of resilience. Results and Discussion: Results show that the current situation offers insight into both possibilities and future challenges. The entrepreneurs' efforts and attitudes show an ability for resilience. Their activities and knowledge can be seen as essential for all destinations; their ability to resilience, not least after the pandemic, should be given more attention. Their contribution to economic development and social capital in tourist destinations and societies seems to be vital. Implications: The study results show the importance of paying more attention to the role of small entrepreneurs in the development of destinations, not least due to their ability to resilience.

Keywords: bricoleur, change management, crisis management, life-stylers, resilience

SDG+Target:11.b

1. Introduction

As we used to know them, life and work were, to an extreme or extensive degree, changed in spring 2020. Across the globe, the spread of novel coronavirus has been leading to profound changes in the whole tourist sector. Destination providers and entrepreneurs in the world, including the island of Gotland, in Sweden, have been forced to adapt to changing circumstances. The common trend in the tourist business worldwide has been the rapid decline of customers. This unexpected event has surprised a majority of entrepreneurs affected, and their companies have had no choice but to accept the situation. Many aspects of the crisis that we are facing have striking similarities with what has been widely

discussed in risk management literature for decades. The current pandemic crisis affects our lives in the social, economic and political context (Zhang et al. 2020).

The scientific literature available on the pandemic platforms shows that the vast majority of articles deal with the technical analysis of the characteristics of the new virus, the challenges in identifying appropriate treatment, while fewer addresses the many psychological and practical challenges and crisis management this pandemic is causing for the people. (Liu et al. 2020; Zhang 2020; Brooks et al. 2020). Resilience management has been a term that has been discussed in adaptation to the current situation. There has been a lack of preparedness in facing this global pandemic; we have been acting in a blind trust in believing that disaster and crisis would not include us, despite several warnings that were out there earlier issued by medical experts. Reports depicting the likely impact of a widespread coronavirus infection could look like, and corresponding countermeasures were previously available in newspapers and expressed by regional and national risk assessments reports in various countries (Griffin, 2007).

In this global lockdown, business management has been rebooted as, more or less, a home-based, technology-enabled, remote activity, sometimes with almost no physical contact (Harris, 2020). The massive lockdown has required business managers to respond overnight. According to the latest data from the World Tourism Organization (UNWTO), the downfall of global tourism was dropping by 74 percent caused by the Covid-19 pandemic. Due to an unprecedented fall in demand and widespread travel restrictions, destinations worldwide welcomed one billion fewer international arrivals in 2020 than in the previous year (UNWTO, 2021). The tourism industry has run into financial difficulties. Many of the tourist entrepreneurs fight for their survival (Gössling, Scott, and Hall, (2020). Innovative solutions are needed not only for survival but also for sustainability. The tourism industry has received financial support at the national level and locally during the pandemic worldwide. Statistics in Sweden and European Commission (SCB, 2013; EC, 2020) state that 1.1 million micro-enterprises in Sweden correspond to 96 percent of all companies in Sweden. This should be transferable to the tourism industry. However, minor tourist entrepreneurs, often classified as micro-entrepreneurs, have received little or no support during the pandemic (UNWTO, 2021). This situation is even the case in Sweden and on the island of Gotland, one of the major tourist destinations in Scandinavia, having many small entrepreneurs working with the tourist industry (Oxenswärdh, 2018). Throughout this crisis, the international statistics community has continued to work together in partnership with national statistical offices and systems worldwide to ensure that the best quality data and statistics are available to support decision making during and after the crisis. The Committee for the Coordination of Statistical Activities, CCSA, has been compiling the results in several reports (CCSA, 2021). There are also initiatives to revitalise tourism after the pandemic by organising competitions and different kinds of events and campaigns (UNWTO, 2021).

There have been suggestions in tourist organisations to use the opportunity to rethink the tourism sector and its contribution to the people and planet, creating more sustainable and inclusive and resilient tourism (Cantele, and Zardini, 2018). This article explores the impact of the Covid-19 pandemic that it currently poses to small tourist entrepreneurs within the destination of Gotland, Sweden. More specifically, the study explores how some entrepreneurs have adapted to the current situation with the pandemic entailing this sweeping and transformative change of organising their work and how they have been able to relate mentally to the situation. Further on, entrepreneurs' strategies for change and recovery plans are investigated.

2. Theoretical perspectives

Change management - crisis management

The rapid pace of change in organisations, society, and technology requires employees to continually adapt to changes (Fugate et al., 2011). Employees' acceptance and support of change are critical to organisational change (Armenakis et al., 1999; Miller et al., 2006). Procedural fairness, a powerful determinant of individuals' reactions to organisational change, has received much attention from researchers and practitioners (Brockner et al., 1994; Brockner, 2002). Leaders have been making a difference through creativity and innovation. The terms organisational change, change management and crisis management appear to be used in various literature perspectives, but the concepts have not been adequately clarified. Crisis management is applying strategies designed to help an organisation deal with a sudden and significant adverse event. The nature of the potential damage varies based on the crisis's nature. In most cases, though, a crisis can affect health or safety, the organisation's finances, the organisation's reputation, or some combination of these. Crisis management is a comprehensive process put into practice before a crisis even happens. Crisis management practices are engaged before, during and after a crisis. The COVID-19 pandemic has forced us to change many traditional crisis management plans worldwide and create new ones (Heller, 2020). Consultants and practitioners have often been driving organisational change management. There have been critics for these offered solutions; they are too general, simplistic, shallow, not evidence-based and therefore misleading (Alvesson and Svenningsson, 2008; Helms Mills et al., 2009). One could claim that change-constant in organisations exist, and function in complex, multiple contexts and is ever-changing. The organisational change management area appears to be in a tangled state without clear boundaries. Many so-called best practices, such as total quality management, Six Sigma and Lean, are based on anecdotal evidence rather than empirical data. The same situation could be expressed in crisis management models (Goffnett, 2004; Schroeder et al., 2005).

We now witness the change that we are not very familiar with. Some common organising structures and patterns have been changing during this crisis management. Networks seem to be at the front-line of the resilience action in the fight against COVID-19. Since the beginning of the pandemic, formal and informal groups connected by social ties have emerged in force. During this period, the favours chains have multiplied with initiatives of support and help towards the most vulnerable. Volunteers have mobilised themselves to meet the basic needs of populations at risk.

The crisis has led to the emergence of collaboration networks, neighbourhood solidarity, and increased volunteerism, causing a substantial change in people's behaviour, from individuality to collectively (Heller, 2020). This change in attitudes can explain why informal networks are mainly essential to enact meaningful change: a) Informal networks of social favours provide bridges over systemic gaps that other institutions do not fill. b) They are natural focus groups in which leaders of informal networks concentrate knowledge of their specific groups to support them. c) Understanding the context matters, as does the socioeconomic conditions of life in communities, cultural nuances and possible partnerships with formal institutions. d) Informal networks have people's trust because they are often motivated differently than public or private entities. A global solidarity movement led by and for people and based on the power of collective capacity response has been created. Research on organisational change has been primarily dominated by a macro or systems-oriented focus. Less research has taken a micro or person-oriented focus (Judge et al., 1999). This is problematic because successful change management depends in part on an individual's psychological predispositions. The changing circumstances represent adaptation demands that may value and exceed individuals' coping resources (Judge et al., 1999). Parallel, researchers have called for a better understanding of organisational change from the individual perspective or person-oriented focus (Herskovits and Meyer, 2002; Judge et al., 1999; Piderit, 2000). Some individual differences that are important to consider when understanding reactions to any change include an individual's willingness to change and the ability to manage to change demands (Fugate et al., 2011; Seibert et al., 1999), and dispositional resistance to change (Oreg, 2003, 2006). In addition to individual differences, situational factors are also likely to influence employees' perceptions of change (Weiner, 2009). In summary, reactions to organisational change are both individual differences and situational factors and likely the interactions between the two. It is also plausible that these variables can influence one another (Carr, 1993, 2001; Carr and Gabriel, 2001).

Entrepreneurs as bricoleurs and life-stylers

Innovative entrepreneurs who create value in environments with scarce resources are called 'bricoleurs' by Baker and Nelson (2005). Being a bricoleur involves three complex sets of behaviours: firstly, making do, which could refer to creating something from nothing; secondly, it means refusing to accept limitations, such as accepted definitions, practices and social conventions; thirdly, it means appreciating

action and improvisation as well as taking part in several projects and always responding to new opportunities (Baker and Nelson, 2005; Davidsson, Baker, and Senyard 2017; Fisher, 2012). Companies seeking long-term survival solutions can benefit from the mindset of entrepreneurial bricolage (Stinchfield, Nelson, and Wood, 2013). A new type of entrepreneurship associated with so-called life-stylers has emerged in the tourism sector. According to Gomez-Velasco and Saleilles (2007), there are numerous definitions of lifestyle entrepreneurs. For Burns (2001), lifestyle entrepreneurs are primarily motivated by their desire to do something they enjoy and provide an adequate income. However, according to Morrison (2006), the main reason lifestyle entrepreneurs start a business is not economical. In the tourism industry, lifestyle entrepreneurship can be a highly creative and innovative occupation because it is not a profit-driven business but rather provides opportunities to engage with market consumers (Shaw, 2004). Research also shows that in creating new tourism products and services and the conservation and promotion of local natural and cultural heritage lifestyle, bricoleurs are important actors in creating platforms for understanding sustainable tourism development (Baker and Nelson, 2005; Ateljevic and Doorne, 2000).

Resilience

Although and maybe because of the transdisciplinary character of the concept of resilience, there is no universal definition applied to all domains. In the 1970s, the term was associated with absorbing and overcoming the effects of significant, unexpected and brutal disruption to ecological systems (Holling, 1973). Hybrid definitions have since emerged in many disciplines, including geography (Holling, 1973), psychology (Richardson, 2002), sociology (Saint Arnaud and Bernard, 2003), organisational sciences (Reinmoeller and van Baardwijk, 2005) and ergo-psychology (Hollnagel, E., Woods, D. and Leveson (2006). In the absence of a consensus over the definition of the concept, resilience can be defined as a system's capacity to absorb disturbances and reorganise itself during ongoing changes (Walker et al., 2004). A system can be very resilient yet fluctuate significantly and therefore be pretty unstable in practice. This approach seems relevant in the case of Covid-19 pandemic where, given the enormity of the shock, it is more important to preserve relationships in the socio-technical system than to return to the previous equilibrium as quickly as possible, which in fact can be considered to be an unrealistic expectation (Bunn and Heinonen, 2011). In the physical sciences, materials and objects are termed resilient if they resume their original shape upon being bent or stretched. For humans, resilience refers to the ability to bounce back after encountering difficulty. Resilience is the ability to maintain healthy levels of functioning despite difficult experiences or returning to normal functioning after experiences of adversity (Constanzo et al., 2009). The characteristics of high resilience levels are optimistic, acting positively, and representing self-assurance when experiencing difficult life situations. This is linked to better physical and mental health and well-being (Connor and Davidson, 2003). People with high resilience in experiencing serious threats are more flexible and adaptive when responding to new crises (Rutter, 2006).

The American Psychological Association defines it as the process of adapting well in the face of adversity, trauma, tragedy, threats and even significant sources of stress – such as family and relationship problems, serious health problems, or workplace and financial stresses. George Vaillant (2002) describes resilient individuals as twig with a fresh, green living core. When twisted out of shape, such a twig bends, but it does not break; instead, it springs back and continues growing. Resilience as a concept is complex, multidimensional and dynamic (Bonanno, 2004). Today, resilience as a concept in research and practice, especially sustainability, is widely discussed (Rockström et al., 2009). It is estimated that up to 90 percent of all individuals will experience at least one serious traumatic event during their lifetime (Norris and Sloane, 2007). Traumatic events throw our lives into turmoil in unpredictable ways; no two people will respond to them in precisely the same manner. For some, the event's stress will become chronic, lasting for years. Nevertheless, many people will find ways to meet the challenge and continue their purposeful lives.

An American research group in psychology has presented ten characteristic features of humans that can be considered resilient. They recognised resilience factors such as 1) being realistic optimist, 2) ability to face fear, 3) having a moral compass, 4) practising religion and spirituality, 5) getting social support, 6) having resilient role models, 7) being in good physical shape, 8) having good brain fitness, 9) having cognitive and emotional flexibility and 10) having a feeling of meaning and purpose in life (APA, 2021; Sharma et al., 2017). According to Norris et al., 2007, an individual's resilience is linked to the community's ability to prepare for, respond to, and adapt to adverse conditions. It could be said that when problems are shared, so must be the solutions (Norris et al., 2007). Norris et al. (2007) believe that community resilience relies on the effective sharing of resources. In their model, community resilience depends on four primary resources: a) economic development, b) social capital, c) information and communication, d) and community competence.

These theoretical aspects, presented above, are used in this study as a foundation for analysing and understanding the statements made by small entrepreneurs, regarding the adaptation in changed circumstances in their work and businesses, due to current pandemic, Coronavirus disease, Covid-19.

3. Methods

This article examines how the ongoing pandemic poses challenges and offers possibilities in destination development by analysing 11 small tourist entrepreneurs' responses to their ability to adapt to the current situation.

Data collection

This qualitative study focuses on some entrepreneurs and their experiences in the current situation of the ongoing pandemic, caused by the Covid-19 virus. The entrepreneurs were chosen among small entrepreneurs having earlier co-operating with the international master course of Destination development programme at Uppsala University, Campus Gotland. All 11 entrepreneurs are practising their businesses in Gotland in Sweden within the tourist sector. The results of this study consist of responses from these eleven entrepreneurs. Data collection for this study took place between Feb-March 2021. An interquest (a hybrid over the interview and inquiry) was sent digitally to respondents. The interquest was composed of three sections, each containing related questions: 1. The background, consisting of, in total, five questions. 2. Consequences of changed circumstances, consisting of eleven questions. 3. Future plans, nine questions. Data analysis was made using the theoretical concepts presented in the section of Theoretical perspectives. The results and analysis are presented using the inquiry structure in the following. The study is limited to a small number of respondents and their reflections on their experiences over the ongoing pandemic and does not claim statistically significant results.

4. Results and analyse

Entrepreneurs and their background

Entrepreneurs in this study can be classified as micro-entrepreneurs having a minor than ten employees, and several of them having only seasonal workers. The responses show that most entrepreneurs in this study are women and have a university degree; most of them have a bachelor's degree. The more significant part is in the age range of 40 to 60 years old. Entrepreneurs seem to have several jobs and entrepreneurship that are partly or totally tourist-related. They can be called bricoleurs. Bricoleurs are innovative entrepreneurs who create value in environments with scarce resources (Baker and Nelson, 2005). Also, Oxenswärdh (2020) highlights these entrepreneurs and their ways of combining several professions and activities to support themselves. On the island of Gotland, this type of entrepreneurship is quite common, having its root reasons in a short length of tourist season, consisting of 2-4 months, primarily due to climate conditions (Oxenswärdh, 2020). Two of the entrepreneurs are married couples, farmers, and BnB providers. They also have other occupations and functions, not referring to entrepreneurship in tourism. Also, an advisor and business developer, civil servant, priest, and digital developer work with other activities than tourism. In table 1., the entrepreneurs and their art of business/work are presented.

Table 1. The entrepreneurs and their art of business.

Entrepreneur
Farmer, tourist entrepreneur
Advisor, project manager, consultant
Business manager and property developer
Priest, Church of Sweden
A representative for the local community
The civil servant in County Administrative Board
Digital developer
Tourist and event entrepreneur
BnB entrepreneur
Event developer (historical event)
Organizer for Harvest festival

Only two of the respondents claim to have had the Covid-19 virus, but nine of them have a close family member or co-worker, a colleague who has been affected by the virus.

Consequences of changed circumstances

Changed working routines

Many tasks have now been taken care of online with digital meetings and planning, respondents state. They also claim to be quite experienced and accustomed to working digitally with the tasks they also performed before the pandemic. However, the difference they experience today is primarily the increased implementation of meetings online that could previously be handled physically. Some entrepreneurs have planned their entire business/events online and digitally. This planning requires increased technical knowledge and more time, and new creative solutions. Entrepreneurs experience both advantages and disadvantages because the new work is mainly managed via computers.

¨ The problem is that it is challenging to mingle and talk freely with anyone. The advantages are that we have had time for more meetings per week as we have not had any travel time.¨

¨ There is an opportunity for multiple trans-regional gatherings. Problems: even more potential networks to participate in (and thus only communication time, no more functional space). Digital fatigue, because I do not get the same contact with my partners across the screen as IRL.¨

¨ The daily spontaneous communication is lacking. I enjoy working at home and creating a more free routine. There is the freedom to control one's day.¨

¨ I gain much time when I do not have to travel to meetings. I miss the corridor talk, the flow of information at work.¨

¨ Have no problem; this has been the best working time I have ever had.

¨I have long and deeper conversations with my co-workers. It happened even earlier, rarely, but now often and with better quality. ¨

¨We cannot talk in the physical workplace as we share space with 50-60 others.¨

¨ Conversations can only be made in coffee rooms with other colleagues around.¨

Seven respondents claim that they have not spent more time planning their work than earlier. Four respondents declare that it has taken longer to plan their activities now due to the pandemic situation than earlier.

¨ We have had more time to work due to less travel time and guests.

¨ Yes, it feels like it takes more time for planning, more energy for implementation, and follow-up. Planning takes much effort that is not replenished at the same rate.¨

These answers witness different thoughts over the current situation and entrepreneurs' different working conditions. Sometimes it is not easy to distinguish which of their areas of activity they refer to. As bricoleurs, they work with different tasks; not all of these responses refer to their role in tourist entrepreneurship. Still, they express both benefits and challenges in working within changed working conditions. The most problematic had been a lack of live communication, which leads to more spontaneous communication and networking with different counterparts. Nevertheless, it seems that entrepreneurs have adapted well to this change. Maybe it's because digitalisation of their business has been going on for the past decade and was nothing new for them when the pandemic broke out (Armenakis et al., 1999; Miller et al., 2006). These answers also show that entrepreneurs indicate realistic optimism to the current situation (Connor and Davidson, 2003; Palmitier et al., 2021).

Support needed and received

¨In the event of significant changes, the need for support is important.¨

¨Because things happen quickly, consultants do not have time to help us with practical questions.¨

Some of the respondents argue that their network has been beneficial in technical matters. Others state that they did not have support what so ever; one of the respondents state that he has got economic support, another one again clarifies that she has acquired new knowledge to cope with the upcoming situation.

¨I have got valuable equipment and psychological support from my boss. Working at home with my husband in another room - also working. Feeling absolutely not isolated as I know others do.¨

¨I got a laptop from work.¨

These answers show how entrepreneurs try to cope with this situation that has arisen by combining networking and self-help in everyday life. This expresses how adaptable these entrepreneurs are to change and the crisis. This, in turn, may be since they are dependent on external circumstances over which they cannot be affected as micro-entrepreneurs (Fugate et al., 2011; Seibert et al., 1999). This seems to create change preparedness and can reduce their resistance to change (Oreg, 2003, 2006).

The Economic situation

Tourism is one of the world's most important economic sectors. It employs one in every ten people on earth and provides livelihoods to hundreds of millions more (UNWO, 2021). Entrepreneurs worldwide, but even on the island of Gotland, are stating that pandemic has been accompanied by fewer customers, changed booking rules but in a generally demonstrated high understanding of the situation.

¨Some of the customers are very scared, but all have been flexible with changed circumstances.¨

¨ We have lost many significant group events, no support offered by anyone!¨

¨ A large part of the guide jobs towards my target group, cruise tourists, will be absent even in 2021, I think; so two summers and missed sales with about half a million in the company feels awkward.¨

¨ Difficult to meet new contacts via networking online.¨

¨ Fewer guests, large amounts of cancellations.¨

The financial losses have been handled in different ways by these entrepreneurs.

¨ Has received support through the Cultural Council, and we have few differentiated activities, so we are not entirely dependent on the hospitality industry.¨

¨ I have received 82,000 SEK in support from the National Board of Housing, Building and Planning in sales support and will possibly receive more.¨

¨ Yes, we have got redundancy support and adjustment support.¨

¨ Yes we have got both, state and municipal support.¨

Half of the entrepreneurs state that they have some economic compensation or support for their losses. Others, often the minor entrepreneurs, have not got any support. The answers show that many of these entrepreneurs have other incomes than those from tourism. This makes them feel safe and less sensitive to economic fluctuations. Generally, entrepreneurs in Sweden have received financial compensation for staff redundancy and state adjustment aid support. Some of the respondents are still waiting for support to come. In the meantime, they are, e.g. renovating their premises and locals and planning for future operations. These responses reveal that entrepreneurs act positively and represent self-assurance (Connor and Davidson, 2003).

In summary, it can be stated that these entrepreneurs describe the consequences of changed circumstances by referring to changed working routines, the support needed and received, and their economic situation during the pandemic. The most significant change has been the lack of guests. This has also led to increased online work and considerable financial loss. However, these changes are perceived as something threatening and harmful, but the entrepreneurs highlight several things that can be seen as opportunities. This, in turn, can mean that entrepreneurs have adapted well to the new conditions caused by the current crisis. Their statements and behaviour can be considered as the ability to resilience (Connor and Davidson, 2003).

Future plans

Although the pandemic has been a time of crisis, it has also brought insights to entrepreneurs about future opportunities to reorganise their work. Some of them have had time to think and review their administrative routines and improve them. The compulsion to work digitally has led to a certain streamlining of operations. Entrepreneurs prefer less travelling and more qualitative meetings online in

their daily work.

¨We will continue to work from home but add ways to meet for the social reasons.¨

¨Divide the week to work from home and on-site.¨

¨Effective meetings, digitised services and products and better dialogue with customer groups.¨

¨Some new age groups have extended the season - I hope it continues. There are 70+ domestic guests travelling around more now instead of travelling abroad.¨

¨The economy will have difficulty recovering as quickly as we wish, revenue from the arrangement as well.¨

¨That we lost each other socially, to dare to socialise physically again.¨

¨Awareness of the importance of infectious risks upon travel.¨

¨It will probably be a new normal for travel patterns, some caution in terms of more extensive public arrangements.¨

¨Tourism will probably be slightly jerky in the beginning, then normalise.¨

¨Educate more in sustainability. Invest in more environmentally conscious technology, such as solar cells etc.¨

¨Continue driving the development of green nutrition and processing.¨

The statements can be seen as proof of a realistic view of life. Entrepreneurs show optimism, have cognitive and emotional flexibility, and feel meaning and purpose in life (Norris et al., 2007). The answers further show that entrepreneurs have accepted the changes and can even see these as opportunities in the future. There seem not to be a return to the previous equilibrium; instead, entrepreneurs are now even more eager, e.g. to strive for sustainable solutions in their businesses than before. This seems to be in line with UNWTO's pursuit of rethinking the tourism sector to contribute to the people and planet, creating more sustainable and inclusive and resilient tourism (UNWTO, 2021).

5. Conclusions

This article aimed to explore the adaptation of small tourist entrepreneurs' to the Covid-19 pandemic situation during Annus horribilis 2020 and early spring 2021. The study was organised by analysing online survey responses from eleven Gotlandic tourist entrepreneurs. These entrepreneurs can be classified as both bricoleurs and life-stylers. When assessing the ability of these contractors to resilience, adaptation ability become these types of entrepreneurship of importance. These entrepreneurs support themselves with the help of various occupations, which make them bricoleurs. This type of entrepreneurship seems to make it easier for them to become resilient. While moving in different contexts, it is easier to create social networks and get support. In practice, they encounter different solutions to problems and create a realistic and optimistic picture of reality, despite the prevailing pandemic. These properties probably also help in dealing with fear. They similarly can easily find resilient role models in their networks. As being so-called life-stylers, these entrepreneurs train their cognitive and emotional ability to adapt to different contexts. They use their moral compass in everyday life, which gives them a feeling of meaning and purpose in life, all characteristics of a person with high resilience skills. This also becomes visible through their answers about the future. They look to the future realistically and optimistically: they are ready to learn from the difficulties and challenges they have experienced, and at the same time, they take the opportunity to improve their operations, not least towards more sustainable solutions that will benefit the entire planet. In conclusion, it can be stated that these small tourist entrepreneurs, bricoleurs and life-stylers, can be considered resilient. Their activities and knowledge can be seen as essential for all destinations; their ability to resilience, not least after the pandemic, should be given more attention. Their contribution to economic development and social capital in tourist destinations and societies seems vital.

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Mining-Dependency and Corporate Environmental Crime

The challenges in the reconstruction of the municipality of Brumadinho/Brazil

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Abstract

Our paper aims to analyze aspects of the Mining-Dependency in the municipality of Brumadinho, Minas Gerais, Brazil, the possibilities of its overcoming, and the challenges for implementing a more sustainable local development. Our theoretical background is based on critical approaches about the economy, the mining-sector and the local government. We conducted a qualitative research through an extended case study. The research findings show that the basis of Brumadinho historical formation is imbricated to mineral extraction activity. The municipality is heavily dependent on mining, mainly in economic terms. The dependence was more pronounced after the tragedy-crime occurred in January 2019 with the rupture of dam I of the Córrego do Feijão mine, under the responsibility of the mining company Vale S/A. The current scenario is marked by numerous repair works that brought momentary warming of the local economy, fear, and concerns about the future of the territory. The application of resources from mining royalties in local public policies and the promotion of alternatives aimed at the diversification of activities were criticized. Local protagonism needs to be more encouraged and better articulated, especially in decision-making processes on the social management of the territory. To address "mining dependence", some actions were presented by social actors. The model of the Economy of Functioning and Cooperation (FCE) can be satisfactory for implementation in the municipality since it adopts a logic focused more on the human and nature.

Keywords: Local Development. Mining. Brumadinho. Functional & Cooperation Economy. Sustainable Development.

1. Introduction

One of the worst externalities that could happen involving mining came to the fore on January 25, 2019, with the rupture of dam I of the Córrego do Feijão mine in the municipality of Brumadinho -

Minas Gerais, Brazil. The first activities in this Mine came in 1941 when the federal government authorized The Iron and Coal Mining Company S/A to search for iron ore in the region (Bechler and Bechler, 2019). The dam, built-in 1976 by the upstream alteamento method for storing tailings from production, belonged to Ferteco Mineração S/A and was sold to Vale S/A in 2001 (Bechler and Bechler, 2019; Companhia Vale do Rio Doce, 2019). With the rupture, about 12 million m3 of tailings were released, causing deaths and a wave of destruction. The mud came down the Serra dos Dois Irmãos, crossed the road that connects Belo Horizonte to Brumadinho, invaded the Ferro-Carvão stream and traveled 9 km to reach the Paraopeba River. In all, 270 were killed and 11 missing. A significant number, much higher than those killed in the Fundão dam rupture in 2015, also controlled by the mining company Vales S/A, in Bento Rodrigues, Mariana, Minas Gerais, Brazil which caused the death of 19 people and incalculable socio-environmental damage. The human losses and all the conjuncture experienced in Brumadinho led to the emergence of serious sequelae for the community. One of them was the growth of mental health disorders. Since the event in the Feijão Stream and the consequences generated for the municipality, the mining company Vale S/A, under public pressure and from the public prosecutor, has been conducting several reparation actions in the territory, paying indemnification fines and emergency aid to those affected.

Because of the above, dilemmas and challenges arise involving: repair of the damage caused to the victims' families, recovery of the Paraopeba River, local economy, collection, and jobs generated (Coelho, 2020). Discourses on Mining-Dependencyand impacts on territories are strengthened, precisely because dependence is a multidimensional phenomenon. One of the biggest challenges of today's society is to build more sustainable paths at the local and territorial level, which makes the task more arduous due to the prevalence of monoindustrial or extractive mineral activities in given regions. To advance the debate, this article aims to analyze aspects of Mining-Dependency in Brumadinho-MG, Brazil, possibilities for its overcoming, and the challenges for implementing a more sustainable local development.

To allow its scope, the article was divided into 5 sections, the first consisting of this introduction. The second section includes the literature review, in which approaches to development at the local level, mining, and the Functional & Cooperation Economy model is worked on. In the third section, the research method and procedures for data collection and analysis were described. The fourth section is composed of data analysis. Finally, the fifth section with the conclusions is presented.

2. Literature Revision

2.1 Development at the local level

The debates about development are very intense in the academic environment. In the scientific literature can be found multifaceted views from various scientific fields - biology, economics, sociology, anthropology, political science. It is necessary to consider that, for a long time, the systematization of the term development was based on the evolutionary logic resulting from industrial processes. For classical economists, industrialization would be able to build developed societies, constituting a central model that would culminate in the movement towards a more advanced social form (Arocena, 1986; Ferraz, 2000).

Progressive logic, however, did not prevent first-world countries from experiencing phenomena similar to third world ones, especially the following socioeconomic ills: the decline of traditional sectors of the economy, social exclusion, migration – context of developed countries; destructuring and precariousness of working conditions and relationships, increased unemployment rates, the informality of work, crisis in the representativeness of workers and the resizing of employability conditions – context of underdeveloped countries (Arocena, 1986; Ferraz, 2000; Melo, 2008). In the face of structural and social crises, there have been growing debates about the emergence of a new economy that takes into account the performance in the use of resources from the dimensions of well-being and state of ecosystems (Abramovay, 2012).

In Oliveira's conception (2002), "thinking about development is, first of all, thinking about income distribution, health, education, environment, freedom, leisure, among other variables that can affect the quality of life of society" (p. 43). It is to conduct actions that reduce deprivation, an idea that goes beyond the common concept of poverty linked to a low level of per capita income, promoting the real freedoms to be enjoyed by people (Sen, 2000). Its effective scope will depend on planning and participatory and dialogical negotiation among social actors (Sachs, 2004).

The locality became an agenda of Brazilian researchers, policymakers, and government officials in the early 1990s, a period of the new institutional rearrangement promoted by the 1988 Constitution (Goulart, 2006). The verticalist and centralizing pattern that prevailed in previous decades gave way to the decentralization of public actions, giving rise to several initiatives conducted by non-governmental entities and municipal governments in the form of actions and projects against poverty, inequality, or exclusion (Silveira, 2010).

Thus, localities are now seen as agents of transformation and no longer as mere physical support of productive relations, configuring themselves as a means enabled to produce the growth of the region from the exploitation of local, effective and potential capacities (Lima, 2000). Local proximity contributes positively to the identification of problems, the proposition of solutions, the use of the potentialities and skills existing in the territory, and greater social control to ensure the continuity of actions (Amaral Filho, 1996; Lima, 2000). Under this logic, the place is seen as an abstract and

socially constructed space by a process of territorial self-institution and by the social relations of the groups that articulate themselves in defense of common interests (Fischer, 1992; Silveira, 2010).

The local community plays a fundamental role in the constitution and establishment of the processes related to the territory. It seeks to work with a more endogenous vision, that is, the community itself by defining and ordering its processes (Furtado, 1984) to promote local development. The premise is to build "from the bottom up" and from "inside out", from the instituting forces of the territory, from intersubjective and communication relations (Silveira, 2010, p. 49).

Its feasibility depends on the initiative and articulation of its different actors – public, economic, and social, considered as the most interested in the decision-making power and control of development processes because it is understood that the numerous interactions established will motivate them to position themselves actively and positively in favor of local development, thus arcane with the benefits or losses of this participation (Dowbor, 2016; Ferraz, 2000; Tenório, 2012). It is noted that the role of the actor and social action and the role of the political and administrative system are essential to enable transformations (Ferraz, 2000) since the more effective scope of the implementation of local development policies depends not only on a mere individual manifestation but on collective and synchronous actions.

2.2 Mining-dependency and sustainable local development

The theme of mining generates great clashes, especially when it involves aspects related to local development. Social and environmental impacts reproduced in the territories, tensions and conflicts with communities, collection of mining royalties, and the promotion of public policies are just some of the issues that emerge. Given the fixed nature of mineral resources, the power exercised by multinational companies, and the fragility, in many cases, of environmental legislation, there are virtually no barriers to entry and fixation into the territories.

The literature on the theme of mining and sustainable development shows that it can only promote development for current generations if it expands socioeconomic well-being and minimizes environmental damage; and from the future point of view, if it is possible to generate, together with the other economic, political and social actors, alternative wealth to compensate for exhausting resources (Cunha and Guedes, 2017; Enríquez and Drummond, 2007). Mining needs to account for various dimensions to advance the sustainability path since resources are finite and largely non-renewable (Enríquez et al., 2011). The most responsible economic diversification, planning, and allocation of public revenues from the activity become essential to minimize the risk of dependence and achieve local development (Enríquez et al., 2011).

A more critical analysis of mining points out that the "specialization of the productive structure of a municipality, region or country in mineral extraction" portrays a situation of "mining dependence", in

which the directions of the local structure are conditioned and defined by external decision-making centers (Coelho, 2017, p. 2). Dependence includes not only economic aspects, but also social, political, and cultural aspects. In the economic sphere, mineral extraction activity reflects the dynamics of local trade, tax collection, and compensation, incomes circulating in the economy, cost of living, and general economic well-being of the population (Enríquez et al., 2011). In addition, a subordination to global commodity markets is created, where exported ore prices are defined (Coelho, 2018). Due to price volatility, the conditioned territory can expand or retract economically and, thus, the collection from the Financial Compensation for the Exploitation of Mineral Resources (CFEM) and the jobs end up becoming subject to the performance of the activity in the global financial markets (Coelho, 2017; Dowbor, 2016).

A large part of the local population ends up accepting the impacts caused by mining due to the longing for occupations in the activity because they need these jobs – partly because they cannot see other alternatives – and the fear that there will be significant losses of municipal revenue stemming from a scenario of paralysis of these activities (Coelho et al., 2016; Trocate and Coelho, 2020). The dependence on jobs and revenue ends up weakening the questioning of communities and the general population regarding mining projects and weakening the creation of resistance to the enterprises (Trocate and Coelho, 2020).

It is also necessary to consider that on the spot are formed sets of social networks that articulate and overlap through relations of cooperation or conflict, according to the interests, resources, and values desired (Fischer, 1992). Once identified, the social networks that constitute the locality lead to questions about the local political space and the forms of exercise of power (Fischer, 1992). The subtleties of power relations should be considered in the local territorial dynamics, especially when talking about actions aimed at development.

Planning sustainable local development for the reversal of the "ore-dependency" framework is not an easy task. Many territories end up in the great dilemma between choosing to diversify the economy or increase dependence on mineral production (Cunha and Guedes, 2017). In many cases, the prevalent activity ends up being reproduced for decades, regardless of the problems caused so far and the state of economic inertia is only modified through the following situations: end of mineral reserves or when they become unviable and, in extreme cases, due to disasters such as the rupture of tailings dams (Coelho, 2018).

2.3 The Model of the Functional & Cooperation Economy (FCE): an alternative path

The late 1970s was marked by significant economic structural changes. Among them can be highlighted: the decay of the Fordist model of social organization and production and the expansion of the tertiary sector in the economy. The gradual growth of services, initialized in the 1980s, interfered

in the forms of value creation of traditional companies and industrial companies, impelling them to rethink their business models (Benqué et al., 2014; du Tertre, 2013).

According to du Tertre (2013), "the predominant role of services in economic dynamics highlights aspects of work that have not been considered either by economic theory or by institutional and social actors within the real economy" (p. 19). From this conception, service dynamics based on the performance of use of goods and anchored in their functionalities is proposed, that is, on the real value of that work and the immaterial resources existing in the process (Stahel, 2005). According to du Tertre (2013), "an action involving the evolution of the quality of the work process and the development of in-material resources would give a relevance and legitimacy to the new performance model to the extent that the human could re-find a central place" (p. 26).

Although always present, the dimensions of the work were neglected and relegated to the background, especially about the identification of the reflexivity effects of the quality of work and the construction of forms of cooperation based on in-material resources (du Tertre, 2013). The author criticizes the dominant model for distancing itself from collective conviviality, becoming illegitimate for some actors, and for not considering negative social and environmental externalities (du Tertre, 2013).

It complements du Tertre (2013, p. 27-28) that "the subjectivity that Taylorism, Fordism, and Toyotism have strived to limit, to deny as an essential increase in production, is at the center of performance" and to focus on approaches that privilege only financial models, ends up limiting the understanding of work modifications as well as their impacts because social phenomena are interfering within the industrial organization (Abramovay, 2009). Therefore, it proposes a break with the previous molds and the incorporation of a new vision, that is, the intersection between work and the conception of development based on the service economy (du Tertre, 2013).

The Economy of Functioning and Cooperation model was first applied in northern France, in the *former Nord-Pas de Calais (NPDC)*region, currently renamed "*Hauts-de-France*", an area that brings together two former regions "*Picardie*" and "*Nord-Pas de Calais*". According to Gentil (2019), the former mining basin of NPDC lasted for almost two centuries with the activity of coal mineral extraction and, in the late 1980s, the region experienced a severe socio-economic crisis. The local economy began to decline through the closure of mines and industrial enterprises, and the extinction of activity, raising the unemployment rate, in addition to economic, environmental, cultural, social, and psychic losses derived from change (Gentil, 2019; Lima et al., 2019).

In general, it is structured in four pillars i) the "scissor effect" that proclaims the degrowth of material goods and the growth anchored in values of use; (ii) cooperative ecosystems based on cooperation and work; iii) the expansion of governance to actors; iv) the service dynamics (Lima et al., 2019).

The "scissor effect" is equated to the logic of service, that is, it touts less dependence on limited material resources and greater emphasis on intangible and infinite resources that generate values

whose effects cannot be measured (de Gasparo, 2019). Cooperation usually occurs between people and their strength comes from meeting those who want to work from the perspective of the common incentive, resulting in the production of joint solutions and distribution of the value produced (Ademe et al., 2017; Gasparo, 2019).

Building an ecosystem depends on sharing knowledge from both people and organizations. Therefore, de Gasparo (2019) states that this new dynamic requires a change in the economic model of companies, public agencies, associations, and residents of the territory itself. The cooperative production ecosystems present in the territories are capable of generating economic and social innovations, contributing to economic development (Lima et al., 2019). However, such innovations should not start from models focused on competitive intensification and economic war, but rather create ways to escape the domination of large companies that exploit local wealth for profit only (Lima et al., 2019). The vital idea is to rethink the value of social relations, not considering them as purely marketable.

FCE contributes to the development of the territory because it "revisits lifestyles and consumption, ways of production and organization of work, mobilization, and development of resources, performance and evaluation model, business model, distribution methods and accumulation of monetary value and governance model" (Ademe et al. 2017, p. 3).

3. Methods

The qualitative research was carried out in a territorial unit that has the predominant mining activity: the municipality of Brumadinho, located in the state of Minas Gerais, Brazil. We chose to choose only one territory because it could represent the phenomenon to be investigated. It is also added the fact that recently Brumadinho suffered and still suffers the reflections of the rupture of the dam I of the Córrego do Feijão mine.

The method adopted was the *Case Study Extended*, proclaimed by the social scientist Burawoy (1998, 2014). Anchored in the reflexive model of science, which is based on the intersubjectivity of the scientist and subject of study, the method seeks to "promote engagement as a way to sociological knowledge" and the intervention in the social reality from the participation in the studied phenomenon and the multiple dialogues established to explain it (Burawoy, 1998, p. 5). The extended case study distances itself from the prescriptive character of positivist epistemology and the traditional models of case studies operationalized in management courses. It approaches the epistemology of Kuhn, Popper, Lakatos, and Polanyi by criticism of the hegemonic form of science (Silva, 2018). The idea defended is to expand things from the field, that is, to take the context as a starting point and participant observation to "locate everyday life in its extra local and historical context" (Burawoy, 1998, p. 5). The method allows the construction of critical social theories emanating from the local realities themselves (Eliasoph and Lichterman, 1999).

The operationalization of data collection occurred in two stages that were built simultaneously to ensure a good triangulation. A survey of historical information, the main characteristics of Brumadinho, and socioeconomic data was made through consultation on official websites of the federal government, the state of Minas Gerais and the municipal sphere, and inspection agencies. Relevant data were collected, such as MHDI – Municipal Human Development Index – (to evaluate human development); GDP *per capita* (to assess economic performance); level of employment and income by sector (to identify the strength of the mining sector and potential sectors of the territory); and the weight of tax collections in the broad and specific sense of the CFEM (to analyze the financial dependence of mining).

In-depth semi-structured interviews were applied to local social actors. The categories observed during the interviews were: ways of life; perception of mining and development generated by the activity; the degree of dependence; impasses, expectations, and challenges for paradigm shifts, especially for the construction of more sustainable alternatives; socioeconomic future of the territory. The choice of local actors was based on the criterion of representativeness of the sector/activity and geographical location. The interviews were segmented into representatives of the 1st sector (municipal public managers), representatives of the 2nd sector (tourism and trade segment, mining companies), representatives of the 3rd sector (organizations / non-governmental associations); and people who reside dwell or reside at some point in the municipality. Before the interviews, a previous list was made - a survey - with the names of people who fit the profile to be analyzed. The indication of the names came from people from the territory itself. Then, telephone contact was made to grant the interview and scheduling. A code was adopted to preserve the identity of respondents.

In all, 12 in-depth interviews were conducted through a semi-structured questionnaire, the first being considered as a pre-test to validate the interview script. Due to the pandemic scenario of Covid-19, which made the face-to-face meeting difficult, 10 interviews were conducted online and 2 in-person.

The data collected through the interviews were analyzed based on the interpretation of the statements. The research findings are presented below.

4. Results and Discussion

4.1 Historical context and characteristics of Brumadinho

The history of Brumadinho has its initial milestone in the late seventeenth century with the arrival of flags headed by Fernão Dias Paes Leme in search of gold and precious stones. The Portuguese Crown encouraged such practices in exchange for the promise of goods and honors to its pathfinders. Numerous expeditions carried out in the state of Minas Gerais, at the time, ended up contributing to the foundation of villages in the region of the Paraopeba Valley and the Rio das Velhas Valley. In Brumadinho, initially, a food supply point and a resting place for tropeiros were created (IBGE,

2017). The demand for precious metals has resulted in the discovery of large deposits of iron ore, very abundant in the region. As a result of this discovery, the small stingrays where the miners came to live were founded. A few years later, the first historical villages were constituted: São José do Paraopeba, Piedade do Paraopeba, Aranha and Brumado do Paraopeba, also known as Brumado Velho (Brumadinho City Hall, 2019). The constitution of such regions marks the first phase of the history of occupation of the territory.

During the period of settlement and arrival of large enterprises both state and private, the social and economic dynamics preexisting in the territory and established by traditional communities – such as riverside, fishermen, indigenous and small farmers – were disregarded (Bechler and Bechler, 2019; Borsoi, 2007). The development of the coffee crop and the possibility of extracting and exporting iron ore were paramount for the construction of the Paraopeba extension that connected the region to the Central Railroad of Brazil. Many people, including foreigners, came to work on the construction of the line and ended up setting residence in several nuclei. The inauguration of the Brumadinho Railway Station in 1917 is considered very important for the ostentatious occupation of the region, contributing to the historical formation of the city of Brumadinho (Brumadinho City Hall, 2019).

Gradually the village of Brumadinho began to take city status, highlighting the opening of small shops. The new spatial arrangement stemming from the creation of the railway complex resulted in the emancipation of the municipality on December 17, 1938, through the decree Law No. 148/1938. Then, Brumadinho went from a district belonging to the city of Bonfim to an independent territory.

Today, the municipality is part of the Quadrilátero Ferrífero (QF) region, the most important mineral province in southeastern Brazil (UFOP, 2020). A name given due to its square morphostructure, the QF region makes an approximate area of $7{,}000^{km2,}$ covering the central-southeast part of Minas Gerais that covers from Ouro Preto, the former capital of Minas Gerais, to Belo Horizonte, a new capital to the northwest (Azevedo et al., 2012; Roeser and Roeser, 2010). Brumadinho is considered the fourth with the largest territorial extension of Minas Gerais with an approximate area of 639,434 km² (IBGE, 2020), and is divided into five districts: Sede, Aranha, Piedade do Paraopeba, São José do Paraopeba and Conceição do Itaguá. In 2020, its population was estimated at 40,666 inhabitants.

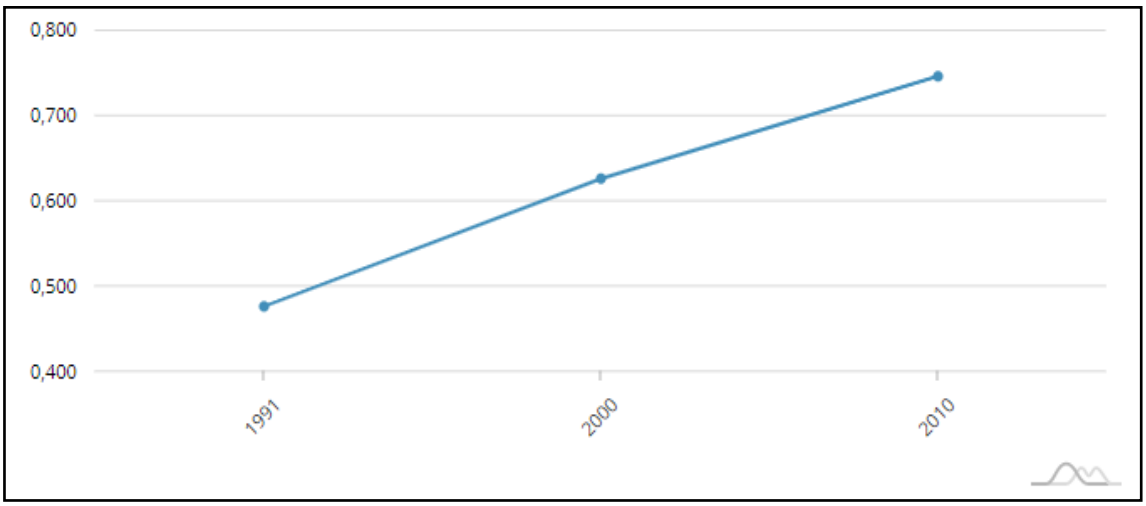
One of the potential activities of the municipality is tourism. There are several sights, such as: the Serra do Rola Moça State Park, the Serra da Moeda, the tourist circuit of Veredas do Paraopeba, the Casa Branca district and Inhotim. The Inhotim Institute is now considered the largest open-air museum in Latin America. Agriculture is mostly practiced by small and medium-sized properties based on the family workforce. Dairy, mixed and beef cattle stand out; fruit growing, with the production of ponkan gossip, so expressive in the region; olericulture; and the production of artisanal cachaça (SENAC Minas, 2020).

4.2 Socioeconomic aspects of the municipality

This topic will be presented the evolution of the following indices and socioeconomic data: MHDI and GDP, generation of work and average income by sector, and mining royalties. The databases consulted were the websites of the Brazilian Institute of Geography and Statistics (IBGE), João Pinheiro Foundation (FJP), Court of Auditors of the State of Minas Gerais (TCE), Ministry of Economy, and National Mining Agency (ANM).

According to the last census of 2010, the MHDI of Brumadinho reached 0.747 (IBGE, 2020), which is considered high. It is noted that there was an expressive growth in the period between 1991 and 2010 (Graph 1). It is important to emphasize that the index is calculated every decade, having as a parameter the demographic censuses.[1]

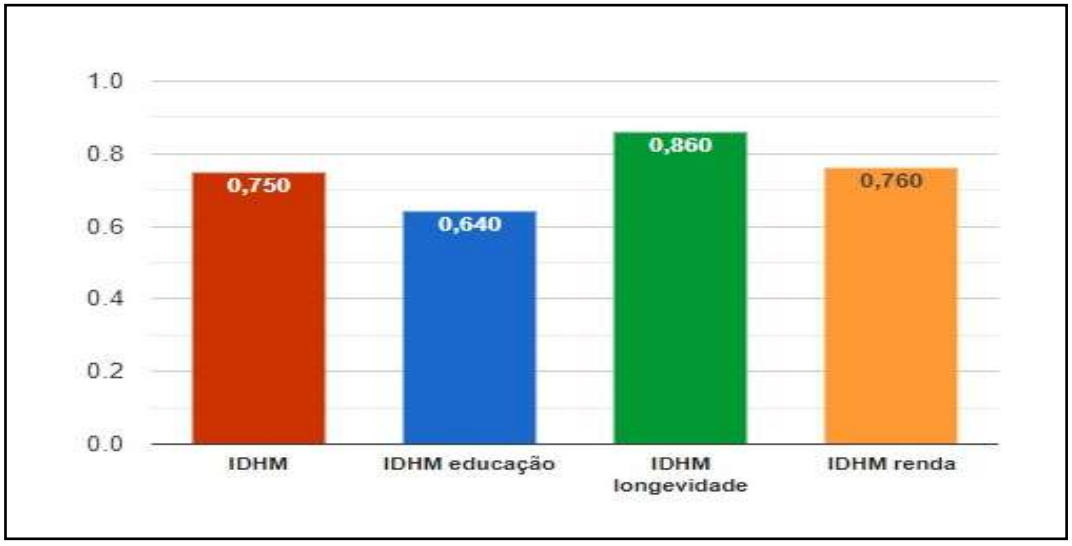
Graph 1. Evolution of the Municipal Human Development Index (1991-2010)



Although growth is at the level considered high, by dismembering the MHDI in the components "education", "longevity" and "income" – nomenclatures adopted by the João Pinheiro Foundation (2020), education presented lower MHDI with 0.640, setting itself in an average position. Income, with 0.760, presented high performance and longevity (0.860) is in a very high position. The data show that there is a need for advances in public policies focused on education (Graph 2).

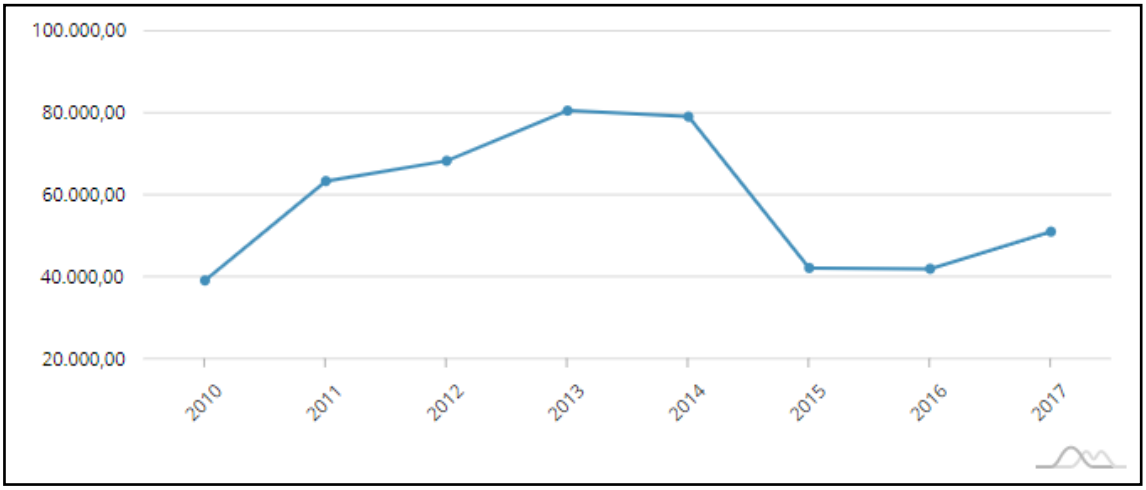
[1] A priori, the demographic census of 2020 was postponed to the year 2021 due to the Covid-19 pandemic. Intense debates are ongoing with the prerogative to postpone it again until next year - 2022.

Graph 2. MHDI and its components - Brumadinho - 2010



Data collected from IBGE (2020) show that in 2017, GDP per capita was R$ 51,164.41. According to the evolution presented in Graph 3, it is feasible that, in the period between 2010 and 2013, there was a growth in values, stagnation in 2014, a sharp decrease between 2015-2016, and more timid growth in 2017.

Graph 3. GDP evolution per capita (2010-2017)



With regard to formal employment ties, according to the Ministry of Labor (2019), the service sector was the most employed in 2019. Occupying the first place, the jobs focused on the public area emerged, reaching the number of 2,778 formal jobs. The industry comes next with emphasis on the extractive industry, which has computed 2,085 hires. The construction sector reached a margin of 1,739 formal jobs, with the construction of buildings and infrastructure works the activities they employed the most, generating 1,003 and 720 jobs, respectively. Trade also stood out through retail trade, about 1,125 formal jobs. Finally, the agricultural activity with 194 contracts (Table 1). On the average remuneration, it is noted that the highest values derive from the sectors arranged in the

following order: extractive industries (R$ 4,368.63); infrastructure works (R$ 2,773.87), and public-area jobs (2,581.65).

Table 1 - Grouping of labor by economic sector and average remuneration in 2019

Sector/ Economic Activity	Stock	Celetista	Statutory	Average remuneration
Total Services	**5.187**	**2.944**	**2.243**	**R$ 2,321.91**
Information, communication and financial, real estate, professional, and administrative activities	704	704		R$ 2,401.21
Other services	667	667		R$ 2,139.83
Public administration, defense, social security, education, human health, and social services	2.778	535	2.243	R$ 2,581.65
Transport, storage, and mail	522	522		R$ 1,953.70
Accommodation and food	514	514		R$ 1,411.83
Home services	2	2		R$ 1,225.00
Total Industry	**2.625**	**2.625**		**R$ 3,694.35**
Extractive industries	2.085	2.085		R$ 4,368.63
Manufacturing industries	534	534		R$ 1,460.60
Water, sewage, waste management, and decontamination activities	6	6		R$ 1,724.29
Total Construction	**1.739**	**1.739**		**R$ 2,248.43**
Construction of buildings	1.003	1.003		R$ 1,863.47
Infrastructure works	720	720		R$ 2,773.87
Specialized construction services	16	16		R$ 1,750.32
Total Trade	**1.166**	**1.166**		**R$ 1,584.71**
Retail trade	1.125	1.125		R$ 1,593.08
Trade and Repair of Motor Vehicles and Motorcycles	33	33		R$ 1,320.76
Wholesale, except Motor Vehicles and Motorcycles	8	8		R$ 1,537.46
Total Agriculture	**194**	**194**		**R$ 1,387.20**
Agriculture, livestock, forestry, fisheries, and aquaculture	194	194		R$ 1,387.20
General Total	**10.911**	**8.668**	**2.243**	**R$ 2,509.99**

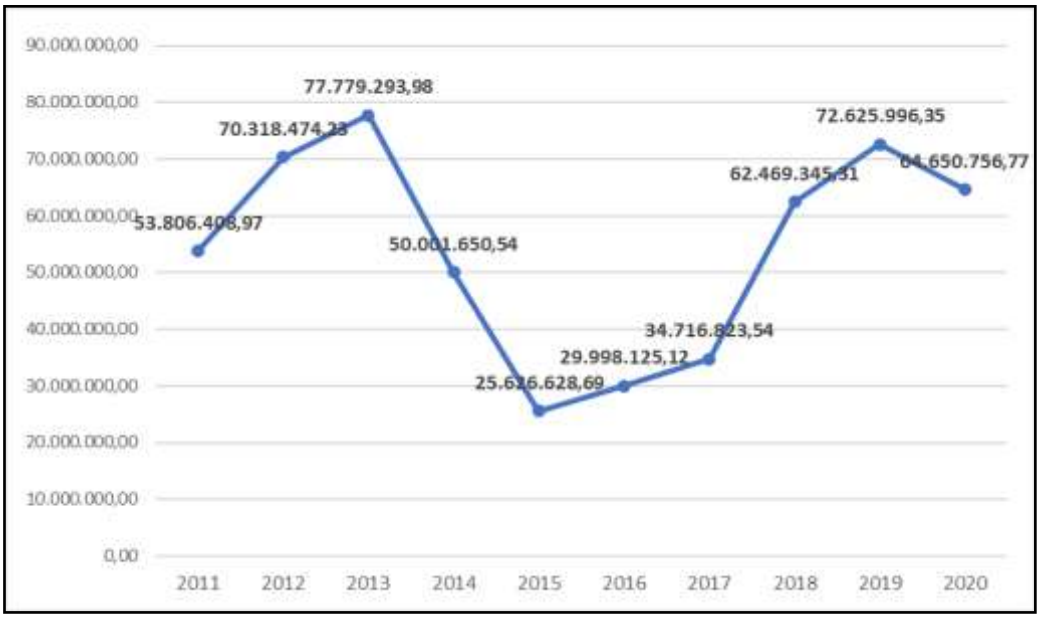
When comparing with the previous year, it was observed that the number of formal jobs increased by 15.53% (Ministry of Labor, 2018). With the exception of agriculture, which suffered a fall of 21.13%, there was the growth of the other sectors, drawing attention to the construction, whose number almost doubled (Table 2). The increase may be associated with the start of recovery works in the territory due to the rupture of the dam. A possible justification for the reduction of formal jobs in agriculture is the contamination of the Paraopeba river and the soil, which prevented many from continuing their work.

Table 2. Grouping of labor by economic sector and average remuneration in 2018

Sector	Stock	Celetista	Statutory	Average remuneration
Services	4.696	3.078	1.618	R$ 2,102.98
Industry	2.441	2.441		R$ 3,696.39
Trade	1.093	1.093		R$ 1,593.98
Construction	979	979		R$ 1,772.80
Agricultural	235	235		R$ 1,434.72
Total	**9.444**	**7.826**	**1.618**	**R$ 2,409.90**

An analysis of the municipalities of Minas Gerais that collected the highest value of the CFEM in 2019 showed that Brumadinho occupies 9th place with an estimated value of R$ 72,625,996.35. The month with the largest contribution to public coffers, in that year, was April with R$ 18,302,618.06. Even in the context of the crime tragedy, the collection in 2019 was higher than the amount observed in 2018 – about R$ 62,469,345.31 (ANM, 2020). Balance taken in 2020 shows an evolution compared to the previous year, reaching R$ 64,650,756.77. Based on the data provided by ANM (2020), a longitudinal cut-off of the CFEM collection of the last 10 years in Brumadinho is proposed in Graph 4 to allow a more analytical view of both the values collected and the oscillations observed over time. The explanation for the occurrence of such variations lies in the dynamics of the global financial market itself.

Graph 4. Evolution of CFEM in Brumadinho - 2011 to 2020



4.3 Clippings of local actors

As presented, the municipality of Brumadinho has its historical formation base imbricated to mineral extraction activity. Costa et al. (2020) state that "this historical-economic constitution at different levels and scales, based on the linkage of the territory to the mining sector, establishes deep roots for the establishment of a dependentist scenario, both in Minas Gerais and Brumadinho" (p. 21). The finding appears in several discourses such as that of this person who has lived in the municipality:

> The beginning of Brumadinho was through mining, right, because there is there on the edge of the line those villages, right, the mining company called Ferro Brasileiro that was the first. She had the buildings and she started with mining. So people today consider themselves sons of mining, right? He's got great-grandfathers, grandparents, kids, grandkids. Everyone, there was created with resources coming from mining.

In Brumadinho, there is a great economic dependence on mining that involves the issue of employment, income, and tax collection. The speech of a public manager portrays this scenario well:

> Today, if mining stops the city dies. Both in the area of employment and the area of income and the tax part for the municipality. The main collection of the municipality of Brumadinho today is the mining royalties. Just to get an idea, before the tragedy, vale's mining royalties, specifically Vale only, were around 30%, 35% of the municipality's revenue. Just Vale's, except the others. So it's completely dependent on mining.

Mining, in addition to interfering in the historical process of space organization, has always played the role of subjugating other alternatives to a subordination relationship in which it persists to the present day. The passive behavior of many municipalities in the face of the structuring of the productive apparatus is seen as an opportunity for large companies to settle on site, produce and export raw materials that do not return to the municipality at the same value as it comes out, devaluing natural and human resources (Dowbor, 2016). As highlighted by a representative of the 3rd sector:

> We have to remember that we export raw materials out, export all this potential to buy in forms of products, right. So we send our ore and buy industrialized products from outside. That is, we make a model that is still colonial, from the seventeenth century, right, which is the model of the colony. It is not mining concerned with balances, with life, with water sources, with the future of the population, it is a model that worries shareholders, right.

Although externalities and mishaps are numerous, for most social actors, mining is considered important and plausible as long as it is practiced on a more sustainable basis, as pointed out by a former resident of the city:

> Look, I even think mining is kind of a "bad thing," you know? But, not mining as it is, as it is, because there are technologies that should be implemented there to make sustainable mining, right, because Minas, as the name says, right, it comes all based on the mining issue. [...] I believe, I'm not in favor, but I believe that if it were done sustainably, it could be a good way out yet.

Despite the economic weight, mining cannot generate social, environmental, and cultural development. What is observed is that companies do not invest in effective social strengthening projects. On the contrary, they work in care activities, compensatory, reparatory - current scenario, or even motivated by the expectation of receiving some incentive. The speech of this representative of the 2nd sector illustrates this well:

> Economic development, this is an obvious thing, and even generates economic dependence on the city. That's a fact. But not social and environmental. Impossible to talk about environmental development when it comes to a mining company, right, unfortunately. And social, look, it's always been... in Brumadinho has a little social development, but it is small. [...] It increased more now, after the tragedy, because it wanted to show service, a way to recover social development in a totally restorative way.

The relationship between local development and democracy has been increasingly strengthened by visions that involve the expansion of the public sphere and the means for social participation (Silveira, 2010). Some segments have openness to incidences and participation in decision-making processes involving actions related to the respective sectors of activity. In counterpoint, this representative of the 3rd sector states that, despite the interest, some communities are not heard:

> The interest of the community exists, but there is a lack of access and voice, you know? It's some basic things that aren't done. For example, back in Tejuco, it's a community here, there's a main street that runs through ore truck all day, you know? The community is not heard and everyone gets pissed off. Getting to people's homes... the wall you can paint of any color, it will pass a month and it is the color of the ore.

Since the post-tragedy-crime, Brumadinho has undergone several transformations. One of them is that numerous localized works are being conducted to repair the damage caused by the dam rupture. As the representative of the 3rd sector points out, the current economic scenario of Brumadinho has attracted people from various states of Brazil to work in the outsourced companies hired by Vale S/A.

> In today's scenario, those who want to work work, work in Brumadinho. Just say, "I want to work." There's more work than people wanting to work. This is largely due to the repair work that is being done, from the pipeline, from Vale's outsourced. But it's a job totally focused on mining.

Despite the warming of the local economy, the phenomenon is temporary and most actors see this context as reckless close to the consequences in the medium and long term. Factors such as population swelling, increased unemployment, and a drop in royalty collection are pointed out. According to the following representative of the 2nd sector:

> Today you have indemnifications, you have a lot of artificial things and that keep the city warm, but this has a... a medium to short term... This is going to end. Joining with other economic impacts that we are experiencing, I worry a lot about how Brumadinho will reinvent himself in the coming years, you know?

Because of what it has raised over the years and continues to collect, it was for the municipality to be more developed to promote more quality of life and equity of income. Criticisms are made to the local public administration, as denoted by the representative of the 3rd sector:

> We have municipalities with a lot of... neighbors with much more population and less revenue that provides much better services than here with this whole collection. I think there has to be effective oversight. Really effective, knowing where it is spent.

Putting human beings at the center of the development is essential to build good policies and generate effective change. This is the logic touted by the FCE model. For this, it is necessary to work the thinking of people (community) about the role of the economy and the value of services. This transition will only be possible with the support of local actors, especially public administration.

The search for new, more sustainable formats involves identifying local potential and promising sectors. Moving in this direction, several economic activities were elucidated as alternatives to counter "mining dependence", with emphasis on propositions aimed at tourism, culture, and gastronomy; agriculture and agribusiness; the creation of industrial hubs; and investment in education for young people.

5. Conclusions

The reports show some weaknesses experienced by the municipality, mainly to the detriment of its dependence on mineral extraction activity. Of all dimensions, the one that most concerns is economic dependence, which became so evident after the tragedy-crime. Despite this, little or almost nothing has been done so far to reverse the scenario and there is concern from the vast majority about how to replace mining.

Another evidence that reinforces economic dependence is the post-tragedy-crime context that has warmed the local economy. It seems that the city is experiencing one of the best moments due to the numerous job opportunities. Even in the face of the pandemic of Covid-19, "What is not lacking in Brumadinho is work". To strengthen the discourse, data on formal employment links showed that the service sector employed more labor in 2019. It seems that the municipality is far from ending "dependence on ore" and the influence of mining companies in the territory. Brumadinho depended before and more now after the post-crime tragedy. The concerns about the future scenario in the medium and long term of the territory are great, especially when the financial contributions of Vale S/A in the municipality are over.

Although GDP (R$ 51,164.41) and MHDI (0.747) are high, numerous criticisms of public management were made, especially concerning the application of resources from mining in local policies. For most actors, there is a lack of transparency. Participatory democracy is still weakened. Local protagonism is still low.

The FCE model can be satisfactory for implementation in the municipality since it adopts a logic focused more on human and nature, strife with immaterial aspects, cross-cutting cooperation, and the potentiation of local activities. In this sense, it would be interesting to deepen the studies with a view to making a diagnosis of the local and business community about the possibility of implementation in its business models. It would be to work from the perspective of action and intervention with more incisive dialogues for the construction of cooperative ecosystems and more integrated solutions.

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Regional Resilience and Spatial Distancing in the Time of COVID-19

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Abstract

Due to the coronavirus disease pandemic that began in 2019 (COVID-19), measures aimed at increasing spatial distancing likely negatively affected the level of employment and the generation of regional wealth because businesses in many sectors were closed. In this paper, we aimed to verify whether the spatial distancing index is a predictive variable of regional economic resilience. Our only variable was a spatial distancing index collected for the Brazilian states from February 2020 until July 2020. The time series were transformed to guarantee stationarity, which made it possible to calculate the Pearson linear correlation among them. The lowest correlation coefficient was 0.85, which indicated a strong positive correlation among the transformed series. Hence, as spatial distancing increases in one state in Brazil, it also tends to increase in the others. According to the literature, due to regional disparities, shocks affect distinct regions differently. Our results showed that Brazilian states behave in a similar way with respect to the spatial distancing index, which suggests that this index does not constitute an advisable predictor of short-term regional resilience in relation to the shock resulting from the COVID-19 pandemic.

Keywords: Regional resilience, Spatial distancing, Shocks, COVID-19, Brazil

1. Introduction

Studies on regional economic resilience, conceived as the "ability of regions to resist and/or recover quickly from shocks" (Bristow and Healy, 2018, p. 266) have investigated why and how some regions return to or improve their performance following shocks, while others decline (Balland et al., 2015; Sensier et al., 2016). Although the study on resilience applied to the regional context emerged just over a decade ago as a result of the 2008 global financial crisis, there is already, in the research field of economic resilience, a reasonably extensive list of variables considered to be predictive of the resilient capacity of regions.

The discussion about resilience—whether in the context of inanimate and abstract beings or in human beings—presupposes the occurrence of events with negative effects on the object under analysis and

which, for this reason, are generally called shocks or disturbances. On the one hand, the literature highlights the existence of types of resilience perspectives (equilibrium and evolutionary). On the other hand, shocks are not usually differentiated with respect to type—for instance, economic, environmental, and urban disasters. The most recent shock refers to the impact of COVID-19, an infectious disease first identified in China in December 2019 (WHO, 2020a) and considered a pandemic in March 2020 (WHO, 2020b).

Once there are different types of shocks, we believe there is a range of promising variables that predict the economic resilience of regions. Moreover, we assume that there are predictive variables of regional resilience that are transversal to all or most types of shocks, while others are specifically applicable in contexts resulting from certain types of shocks. As examples of transversal predictive variables, we consider the flexibility of labor relations (Balland et al., 2015), openness to new ideas and innovative practices (Clark et al., 2010), public spending (Raco and Street, 2012), and human capital (Di Caro, 2017; Eraydin, 2016a; Giannakis and Bruggeman, 2017), evidenced in studies carried out from different types of shocks. Given their punctual presence in research, we suggest, as examples of predictive variables specific to certain types of shocks, the dispersion of the immigrant workforce among occupations (Lester and Nguyen, 2016), regional urbanization level (Brakman et al., 2015), and the existence of governance mechanisms (Rutherford and Holmes, 2008). As research on regional economic resilience involving shocks from pandemics is at an early stage (Appel and Hardaker, 2021; Gong et al., 2020), the question of what data can be used specifically for this type of shock is still open.

Given the COVID-19 pandemic, it can be assumed that measures aimed at increasing spatial distancing negatively influence the level of employment and the generation of regional wealth, due to firms that are closed in different sectors and to restrictions to access firms (Appel and Hardaker, 2021). Hence, in this research, we aimed to verify whether the spatial distancing index is a predictive variable of regional economic resilience. To accomplish that, we carried out descriptive research, based on the exploratory analysis of time series of the spatial distancing index in Brazilian states from February to July 2020. We tabulated data from the InLoco website (Inloco, 2020), once they were widely used to address spatial distancing in Brazil (Barberia et al., 2021; Heck et al., 2021; Peixoto et al., 2020). The referred index makes it possible to assess people's movement patterns based on geolocation data collected from mobile devices, such as cell phones (Peixoto et al., 2020). The higher the index, the less the movement of people whose data is being collected.

The present study contributes empirical evidence that the spatial distancing variable, addressed in this study once it was one of the main strategies suggested by health experts to face COVID, did not prove to be a predictor of regional economic resilience. In the field of public policy, assessing regional resilience in the short term enables a localized and targeted response by public agents. This contributes to a greater speed of regional recovery. The delay in measuring and making available

some indicators, such as employment and produced wealth, which are widely applied in the regional economic resilience research field, leads us to question the feasibility of using real-time indicators to assess short-term economic resilience.

2. Methods

A descriptive research with a quantitative approach was developed, under a functionalist paradigm, based on secondary data. As a data collection strategy, documentary research was adopted, through data systematization and analysis, in this case, numerical data. The next subtopics present the unit of analysis, data source, and procedures adopted for collecting and analyzing data.

2.1. Unit of analysis

One of the challenges in research on regional resilience is to establish the spatial scale of analysis (Sensier et al., 2016). Data series were collected for each of the Brazilian states (including the Federal District). Although there is a discussion about the appropriateness of using regional limits like this for the study of resilience, data availability justifies the scale adopted (Martin, 2012).

2.2. Data source and collection

Data were obtained over the website of Inloco (2020). The variable adopted was the spatial distancing index. The referred company reports having data from more than 60 million devices in Brazil, and, according to Peixoto et al. (2020), Inloco collects data through anonymous tracking, location, and movement of these devices. On the company's website, data on the samples by state are not available.

We collected daily data from February 1, 2020, to July 31, 2020. Once these data come from third parties and are made available only through an interactive graph, data were tabulated individually by two researchers who then proceeded with verification of tabulation discrepancies and with corrections by consulting the Inloco website.

2.3. Data analysis

Data analysis was performed with support from the R language, the integrated development environment RStudio, and the packages tseries (Trapletti and Hornik, 2019), ggplot2 (Wickham, 2016) and corrplot (Wei and Simko, 2017). Having tabulated the data, missing values were initially checked out. Then, to view data in an exploratory way, graphs of the series were elaborated for the 26 states and the Federal District.

To allow comparison among the series and to avoid spurious correlations, data were transformed to ensure stationarity. In stationary time series, its properties do not depend on the time when the series is observed (Hyndman and Athanasopoulos, 2019). For that, after being converted to a logarithmic scale, the series underwent differentiation and standardization (Johansen, 2008).

In order to verify whether the series had become stationary, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test was adopted by using the tseries package (Trapletti and Hornik, 2019). This test adopts the null hypothesis of data stationarity (Kwiatkowski et al., 1992). Once the transformation had already been carried out, the test sought not to reject the null hypothesis. For all series, p-values of 0.1 were obtained, resulting in weak stationarity, a condition sufficient to perform Pearson linear correlation. Hence, a Pearson correlation matrix was elaborated to the transformed series.

3. Results and Discussion

Time series of the spatial distancing index for Brazilian states are illustrated in Figure 1. It is noted the increase of the index in mid-March 2020, due to the implemented distancing measures. From April 2020 on, the index declined in all states, but remained above the measurements of February and early March 2020.

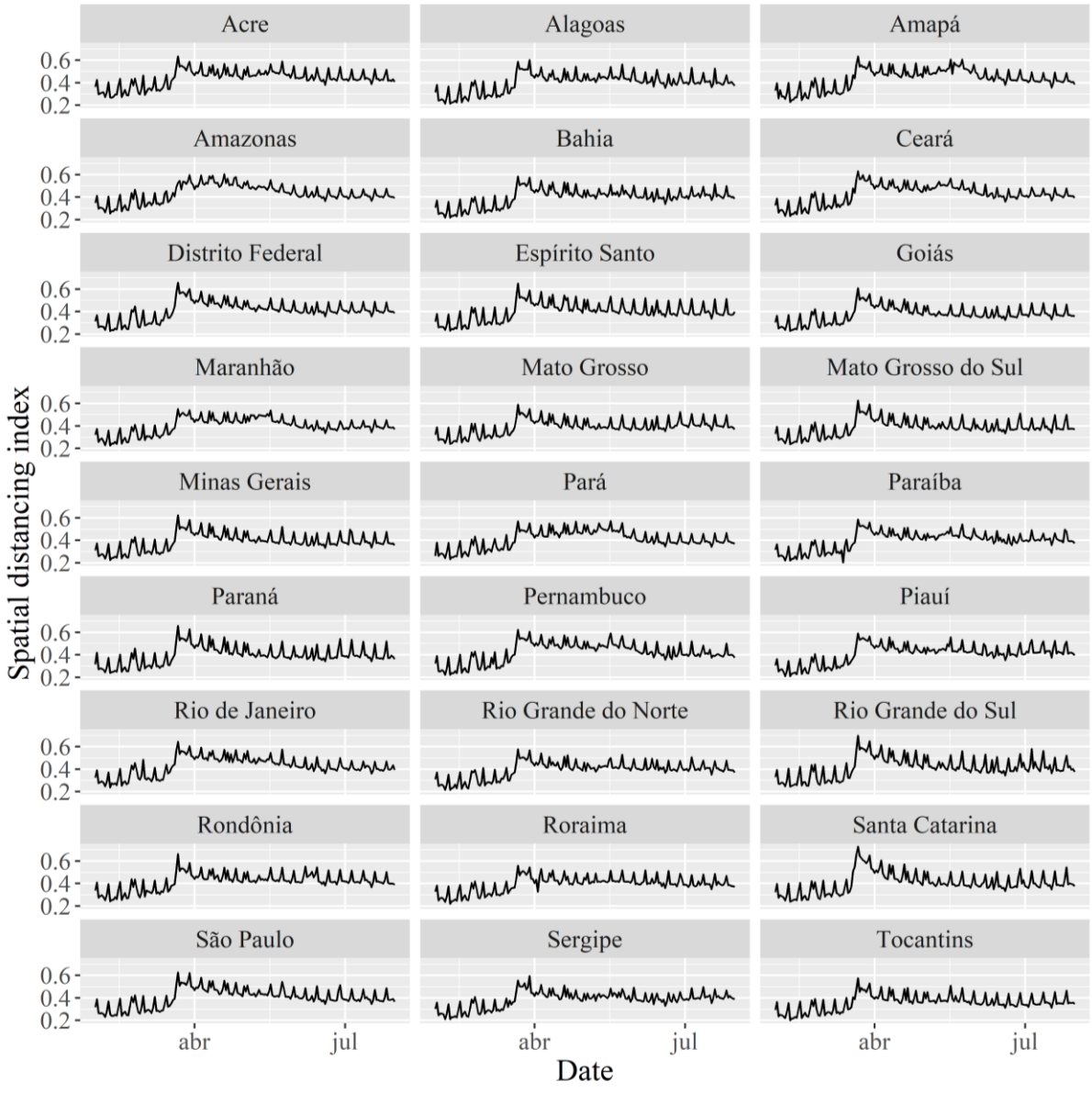

Figure 1. *Time series of the spatial distancing index, from February to July 2020, by state.*

In all states, the daily spatial distancing index was below 0.5 during, at least, 75% of the collection period. It is noteworthy that, in Brazil, the health and economic crisis is added to a political crisis, and that the country is marked by many informal workers, of people in poverty, of homeless people, and of people deprived of their liberty, which can jeopardize the effectiveness of spatial distancing (Aquino et al., 2020).

Figure 2 shows the series after transformation to ensure stationarity.

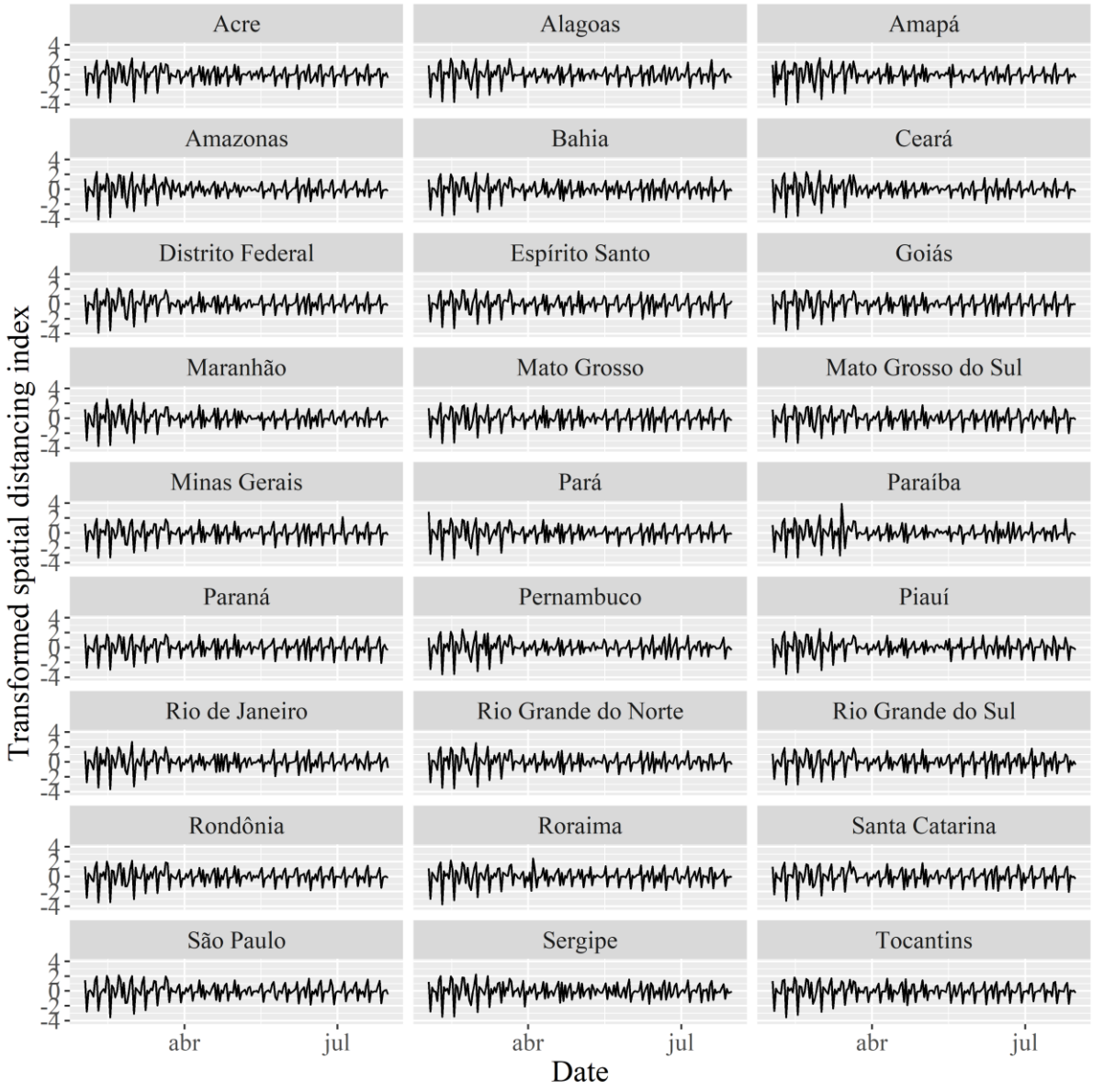

Figure 2. *Time series of the spatial distancing index transformed to stationarity, from February to July 2020, by state.*

Figure 3 illustrates the distribution of this index after transformation by using a boxplot. It is observed that all states behave in a similar way with respect to spatial distancing.

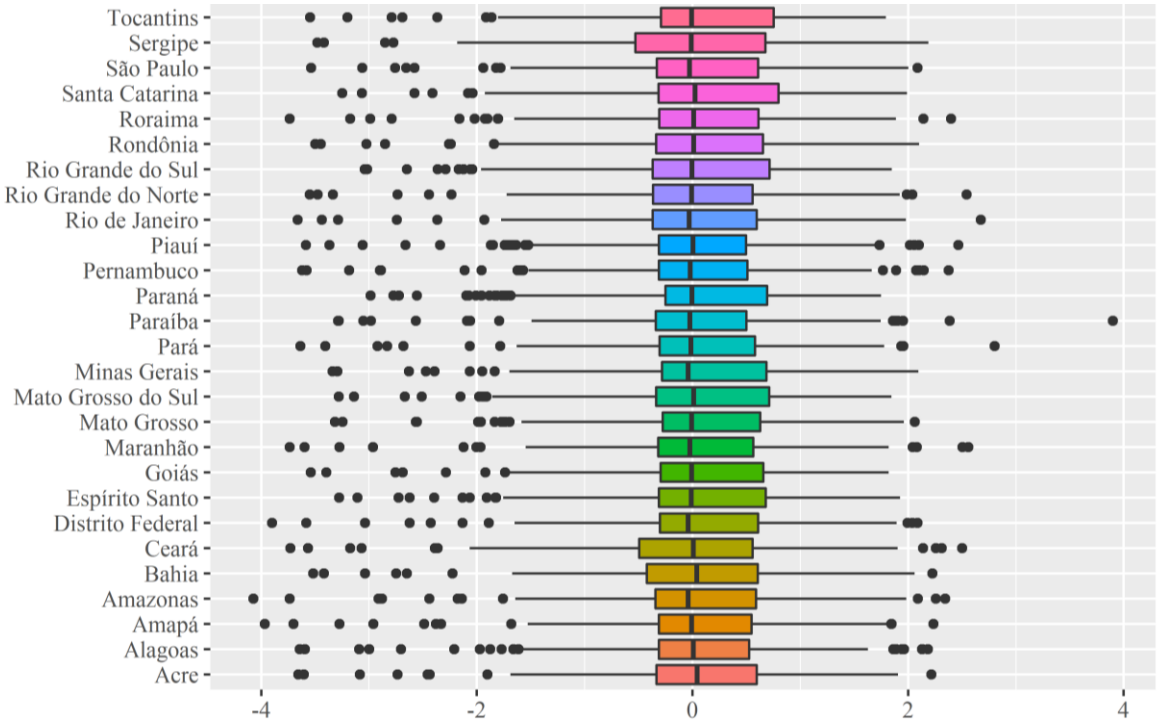

Figure 3. *Boxplot of the spatial distancing index transformed to guarantee series stationarity.*

The correlogram (Figure 4) shows the correlation matrix of the spatial distancing index, also after transformation. The lowest Pearson correlation coefficient found was 0.85, indicating a strong positive correlation among the data (Hyndman and Athanasopoulos, 2019). Hence, it is observed that, as spatial distancing in one state increases, it also tends to increase in the others.

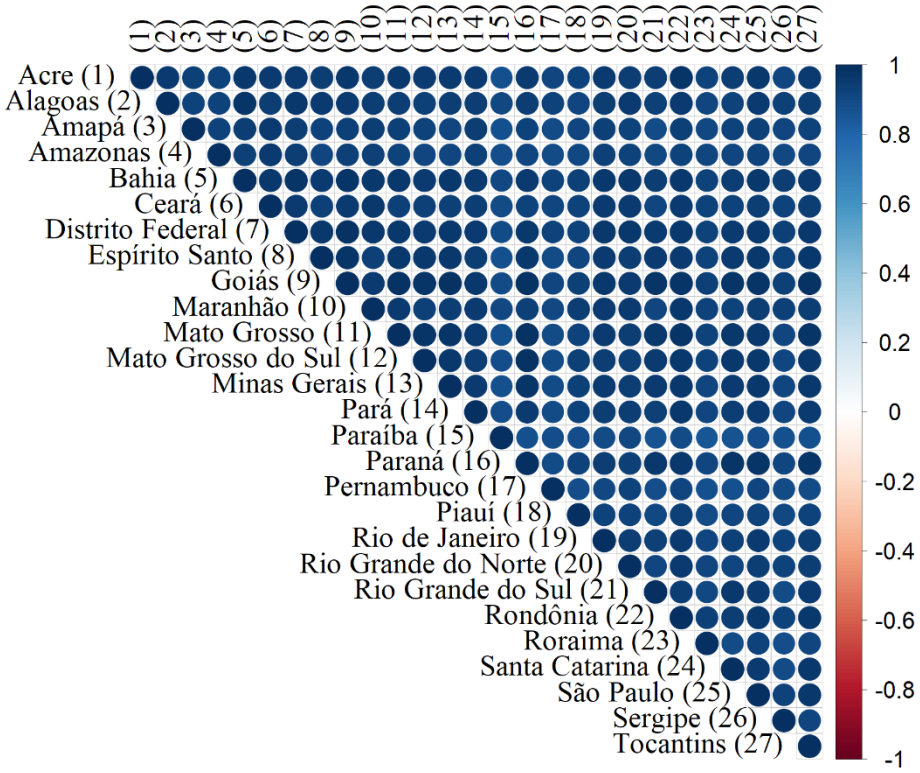

Figure 4. *Correlogram of the spatial distancing index for transformed series.*

4. Discussion and conclusion

Many studies have focused on investigating the association between factors and regional economic resilience. Part of these studies operationalized regional economic resilience through data regarding employment or production, usually through gross domestic product (GDP) (Brakman et al., 2015; Di Caro, 2015; Dokić et al., 2016; Eraydin, 2016b; Eriksson and Hane-Weijman, 2017; Palaskas et al., 2015; Petrakos and Psycharis, 2016; Sedita et al., 2017; Sensier et al., 2016). Sensier et al. (2016) point out that different shocks produce different results, and the operationalization of economic resilience GDP or employment data shows moderately different results. Nevertheless, regardless of the variable adopted, the literature on the topic notes that regions present different resistance to shocks (Brakman et al., 2015; Cuadrado-Roura and Maroto, 2016; Dokić et al., 2016; Sensier et al., 2016; Wink et al., 2016).

The transformed series of the spatial distancing index present a strong positive correlation, pointing out that the Brazilian federative units behave similarly with respect to the spatial distancing index. This indicates that it is not advisable to use such data in an analysis of association with a dependent variable, such as employment or GDP. The fact that a predictor varies does not make it able enough to predict short-term regional resilience. Nevertheless, given the similar behavior among Brazilian regions, the adopted index conflicts with the understanding that different regions respond differently to a shock. It is a requirement analysis and not a sufficiency analysis. In this sense, the present article contributes to the study of regional short-term resilience related mainly to the dimensions of resistance and recovery and to the bounce-back perspective. Thus, we suggest:

Proposition 1*: the restriction or limitation of mobility is not directly correlated to employment level or GDP.*

The result on short-term regional resilience depends on how resilience is assessed (Sensier et al., 2016) and, from a theoretical point of view, the knowledge about the effectiveness of spatial isolation regarding containment of the pandemic is well established (Aquino et al., 2020; Malta et al., 2020; Massaro et al., 2018; Wilder-Smith and Freedman, 2020). It is noteworthy that the gap explored in the present research refers to the predictive capacity of a spatial distancing index on resilient capacity of regions regarding the side effects of the COVID-19 pandemic in the economic sphere and in the short term.

A great part of studies on regional resilience dealt with the economic crisis that took place around 2008 (Dokić et al., 2016; Giannakis and Bruggeman, 2017; Hoffmann et al., 2017); and a great part of methods and techniques used in the study of resilience assumes data availability in a wide time range. In the coming years, studies should focus their attention on the most recent global economic crisis, resulting from the impacts of COVID-19. For future studies, data regarding employment should be intersected to other data provided by government agencies, which may provide information on the

regional resilience of Brazilian federative units. Moreover, qualitative analyses focused on regional reorientation and reorganization will elucidate whether the COVID-19 post-shock regional resilience will be associated more with a return to the previous situation (bounce back) or to a transformative resilience.

The main limitation of the present study is the impossibility of verifying the relationship between the spatial distancing index and other indicators, due to methodological differences in database construction and due to strong correlations among series of the adopted spatial distancing index. This can be explored in future studies by using different databases or by considering other regions/countries.

The present study contributes to the literature on regional economic resilience by (i) addressing a poorly researched locus, (ii) dealing with a recent crisis whose consequences are not yet fully understood, and (iii) yielding a proposition about the use of spatial distancing indices as a proxy for regional short-term resilience to the shock resulting from the COVID-19 pandemic. In practical terms, based on the yielded proposition, it is argued that the index does not constitute an effective substrate for the elaboration of short-term socioeconomic policies aimed at increasing economic resilience of regions that are most affected by the pandemic crisis. This argument does not minimize the role of the index as a guide for public health actions aimed at viral contagion reduction.

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Posters

The 27th International Sustainable Development Research Society Conference
13–15 July 2021
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Mid Sweden University
Virtual Conference, Sweden
Mittuniversitetet
MID SWEDEN UNIVERSITY

Ellis Walton
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Advancing Climate Equity– Under the Law

Introduction

Climate change presents a significant challenge to the development and viability of communities across the globe, affecting our natural systems, built environment, and financial structures that undergird modern life.

These events have a disproportionate adverse impact on vulnerable populations such as **people of color, the poor, and women and children**. Resilience strategies to combat climate change must be centered around these marginalized groups to achieve an equitable outcome for all people.

(UN SDG's: 9,10,11,13)

Climate Harms:

1) Desertification
2) Drought
3) Natural Disasters
4) Sea Level Rise
5) Heat Islands and Rising global temperatures

Climate resilience: The ability of a community to absorb, withstand, and reorganize after a climate-related event It demands the construction of better and more durable systems that allow communities to plan, adapt, and thrive in the face of a changing climate.

Resilience planning considerations:

1. Providing continuous access to essential services: energy, food, water, shelter, healthcare and transportation
2. Supporting vulnerable populations
3. Planning land-use, system, and infrastructure strategies with the environment and natural forces in mind
4. Ensuring safety through improved emergency preparedness and strong communication between relevant agencies, first-responders, and the community
5. Offering diverse transportation and access options
6. Building structures and systems which are sustainable, flexible and durable

Framework

Procedural Justice - Creating a fair process that allows fair and meaningful involvement of all people.

Distributive Justice - eliminating all harms, especially those that are unevenly distributed to vulnerable groups.

Social Justice - Recognizing that climate change is a systemic problem that can be exacerbated by other structural inequalities.

Corrective Justice - Penalizing actors for the environmental harm they've caused and rectifying it through compensation/reparations.

Legal Tools:

1.Flood maps
2.Flood risk disclosures
3.Environmental impact assessments
4.Public utility regulation
5.Permit conditions
6.Securities disclosure: Heat adaptation
7.Building codes
8.Inspections
9.Eliminating toxic sites
10.Architects' training
11.Managed retreat
12.Mandatory Inclusionary Zoning
13.Affordable/Free Housing Policies

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Regional Resilience and Spatial Distancing in the Time of COVID-19

Introduction

Due to the coronavirus disease pandemic that began in 2019 (COVID-19), measures aimed at increasing spatial distancing likely negatively affected the level of employment and the generation of regional wealth because businesses in many sectors were closed. Hence, we aimed to verify whether the spatial distancing index is a predictive variable of regional economic resilience.

Methods

Our only variable was a spatial distancing index collected for the Brazilian states from February 2020 until July 2020. The time series were transformed to guarantee stationarity, which made it possible to calculate the Pearson linear correlation among them.

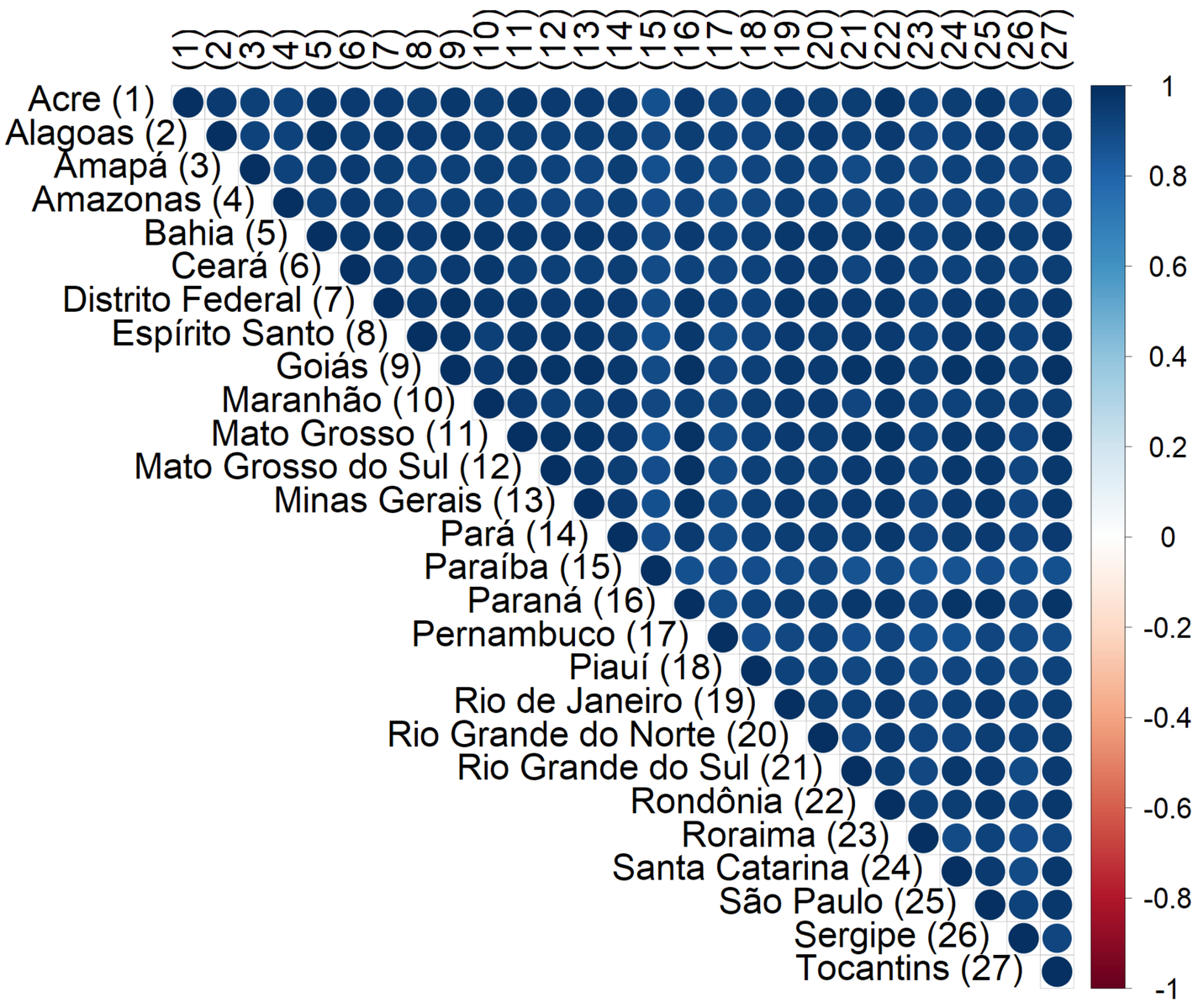
Results and discussion

The lowest correlation coefficient was 0.85 (Figure 1), which indicated a strong positive correlation among the transformed series. According to the literature, due to regional disparities, shocks have different impacts on distinct regions. Our results showed that Brazilian states behave in a similar way with respect to the spatial distancing index, which suggests that this index does not constitute an advisable predictor of short-term regional resilience in relation to the shock resulting from the COVID-19 pandemic. The fact that a predictor varies does not make it suitable for predicting short-term regional resilience. Nevertheless, given the similar behavior between Brazilian regions, the adopted index conflicts with the understanding that different regions respond differently to a shock. Therefore, we recommend the following:

Proposition 1: the restriction or limitation of mobility is not directly correlated with employment level or gross domestic product.

These results do not minimize the role of the index as a guide for public health actions aimed at viral contagion reduction.

Figure 1
Correlogram of the spatial distancing index for transformed series of the Brazilian states.



6. Sustainable Cities and Communities

6c. Sustainable Buildings and Construction Technologies

Abstracts

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How business model enhances engineering wood technology towards sustainability transitions: a case study from the wood construction value chain

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Abstract

The construction sector is one of the largest and very central industries, accounting for 13 percent of global GDP and performing core and very basic functions for our society, the needs for housing and infrastructure. The sector has its footprint literally in every aspect of our life by developing the building environment upon which we establish our business, household, institutional, and leisure endeavours. However, the dominant design in construction takes rising social and political criticism due to the fact that it unsuccessfully meets the growing sustainability expectations and productivity standards. The landscape pressure gives into labour global sustainability initiatives that push the construction sector to decrease its carbon footprint (Toppinen et al., 2018). This opens a 'window of opportunity' (Geels, 2002) for the niche-level initiatives, which allow market experimentation with engineered wood technologies, more radical innovations in prefabricated building processes, and collaborative business models that consider nature and society as key stakeholders.

The emergence of engineered wood is an alternative direction or development path that lead to a change towards more sustainable development of the construction industry and might disrupt or restructure the existing regime. The engineered wood already built its momentum as niche innovation. Ongoing landscape changes pressure the regime and create a window of opportunities for scaling up in the mainstream construction market. Forerunner companies with sufficient size, resources and traditions in the forest-based industry are on the edge of initiating transitions in the construction value chain towards a more sustainable future. Their efforts are in establishing engineered wood technology as a mainstream solution by reshaping the established socio-technical system. The paper conducts an in-deep case study of Stora Enso, the largest worldwide producer of engineered wood, the changes in their value creation logic and business model for achieving transitions in the construction value chain with engineered wood technology. We explain how business model innovations, which relies on collaborative value creation by multiple actors, is applied to enhance engineered wood towards sustainability transitions. Our findings help to understand how sustainable technologies are developed in a broader socio-technical system context.

This paper we aim to contribute to the following SDGs: GOAL 9: Industry, Innovation and Infrastructure, GOAL 11: Sustainable Cities and Communities, GOAL 13: Climate Action. The paper relates to key topics of the ISDRS2021 conference by exploring transitions and larger-scale system changes towards sustainable development in the construction value chain. The sustainable transition based on engineered wood technology and business model innovation is studied from a multi-level perspective including interrelations with stakeholders.

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Urban Eco-village lifestyle and pandemic

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Abstract

To tackle the sustainable global goals, especially reducing the CO_2 emission (SDG 13) and transition towards sustainable cities (SDG 11, Target 11.6) there are many different initiatives around the world that build more environment friendly housing. For example, the EU has a goal that all buildings should operate at net-zero carbon emissions by 2050. Passive houses and passive plus buildings are important

initiatives in this direction. The public's perspectives, engagement, and willingness to live and adopt within an urban eco-village are essential for these concepts to take place.

The suggested paper presents an urban eco-village in Sweden. This eco-village consists of two multi story buildings constructed out of wood with total of 30 apartments that are near the center of a medium-sized city. The sustainability vision of the project includes several innovative ideas, such as electric car-pools, gardening on balconies, passive house design, and sustainable construction materials. The project was delayed due to the Corona crisis; the moving-in date is planned for April 2021.

The paper is based on individual interviews that focus on environmental willingness and engagement. The householders' motives for deciding to move into the village and their expectation on living in the eco-village were also studied. The initial interviews were carried out in November 2019, with 41 respondents from households who declared their interest in moving into the eco-village. The interviews covered the following areas; energy, transport, occupancy, and motives for living in the eco-village. The follow up interviews with persons moving in will be carried out in March 2021. These interviews will study the influence of COVID-19 on willingness to participate in environmentally sustainable programs, for example using the car-pool.

The results of the initial interview show that halve of households (21) feel positively about the car-pool system, while the other households are hesitating or not interested. Similarly, the big majority of households (28) are willing to use shared laundry facilities, while only 13 households prefer to have their own laundry machines. The results also show that the two main reasons that people want to move to the eco-village are to reduce their own environmental impact and the location of the eco-village.

The upcoming interviews will assess the question if challenges due to the pandemic (such as social distancing) can be in conflict with some aspects of a sustainable lifestyle (e.g. lack of access to a personal car and washing machine). Furthermore, traditional eco-villages are often characterized by detachment from mainstream. The urban eco-village studied is more integrated with mainstream and therefore has more potential for propagating its ideas due to high visibility and links to the larger social setting.

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The critical analysis of Tiny Houses as Sustainability Innovations for the Base of Pyramid Markets in Germany

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Abstract

Problems related to housing shortages are becoming increasingly evident in large German cities. The insufficient number of accessible social housing is causing a growth in homelessness, associated social inequalities and poverty. In this context, the Sustainable Development Goals 1, 10 and 11 emphasise the importance of an improved housing situation. Tiny houses are creating potential to reduce inequalities. Besides providing shelter, they may also be seen as low-cost alternatives for people with limited financial means or even as helping measure for social reintegration. There is insufficient scientific research on sustainability impacts as well as the reduction of inequalities in connection with tiny houses. So far it has not yet been clarified whether the analysed housing form meets the criteria for innovations in BoP markets under sustainability aspects to be determined. This is important in order to meet the goals of sustainable development while identifying and averting problems at an early stage. There is a significant lack of academic literature on the international and the German tiny house movement including the associated housing.

The available literature is primarily composed of media content, such as articles in magazines, blogs, television reports or narratives. Principles for BoP innovations have been derived from theory and analysed. The study focuses on the German region and investigates to what extent tiny houses fulfil the criteria of BoP innovations and whether they can support a reduction of inequalities. As part of the research, in August 2019, expert interviews with different stakeholders (NGO, manufacturer, association and blogger) have been conducted. Based on the results of this study, challenges and potentials with regard to possible sustainability effects have been identified and analysed by highlighting their ecological, social and economic relevance. The study demonstrates the scope of a potential transferability of tiny houses to the principles for BoP innovations for the German region. In this context, it should be emphasised that not all principles are relevant for all use cases. The individual criteria should be selected according to their priority and usefulness for a particular situation.

The abstract refers in particular to SDG 1 Target 1.2; SDG 10 Target 10.2 and SDG 11 Target 11.1. The paper highlights tiny housing as a multi-adaptable innovation for people experiencing poverty and exclusion. It also identifies individual challenges from a sustainability perspective. In this way, the study supports progress in the sense of accommodating the focused SDGs.

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A simplified supply-demand model for availability and carbon storage potential of timber in construction

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Abstract

The building and construction sector accounts for ~ 40% of global final energy use and energy- and process-related emissions. These emissions are of great concern because (i) construction is a hard to decarbonise sector and (ii) global urbanisation and population growth will add 230 billion m^2 of new buildings by 2060. A continued use of conventional building materials would pose significant carbon lock-in challenges. This is because emissions linked to the manufacture of, say, steel and cement, are incurred now on carbon-intensive energy sources and then locked into buildings and their assemblies for the whole, long lifespan of these built assets.

One of the most effective strategies to mitigate embodied emissions in buildings is through interventions at the material level. These can be broadly clustered into material efficiency (using less of the same material) and material substitution (using alternative materials with lower embodied emissions). When substituting conventional materials, a further opportunity exists if the choice falls on so-called bio-based materials that can store carbon. The transition to post-carbon cities will require the use of carbon storing materials due to both their storage potential and reduced life cycle carbon emissions. It has been recently estimated that up to 2.49 Gt CO_2e per year can be stored in buildings between 2020 and 2050 with aggressive adoption of bio-based structural materials.

However, carbon stored in the world's forests has reduced at an average rate of 0.73 GtCO_2e per year since 1990, a number that might increase if demand increases. This poses questions on both the availability and sustainability of an increased use of timber in the construction of buildings. By bringing together data on global forests and their yield, projected urbanisation and population growth, and the ensuing construction activities in most of the world's countries we develop a simplified supply-demand model to establish the extent to which timber based construction can meet projected growth in global floor area.

We find that globally timber demand in 2020-2050 would exceed supply by ~ 6000 Mt with current figures for forest area. As a consequence, the carbon that can be stored in timber buildings over the same time period is 0.215 Gt CO_2, which is significantly lower than recent estimates. Therefore, our results contend glamorous claims on timber as a 'one-size-fits-all' solution and show that for most countries in the world a timber-only approach is neither possible to meet floor area demand nor desirable to maintain a healthy forest balance. Faster growing bio-based materials (e.g. bamboo and grasses) that have greater yields can be explored as an alternative solution which should be explored in greater detail.

At a time when there is increasing global awareness of the environmental impacts of buildings and construction, and the temptation might be to find a silver bullet for this hard-to-decarbonise sector, this paper contributes to accelerating both understanding and progress towards efficient and effective use of materials in buildings, and specifically addresses a number of Sustainable Development Goals (SDGs) and their targets: SDG11.6, SDG12.2, SDG15.1, and SDG15.2.

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Improving indoor comfort in elementary school environment in North of Sweden with green plants - experimental study.

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Abstract

Poor indoor environment in primary schools in Sweden seems to be a problem in many municipalities in Sweden. In a report from the Swedish Public Health Agency, it is estimated that 40 percent of schools have complaints about air quality. The causes of the problems are poor ventilation, high humidity, changes that where made to the buildings, and high density of pupils in the classrooms. Improving indoor air by improvement of ventilation systems can be too costly for municipalities.

In this project, we have looked at whether an installation of a large number of green plants in classrooms could change that, and even reduce energy use. There is research that shows that we feel both physically and mentally better if we are surrounded by green plants. Physically, because they can purify the air and convert carbon dioxide to oxygen. In addition, they increase the humidity and regulate the temperature. Mentally, perhaps because we are part of nature and have lived in it most of human history.

The case study in this project was an elementary school located in a small rural community in the northern part of Sweden. A total of 350 green plants were installed in four plant-stands distributed in 2 different eighth grade classrooms with about 25 students in each. A similar adjacent classroom (ninth grade) was used as a reference object without green plants. The plant-stands were designed by industrial design students at Mid Sweden University and would result in functional prototypes with automatic irrigation. The project lasted for two semesters, the autumn semester 2019 and the spring semester 2020.

Measurements of the indoor temperature showed that the green plants contribute to a more stable temperature and can even increase the temperature slightly, which can be used to reduce the need for heat. The effects on humidity were only higher in the classrooms with plants during the night when the ventilation flow was low. The carbon dioxide levels in the classrooms with the plants were 10% lower during education time compared to the control classroom, which indicates that green plants could be used to reduce the ventilation air flow and thereby reduce heat losses from exhaust air flow. The amount of airborne particles was already low and no change could be observed after the installation of the plants.

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Adapting the revised REHVA guidelines due to COVID-19 in Swedish context

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Abstract

Since the Corona pandemic swept over the world like a Tsunami, each country has developed their own strategies to reduce the effect of Covid-19. In an interview survey, conducted during May-June 2020, on HVAC and Covid-19 in Sweden, authorities, industry associations, consultancy and real estate companies suggest the need for new knowledge on ventilation and indoor environment. Some of the 21 interviewees expressed the opinion that it is too early to assess whether there is a need to revise the Swedish HVAC codes and regulations. However, other interviewees argued for revisions in the relevant regulations. Although Sweden and some other countries has not initiated any revision in their codes and regulations, there are others including international organizations has revised their guidelines. Recently, REHVA has updated their guidelines for ventilation to reduce the risk of airborne transmitted SARS-CoV-2 infection of humans. Such revision in guidelines by international organizations have consequences in building operation in Sweden.

In this work, we introduce the results of the interview survey about HVAC and Covid-19 with a comparative study of the revised REHVA guidelines and the current relevant Swedish building codes and standards. The scope of work is to investigate how the specific revision of REHVA guidelines relates to the Swedish HVAC codes and regulations. The aim is to contribute with learnings for future revisions of Swedish HAVC codes and regulations.

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Building Thermography Inspection by using a Low-Cost Visual-Thermal Drone System

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Dr Allan Hawas

Abstract

For decades, thermal imaging technology serves as an effective tool and is implemented in many industrial and commercial applications, including energy and building sectors. Recent trends in the field further show an increased interest in aerial thermal imaging applications that brings new opportunities toward sustainability. Unmanned aerial vehicles (UAVs) (i.e., drones) equipped with thermal cameras are currently used for building thermography inspection, which is a crucial technology to accelerate the identification of CO_2 mitigation within the building sector to tackle the global goals (SDG 11 target 11.6 and SDG 7 target 7.3).

This study presents an evaluation of a low-cost, visual-thermal drone system for building thermography inspection (SDG 9 target 5.5). The evaluation was limited to the thermal imaging potentials of the system. The UAV system is used to examine its capacity to detect various heat loss, including insulation defects, air/ water leakage, and validation of different suspected energy loss case studies. The examination also involves the evaluation of the cost-effectiveness of the thermal-drone system. The thermography inspection was carried out on several buildings with different sizes, types, and activities they are used for. Therefore, the detection/identification tasks for the thermal-drone system were different from an inspection to another. This study aimed to identify different limitations and advantages of using such a low-cost thermal-drone system for building thermography inspection. The technical evaluation was based on several criteria, including fly duration, stability, image quality, data flexibility, integration potentials, etc.

Additionally, the cost-effectiveness and other practical aspects were considered in the evaluation. The results show a combination of both limitations and advantages of adopting such a low-cost drone system. In contrast to the supplier's description, the thermal image data are not a radiometric JPG file that significantly limits quality and opportunities. Accordingly, the thermal image gives a standard JPG file and does not provide a temperature distribution to make any post-analysis processing or post-editing presentations. This issue can be solved partially, as the live thermal images provide a temperature distribution that allows different utilizations, e.g., identifying temperature spots, which can be included in a screen-shot of the drone screen controller.

Furthermore, the image data's limitations do not allow 3D modelling of the building objects which is possible for the radiometric image files. The image resolution and accuracy are limited; however, short distance inspections provide good image qualities. The results reveal that the thermal drone system can detect common insulation issues such as missing insulation and clear energy loss.

However, the capacity is limited in regards to high accuracy demand and more in-depth data analysis. In conclusion, the examined drone system is a cost-effective tool for DIY use and superficial aerial building thermography inspection (SDG 11 target 11.6). Therefore the suggested system is not sufficient for higher demand and more professional inspections. The suggested proposal is an effective method to identify CO_2 mitigation potentials within the buildings that are significantly promoting the achievement of some SDGs. Additionally, the inspection method can be conducted remotely, keeping social distancing in the time of pandemics.

7. Social-economic Aspects of Sustainability

7a. Global inequality and poverty

Abstracts

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Exclusion and inequalities in access to e-health services on the example of Poland

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Abstract

- **Exclusion and inequalities in access to e-health services** concern some aspects of sustainable development as far as e-health services are concerned. Unfortunately, many countries, such as Poland, have limited access to e-health services for many reasons, e.g. lack of internet access, lack of computer skills or attitudes towards the services offered.
- The article aims to i**dentify barriers and factors** affecting exclusion in e-life services in Poland in relation to other EU countries and the 2030 sustainable development guidelines.

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Investigating emergent linkages between SDG 1 and SDG 7: A global survey of energy narratives under COVID19

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Dr Saruabh Biswas

Abstract

Almost immediately after COVID19-forced restrictions and counter measures took effect, a range of socio-economic distresses emerged as a consequence, disproportionately affecting low-income populations worldwide. Reports from inter-governmental agencies, industry associations, and others indicate that access to fuel and electricity resources may have fallen for low-income populations and that energy burdens may have contributed to the declining well-being and quality of life. However, reports and research thus far have not been able to illuminate the dynamics of the relationship between changes in energy systems and their multi-dimensional impact on poverty, preventing systemic action to disrupt the effects of this vicious cycle. To investigate the dynamics between energy systems, energy users, and service providers under COVID19, a global survey of organizations and individuals with first-hand knowledge is being conducted. Survey respondents will include off-grid energy businesses, energy access nonprofits, government utilities, academic experts in the field of energy access, microgrid developers, etc. Capitalizing on these respondents' proximity and service provision to socio-economically marginalized population groups, this study explores two overarching questions: What systemic strengths and weaknesses of energy systems and policies were revealed, enabling or impeding human well-being? Were existing energy burdens worsened and/or new ones created due to the pandemic?

Following the four-dimensional systemic structure of the energy-poverty nexus framework, this study investigates evidence of changes in availability, utilization patterns, forced trade-offs for energy services, and the consequential impact on socio-economic capabilities of energy users. The survey is designed to capture:

a. Observations by service providers of changes in lifestyles, economic capabilities, and/or energy use among energy users as a result of COVID19.

b. Operational challenges and adjustments made to energy product/service provision and/or impacts on planning and adjustments made to sustain energy services and/or support energy users in the wake of COVID19.

c. Major risks identified or illuminated by COVID19 to energy provision, use, or demand and potential strategies to de-risk users and service providers from similar shocks in the future.

Beginning the third week of January 2021, the survey is being distributed to over one hundred primary contacts globally. By the end of March 2021, the responses will be compiled, and analysis of trends is expected to reveal insights on a range of impacts on poverty and energy systems under COVID19.

It is expected that the results of this study will demonstrate key parameters for measuring the ability of energy systems to enable pathways out of poverty, moving beyond techno-economic elements of the sector. In terms of SDGs, this study is expected to characterize the links between SDG 1 (specifically targets 1.1, 1.3, 1.4, 1.5,1.a,1.b) and SDG 7 (specifically targets 7.1, 7.b). This will further substantiate the assertions of the energy-poverty nexus framework as a key arena of attention for SDGs, underlining the need to expand the SDG 7 targets to strongly incorporate parameters that explicitly provide guidance for the role and potential of energy systems to address poverty.

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Environmental Justice Legislative Tracker: Climate Change and Clean Air Provisions that Support Overburdened Communities

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Abstract

This paper addresses the legislative decisions made in all fifty states in the United States to address the needs of environmental justice communities. The research conducted for this paper explores all the environmental justice provisions embedded into clean air and climate change bills and resolutions across all the states.

A legislative tracker was completed that provided a state-to-state comparison that highlighted important provisions that other legislative bodies in the country could emulate. To identify the bills and provisions that could serve as strong models for the rest of the country, a variety of questions were used to guide the analysis of the bills including:
1) whether a task force or council was created,
2) whether there were any environmental definitions included,
3) whether there was justice as recognition provisions,
4) whether there were economic provisions, and
5) whether procedural justice and community involvement provisions were included.

Legislation between the years of 2018 to 2020 were the primary focus of the research. The results of the research showed that many of the eastern and western states in the United States had the most comprehensive and robust bills and resolutions in the nation. Many of the bills and resolutions included strong environmental justice definitions, procedural justice and community involvement provisions, and economic provisions.

Additionally, the states in the east and west typically acknowledged the impact of climate change and the lack of clean air on vulnerable populations, especially as it relates to the health of those within the communities. These bills and provisions served as an exemplar for the rest of the country. The southern and midwestern states were missing environmental justice provisions that directly supported and protected overburdened communities.

The legislative research conducted relates to SDG 1 and SDG 10. Furthermore, this research contributes to the topic of the conference as it directly addresses the global inequality and poverty that significantly disadvantage communities and their environments.

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Populations living near waste dumps in Nampula City, Mozambique: implications and perceptions on health and environment

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Abstract

Urban waste dumps near communities cause several problems in the environment and public health, as described by several authors. Populations living near these dumps suffer several diseases such as malaria, asthma and bronchitis, diarrhea and cholera, more frequently and other diseases caused by air and water pollution.

These effects cause a delay in the development of communities, causing weaknesses in the health of the populations. The objective of this study is to verify the effects that waste dumps have on public health and the environment, and to identify the perception of these populations living near the dumps about their quality of life. A epidemiological research questionnaire was developed with a pre-test of 5 people and questioned 300 people (convenience sample of populations living near waste dumps) in four different geographic areas (administrative posts) in Nampula city, Mozambique, three of these areas are exposed to waste dumps (cases): Carrupeia (n=50), Muhala-Expansion (n=40) and Namicopo (n=110) and one place is not exposed to waste dumps (control population): Marrere (n=100).

This questionnaire was indirect application and are developed in five distinct sections:
1) Socio-demographic information; 2) Health status; 3) Eating habits; 4) Environment; 5) Perception about the place where they live. It is important to mention in the socio-demographic characteristics there were no significant differences between the two population groups, representing a homogeneity in the chosen sample.

Regarding the perception about their health status, it was found that both in the controls and in the cases, about half responded that it was good and the other half indicating a positive perception about their health status. There were only significant differences ($p<0.05$) for Matequenha disease, with a lower prevalence in controls than in cases (34%, n=34 versus 48.5%, n=97). Regarding feeding habits, it was verified that the population has only 2 or 3 meals per day. In general, 75% of the population, both controls and cases, have 3 meals and 25% of the population (also controls and cases) have 2 meals a day. The perception of the population about the quality of the place where they live is favorable and there are no significant differences between the cases and controls. The participants selected most of the normal and good options (which totaled about 92% versus 88%; $p=0.103$). When asked what could be improved in the place where they live, the most chosen options were: 1º, "build landfills"; 2º, "build walls in the waste dumps"; 3º, "build gwaste dumps far from the communities"; 4º, "indeminize the people who live near the waste dumps"; 5º, "resettle the people who live in the waste dumps". The least chosen option was "to give employment to people who live near the garbage dumps".

The results of this study contribute to understanding the public health implications and perceptions of people living near the urban waste dumps in the city of Nampula, Moçambique.

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Variations in Sustainable Development Goal interactions: Population, income, and regional disaggregation

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Abstract

To fulfill the 2030 Agenda, the complexity of sustainable development goal (SDG) interactions needs to be disentangled. However, a holistic understanding is currently limited. We conduct a cross-sectional correlational analysis for 2016 to understand SDG interactions under the entire development spectrum. We apply several correlation methods to classify the interaction as synergy or trade-off and characterize them according to their monotony and linearity. Simultaneously, we analyze SDG interactions considering population, location, income, and regional groups.

Outcomes of our study provide a few new insights. First, our analysis reveals that synergies outweigh trade-offs and linear outweigh non-linear interactions. However, under the entire development spectrum, most SDG interactions are not-classified. Second, we detect, for the first time, (non-)linearity on SDG interactions. SDG 1 and SDG 6 are associated with linear synergies, whereas SDG 2 and SDG 5 with linear trade-offs. SDG 3 exhibits the most non-linear interactions for synergies but also trade-offs. Third, we highlight that socially-oriented SDGs currently show more variations in interactions than environmentally and economically oriented SDGs, globally. This implies that countries around the world are more likely to follow the social development paths of other countries than environmental and economic paths. Fourth, SDG interactions vary according to a country's income and region, along with the gender, age, and location of its population.

Our results show significantly less non-linear and not-classified SDG interactions within the income and regional groups than globally. Further, the female, younger, and rural populations have mostly synergistic SDG interactions in comparison to male, elderly, and urban populations.

Consequently, countries tend to follow the transition paths of other countries within the same group in all sustainable dimensions. In summary, to achieve the 2030 Agenda, the detected interactions and inequalities across countries need to be tracked and leveraged to “leave no one behind.” Development is generally not a linear process; neither is SDG development. For achieving the 2030 Agenda, rapid progress towards SDGs is required following non-linear paths, leaving no one behind.

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Are international organizations influenced by global goalsetting? The case of the World Bank, the SDGs and the reduction of inequality

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Abstract

In 2015, 17 Sustainable Development Goals (SDGs) were universally agreed upon, to be reached by 2030. International Organizations provided input during the SDG negotiation process, and many received the role of 'indicator custodian' for the SDG indicator framework. Although International Organizations therefore play an important role within the overall governance architecture of the SDGs and are crucial for the 'success' of this set of goals, not much is known about the extent to which these global actors themselves are influenced by global goalsetting. The current study contributes to filling this gap by studying one of the most prominent international organizations' uptake and prioritization of the SDGs, namely the World Bank.

The main questions we try to answer in this paper are the following: Have the SDGs become an integral part of World Bank discourse? Or are they solely used for outside reporting? Is the Bank also taking on goals that it might not have agreed with during the negotiation process? And if so, how does the Bank use these goals in its discourse? The aim of this study is two-fold. Firstly, we study the uptake of different SDGs within World Bank discourse. Thereafter, we provide a detailed case study of one goal, namely SDG 10 that aims to reduce inequalities, a novel goal captured in the SDG framework.

This goal has been one of the most controversial goals that came out of the SDG negotiation process, and it has been remarked by scholars that the World Bank disputed the need for an individual goal on inequality. Since this goal was nevertheless taken up in the final list, it provides a good case study to

explore the extent to which setting goals that might not fully resonate with a particular organization can nevertheless influence its priorities and communication. For this study, we compiled a corpus consistent of 282 key World Bank documents, separated into a pre-SDG (2000-2015) and SDG period (2016-2020). These documents include i) speeches of World Bank presidents, ii) Annual Reports and iii) Flagship Reports. We used (automated) text analysis to map the overall coverage and prioritization of the SDGs by the World Bank. Thereafter, we used a mixed-method approach to analyze the case of SDG 10 on inequality, combining (automated) text analysis and discourse analysis. This resulted in an overall picture of the (change in) occurrence and contextualization of this disputed topic over time.

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Poverty and sustainable development: a legal perspective

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Abstract

Sustainable development goals were adopted by all United Nations Member States in 2015 as a global call to action to end poverty, protect the planet and ensure that everyone enjoys peace and prosperity by 2030. The developmental educationalists define sustainable development as a reduction of hunger and poverty in an environmentally sound manner. This implies the fulfilment of human requirements within a society while still maintaining the natural environment indefinitely.

This paper seeks to consider sustainable development in terms of balancing between people's economic and social needs and the preservation of natural resources and ecosystems to meet present and future needs. Idealistically, development should balance social, economic and environmental sustainability. However, the paper argues that poverty has remained a major obstacle to sustainable development in Nigeria. Indeed, the overwhelming plague of poverty has stunned the ability of its people to transform themselves and the environment. It is no gainsaying the fact that several measures have been taken to alleviate poverty in Nigeria yet no commensurate return in terms of a better life for the people. Thus, this paper will consider the nexus between poverty alleviation and sustainable development in Nigeria. In line with this, the paper will examine why despite the abundance of economic resources, attempts to reduce poverty and promote sustainable development have not become a reality in Nigeria.

It will also examine other challenges confronting poverty reduction in Nigeria which include corruption, ethno-religious conflicts, income inequality, political instability, lack of proper coordination and management for sustainable development programmes and wasteful patterns of production-consumption. Importantly, the paper will further examine from legal perspective issues hindering the achievement of desired sustainable development including environment and poverty alleviation.

This is crucial as Laws, regulations and policies are among the vital instruments for transforming the environment and achieving sustainable development. That being said, the paper will inevitably consider whether there is no sufficient and legal framework on sustainable development or whether they are weak or not implemented.

Full papers

Territorial development prospects in the light of the dynamics of economic and social polarization in the EU

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Abstract

Financial crisis, predatory attitudes, markets, finance, speculation, international trade, asymmetrical globalization, political choices represent some of the factors underlying a growing inequality, to be found among the world population.

In the past significant differences related to the opportunity to access to resources and quality of life characterized the least developed countries. In recent years - since the 1980-, these disparities are interesting even Western countries such as the industrial economies of the Atlantic and European countries; an international scientific and political debate has developed around this theme.

Looking at the inequalities from the social and economic perspective, it produces a widespread sense of injustice, which culminates in the erosion of the trust in institutions, politics and the market economy; the issue also takes importance from a geopolitical point of view, especially if it is observed jointly with the polarization of individuals and countries, or if it is placed in correlation with the crisis of liberal democracies, often accompanied by the spread of nationalist currents capable of putting into discussion the pillars of the EU system.

The paper observes the inequalities through the scientific literature and through it it's possible to find the causes and effects of this condition. In particular, it is possible to note the progressive impoverishment of the middle class of the population and the correlated concentration of national wealth in favor of a small minority (Stiglitz, 2014), the rise of a hyper-paid elite (Piketty, 2018; Saez and Zucman, 2019), a reduced upward economic mobility (Krueger, 2021). These phenomena should be reread in the light of the aggregation of individual behaviors to better understand the increasingly evident phenomenon of the disintegration of the social fabric, considered, in many cases, also the cause of the political metamorphosis of some States. The research analyzes the statistical data acquired from Eurostat and Istat, with the aim of carrying out a comparative analysis between states and regions, functional to the observation and definition of the dynamics of social and economic polarization in the

EU space. The results of the study, declined on the local scale, could represent a contribution for a better setting of the policy lines capable of achieving objectives contained in the 2030 Agenda.

Keywords: Socio-economic polarization, Inequalities, Poverty, European countries, Italian regions

1. Introduction

The issue of economic and social inequality is complex, articulated and extremely widespread on a global scale. It concerns both the so-called "North of the world" and the poorest regions of the planet and affects above all the weakest fringe of the population, more exposed to the risks of poverty and injustice. The growing concentration of wealth in the hands of a few individuals and the enlargement of the number of poor people are two emblematic aspects of a high degree of social polarization. The latter shows itself with increasingly marked boundaries between protected and unprotected categories of people, rich and poor, and between those who can access essential services, such as education and health, and those who cannot.

The economic crisis of 2007-2008 and the still ongoing crisis due to Covid-19 have led to an increase in unemployment, low-paid work, and precariousness, negatively affecting many dimensions of human living (Corbelle Cacabelos and Troitiño Cobas, 2013; Rueda-Cantuche, 2021; OECD, 2021). This caused a greater exacerbation of inequalities especially for those individuals who were already in conditions of marginality (Carta and De Philippis, 2021).

The concern with respect to poverty and inequality is perceived at all levels, as is evident from the Millennium Goals promoted by the United Nations (Atkinson and Brandolini, 2010), the Europe 2020 Strategy (Barreiro Gen et al., 2013) and the 2030 Agenda (Di Blasi, 2016).

Given that poverty, material deprivation and social exclusion are interconnected critical issues (Sen, 2010), the search for sustainable and effective solutions should necessarily start from the analysis of the underlying causes of inequity. The financial crisis, predatory attitudes, markets, speculation, international trade, asymmetrical globalization, and certain political choices represent some of the factors behind growing inequality, on a global scale.

If in the past considerable differences referring to opportunities for access to resources, quality and standard of living characterized the less developed countries (Madau, 2014), it is since the 1980s that these disparities have also affected Western countries in an increasingly sensitive way. Socially and economically inequality produces a widespread and profound sense of injustice, culminating in the erosion of trust in institutions, politics, and the market economy.

This is also a relevant topic from a geopolitical point of view, especially if we look at it from the perspective of the polarization of individuals and countries, or if we correlate it with the crisis of liberal democracies.

In this paper, the theme of inequality is addressed through the analysis of some key indicators – relative poverty, gross domestic product (GDP) and the Gini coefficient – whose interrelated reading allows us to interpret the evolutionary trends over a specific period.

The research is based on the elaboration of statistical data acquired from the Eurostat and Istat databases with the aim of carrying out a comparative analysis between the countries of the European Union (EU) and between the Italian regions. This analysis will be functional to the observation and definition of the dynamics of social and economic polarization which can be found in the EU area and in Italy.

The investigation highlights how some drivers of inequality behave at different scales, providing guidance for future adoption of policies that also consider the effects produced by the Covid-19 pandemic.

Relative to the structure of the paper, we report in section 2 the literature review, in section 3 the methods and data, in section 4 the results, and in section 5 the conclusions.

2. Literature review

The increase in disparities, according to a trend recorded for years at the global scale and expressed by a pronounced social polarization, moreover fueled by a marked inequality in income distribution (Stiglitz, 2014; Piketty, 2018), is a topic of absolute centrality within the political and institutional agendas. If until the 1980s the issue was treated almost marginally by policy makers, today there is a growing interest in it mainly because of its objectivity and self-evidence (Perocco, 2018).

Inequalities represent, in fact, a real menace for the stability of democracies and for the harmonious development of territories; this is witnessed also by numerous programmatic documents elaborated by different international organizations with the purpose of identifying possible solutions able to contain their effects. These include the 16 Global Risk Reports produced by the World Economic Forum since 2006, in which the dynamics of inequality are analyzed and related to directly or indirectly linked and contingent issues. For example, if in the 2017 Report there were explicit references to the climate and environmental emergency, then particularly felt also in light of the recent approval of the Paris Agreement, in the 2021 Report the focus is also placed on the gaps detected in digitalization processes and the outcomes of the pandemic, which has further exacerbated certain situations of disadvantage (WEF, 2017; 2021).

The distortions inherent in the relationship between wealth distribution, income generation and the increase in inequality and poverty is confirmed by data certifying that between 1980 and 2016, 27% of the total increase in global wealth ended up in the hands of the richest 1% of the planet's population.

In the face of this centralization of wealth, however, there is also an improvement in the living conditions of the poorest 50% of the population, mainly due to the boom in emerging economies;

however, as the 2018 World Inequality Report points out, this increase was only 12% of the total (Alvaredo et al., 2017).

The causes of inequality in wealth distribution are diverse and systemically interrelated. The main ones include liberalist pressures, the financialization of the economy, the asymmetric globalization, and the political choices of different countries. With reference to this last point, the World Inequality Lab highlights how world economies have responded in different ways to the changes that have taken place in contemporary society, in some cases succeeding in reducing (but not eliminating) inequality thanks to the adoption of special welfare systems, as has happened in Europe (Ibid).

The process of transition from neo-Keynesian policies to the new economy has therefore not prevented social inequalities from becoming explicit and expanding even within and between European Union (EU) countries, reflecting on territories in the form of conflicts, social clashes, and spatial justice problems (Prisco, 2013).

Inequalities, in fact, under the social and economic profile, create a widespread and deep sense of injustice (Saez and Zucman, 2019), which culminates in the erosion of trust in institutions, politics and the market economy; the issue also assumes relevance under the geopolitical profile, especially if we put it in relation to the crisis of liberal democracies, often accompanied by the spread of nationalist currents.

These critical issues even affect the exacerbation of polarization with regard to employment (Krueger, 2021), with a labor market characterized by the growth of very specialized and well-paid occupations on the one hand, and low-skilled and lower-paid occupations on the other. All this contributes to widening the wage gap at the expense of a middle class that, especially in the last 10 years, has been significantly weakened (Tricarico, 2019). The Committee on Employment and Social Affairs of the European Parliament expressed itself on these issues in its Report (2019/2188(INI)) of 27/01/2021.

In this policy document, after taking stock of the serious situation of European countries due to the increase in inequality and poverty and after highlighting specific critical issues such as, for example, job insecurity, obstacles to social inclusion, problems related to the protection of rights and equal opportunities and the economic and social consequences of the Covid-19 pandemic, member states and the Commission are invited to adopt concrete measures to reduce the conditions of disadvantage that afflict millions of citizens.

To an already fragile situation must be added, as mentioned, the consequences of the pandemic which, as highlighted in a recent Oxfam report (2021), is contributing to worsening inequalities, above all to the detriment of the most fragile groups exposed to the risk of poverty.

The effects of the pandemic are felt in all EU countries, including Italy, which already in the pre-crisis period bore the brunt of inequality, even though in recent years there have been improvements in this

sense due to the introduction of new welfare instruments such as the inclusion income and the citizenship income.

If in 2019 there were 4.6 million absolute poor in Italy, or 7.7% of the population (in 2018 this incidence was 8.4%) and 1.7 million Italian households were in poverty (6.4% of households), it is reported that the pandemic has set the country back 10 years in terms of poverty and economic situation. The crisis triggered by the spread of Covid-19 has afflicted above all the most fragile categories (women, young people, unprotected workers, the unemployed, etc.), although the adoption of measures such as the emergency income has partially mitigated the negative effects.

Yet, it is noted that the inequality gap was wider in 2020 than it was at the time of the 2008-2009 crisis (Istat, 2020). The complexity of the situation, also in function of the current historical period characterized by a high pervasiveness of the digital in all fields of human life, has favored the emergence of new facets of inequalities.

This is certified by data on the increase in educational poverty (Da Lauso and De Capite, 2020) and the difficulty of accessing new technologies (WEF, 2021). It is evident that the less educated and those unable to use digital connection tools have been more exposed to the effects of an economic and social crisis that the OECD itself has not hesitated to define as "unprecedented" (OECD, 2021).

3. Methods and data

The aim of this paper was to investigate some dimensions of inequality, mainly related to the fields of poverty and wealth, in relation to specific geographical areas (EU countries and Italian regions). In fact, poverty and wealth are two important drivers whose interrelated reading offers the possibility to explain how certain socio-economic dynamics evolve over time and space.

The analysis was carried out on the Nuts 0 and Nuts 2 scales using the Gini Index, a specific poverty indicator and the GDP per capita.

For the Nuts 0 scale, data were extracted from Eurostat's database for the 28 EU countries in relation to the years 2009 and 2019, to highlight trends over a sufficiently long time period to detect possible variations and deviations. During the elaborations, it was decided not to include the United Kingdom due to the absence of data for 2019 and Croatia due to the lack of data for 2009, so the total number of countries considered is 26.

Regarding the Nuts 2 scale, the study focused on the Italian regions and the autonomous provinces of Trento and Bolzano; the data come from the Istat database for the years 2007 and 2017, this being the last date for which the Gini coefficient was officially calculated at regional level.

With reference to the measure of poverty, at the state level has been used the composite indicator "People at risk of poverty or social exclusion" from Eurostat, expressed in percentage values. Instead,

for the Italian regions was used the "risk of poverty or social exclusion" index, also provided in percentage terms by ISTAT.

Concerning the GDP of the Italian regions, real GDP (referring to the years 2007 and 2017) was taken with chained values as of 2015, while for the EU countries the GDP per capita expressed in PPS was used for the years 2009 and 2019. To obtain the GDP per capita at regional level, the real GDP was divided by the resident population in each region for the years 2007 and 2017 (data on the resident population on 1 January 2008 and 1 January 2018 come from Istat).

For the poverty measure (Pov), data were transformed by dividing the corresponding percentage value of each region by the regional average. The same procedure was followed for the transformation of the poverty indicator to the Nuts0 scale.

$$PovReg1 = \frac{Pov\ Reg1/100}{\frac{\sum_{1-21}(PovReg/100)}{21}} \qquad PovState1 = \frac{Pov\ State1/100}{\frac{\sum_{1-26}(PovState/100)}{26}}$$

The Gini coefficient was also transformed by dividing the value of each region and state by the corresponding average value.

$$GiniReg1 = \frac{Gini\ Reg1}{\frac{\sum_{1-21} GiniReg}{21}} \qquad GiniState1 = \frac{Gini\ State1/100}{\frac{\sum_{1-26}(GiniState/100)}{26}}$$

Once all the data had been transformed, correlation coefficients were calculated between Poverty and Gini, Poverty and GDP, Gini and GDP, at both Nuts 0 and Nuts 2 scales.

Poverty indicators and the Gini coefficient were also analyzed by dividing the scatter plots into four quadrants in order to analyze the positioning of different territorial units over time in relation to the levers of inequality considered.

4. Results and Discussion

In this paragraph we first analyze the dynamics at the level of European countries. During the period considered against a positive GDP per capita dynamic, there was a substantial reduction in the proportion of people at risk of poverty and social exclusion and a slight increase in the income concentration indicator. At Italian level, the dynamics are quite different because, in the face of a substantial reduction in per capita income, we see a worsening of the poverty indicator and a slight increase in the Gini indicator.

If we look at the correlations between the three indicators, there is considerable dynamics in all three cases. The correlation between Poverty and Gini was already extremely strong in 2009 and as this link has been further strengthened over time, it is clear that the construction of interventions to combat inequalities can only pass through forms of reduction of income concentration, i.e. policies of income redistribution. The link between the two indicators and GDP has weakened, and this could be a sign of

the inadequacy of GDP per head in reporting people's poverty (Table 1). It is clear that the above considerations must be adequately confirmed in robust statistical causal mechanisms.

Table 1. *Trend of analysed indicators (2009-2019).*

	2009	2019	% changes 09-19
GDP UE26	99.65	103.54	+ 3.9 %
Poverty index UE26	0.240	0.211	- 0.029 %
Gini index UE26	0.296	0.308	+ 0.016 %
GDP Italy	108	96	- 10%
Poverty index Italy	0.249	0.256	+ 0.007%
Gini index Italy	0.318	0.328	+ 0.01 %
Poverty/Gini	0.697	0.878	+ 0.181 %
Poverty/GDP	- 0.58	- 0.33	+ 0.25 %
Gini/GDP	- 0.324	- 0.177	+ 0.147

(Source: our elaboration on Eurostat data)

In the following two graphs (Figures 1 and 2) we see how the relative position of the different European countries evolves. Compared to the origin of the axes identified by the coordinate point (1.1), corresponding to the EU26 average values, it can be seen, for example, that Italy shows an extremely negative dynamic with regard to the poverty indicator, which goes from a value in 2009 of 1.04 (4% higher than the average value) to one in 2019 of 1.22 (22% higher than the average value).

It can also be seen that the strengthening of the correlation indicator between the Gini index and the poverty index depends on the rapprochement, with respect to the core of the scatter plot, of some eastern European countries (Hungary, Romania and Bulgaria). This last element will make it possible to imagine measures to combat inequality with a transnational value, since the link between the two indicators is now very clear in all countries.

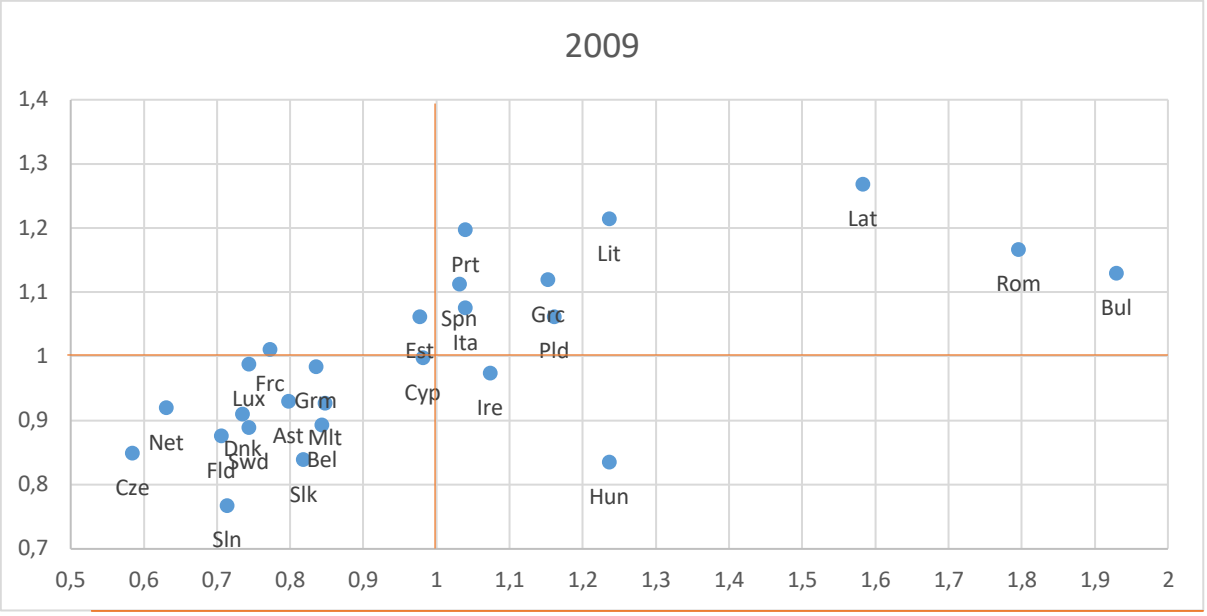

***Figure 1**. Correlation between Gini coefficient and Poverty Index – 2009 Nuts 0 level (Source: our elaboration on Eurostat data)*

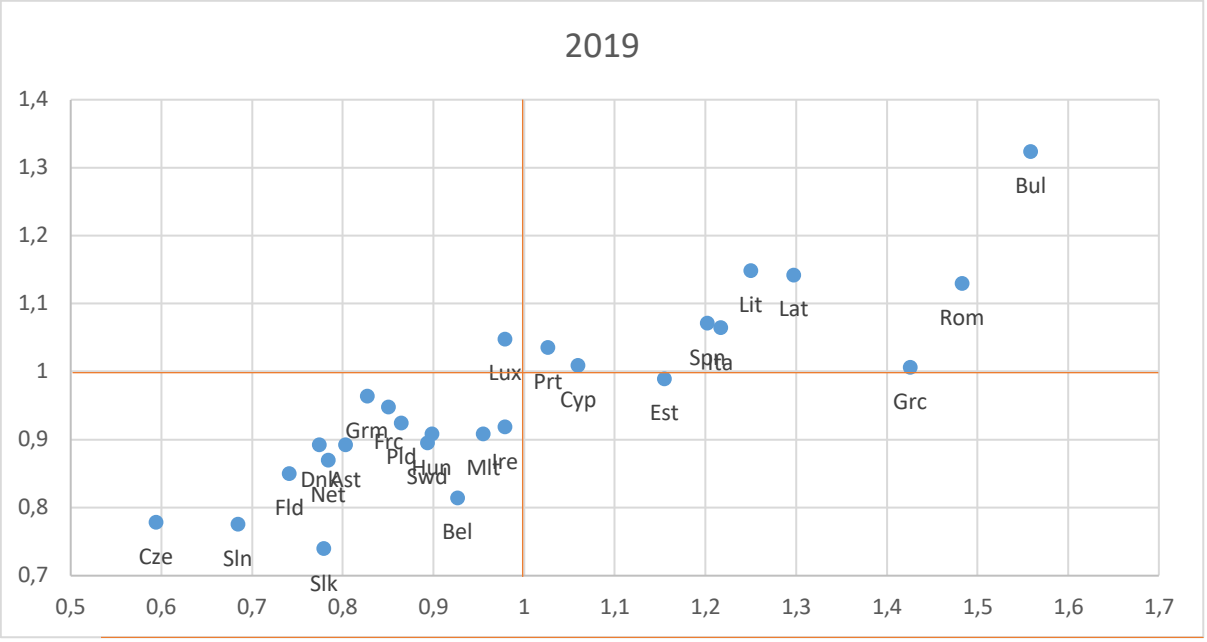

***Figure 2**. Correlation between Gini coefficient and Poverty Index – 2019 Nuts 0 level (Source: our elaboration on Eurostat data)*

Let us see below how the situation has evolved at the level of Italian regions. Although the reference period is slightly different, the dynamics already underlined in relation to the EU26 values are confirmed, namely a sharp reduction in GDP per head, a substantial increase in the poverty indicator and a slight increase in the Gini indicator.

In this context, regional dynamics see Sardinia further penalized in the reduction of GDP per capita and in the accentuated dynamics of the inequality indicator. If we look at the correlation indices, however, a situation appears rather different from that described above. In the face of a reduction in strength

linking poverty index and income concentration index (- 10.8%) there is a very strong negative correlation between GDP per capita and poverty, a symptom of the fact that in Italy, more than at European level, the roots of poverty are mainly due to the lack of economic resources (Table 2).

Table 2. *Trend of analysed indicators (2007-2017).*

	2007	2017	% changes 07-17
GDP Italy	30105	27968	- 7.11 %
Poverty index Italy	0.244	0.280	+ 0.036 %
Gini index Italy	0.269	0.288	+ 0.019 %
GDP Sardegna	21847	20191	- 7.60 %
Poverty index Sardegna	0.303	0.381	+ 0.078 %
Gini index Sardegna	0.288	0.304	+ 0.016 %
Poverty/Gini	0.831	0.723	- 0.108 %
Poverty/GDP	- 0.891	- 0.894	- 0.003 %
Gini/GDP	- 0.636	- 0.501	+ 0.135 %

(Source: our elaboration on Istat data)

We complete the analysis with the scatter plot (Figures 3 and 4) which show that in 2007 regions are very clearly divided between regions in the South where the indicators of poverty and concentration of income both take values above the national average and regions of the North and Centre which, apart from Lazio, Lombardy, Emilia Romagna and Liguria, show both indicators below the national average. Ten years later, the separation is clearer between regions of the first quadrant (southern regions) and quadrant III (central and northern regions).

From this obvious dichotomy are distancing Abruzzo and Molise in one way (in which the worsening of poverty indicator is accompanied by the improvement in the Gini indicator) and Lazio which now moves into the first quadrant due to the increasing value of the income concentration indicator. These shifts overall lead to an increase in the dispersion of points with a less strong relationship between the two indicators.

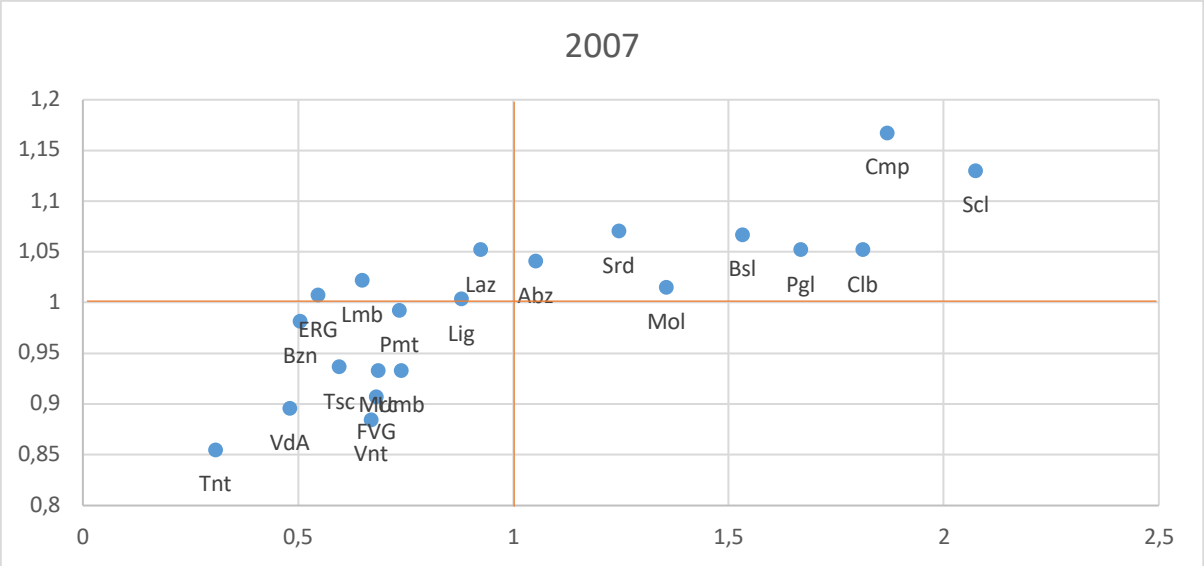

***Figure 3**. Correlation between Gini coefficient and Poverty Index – 2007 Nuts 2 level (Source: our elaboration on Istat data)*

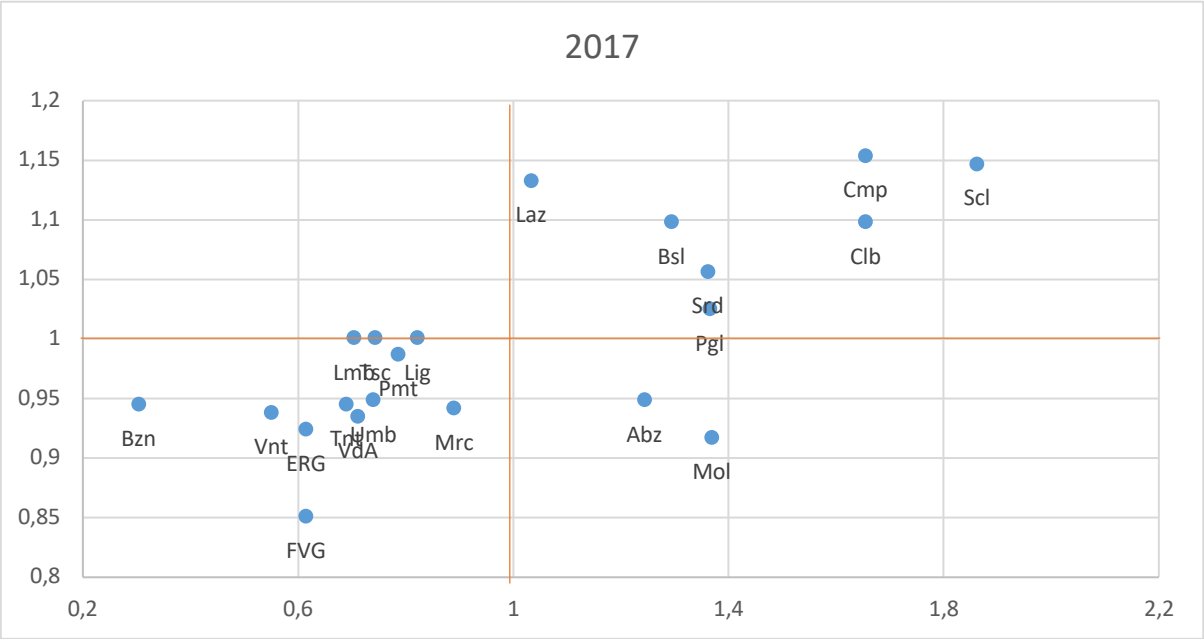

***Figure 4**. Correlation between Gini coefficient and Poverty Index – 2017 Nuts 2 level Source: our elaboration on Istat data)*

5. Conclusions

The European Union socio-economic performances must be observed, more than in absolute terms, from a spatial-temporal perspective. This is important to understand, in a deeper way, the evolution of phenomena that are distributed and linked (among themselves jointly, and for each of them,

individually, in specific geographical areas) in a context that is characterized by strong regional disparities and therefore requires the implementation of targeted and differentiated policies.

This study is focused on the EU area and highlights the positive dynamics referred to the growth trend of GDP per capita detected in the 2009-2019 period, and a (slight) decreasing variation, at the same time, of the poverty rate. These values should be read under the lens of the multiple and heterogeneous territorial scenarios of the Union, to be able to make the necessary territorial distinctions.

Through an evidence-based approach, linked to the specificities of the places, it is possible to reorder the socio-economic mosaic of the EU. It is possible to distinguish three macro-regions, characterized by growth trends of variable geometry, within which the correlation between the factors investigated (GDP - Poverty Index - Gini) is the cause-effect of very different phenomena.

Macro-region 1: In the Western EU it is possible to identify an economic backbone called the Blue Banana (Buent 1989, in Faludi and Waterhout, 2002) that intersects the "European pentagon" and includes Central Europe. This area, the best performing in terms of economic productivity and the most profitable in the EU system, is the one in which GDP per capita, acquired in absolute terms, is at its highest.

Despite this virtuosity, in some countries the poverty index (Belgium and Luxembourg) and even the Gini index (Germany) show an upward trend. In this specific context, where inequality is not to be found in the distribution of income (which in the area has higher values than the EU average), and the problem is not due to the lack of material goods, the factors on which it is deemed necessary to act do not refer to equalization, but rather to process equality and equal opportunities.

In this case, the analysis carried out revives a research question that has been central to the international scientific debate for years now, which emphasises the adequacy of GDP as a benchmark for measuring economic performance, i.e. the need to evaluate the economy of the average citizen rather than "the performance of the economy on average" (Stiglitz, 2018), in order to better direct policy activity.

Macro-region 2: The Euro-Mediterranean area represents a complex geo-economic reality, a periphery not only geographical but also economic of the EU system. In the Italy-Spain-Greece quadrant, there are increasing rates of poverty, a significant contraction in GDP, and higher values of the Gini coefficient than the EU-15 average. An additional critical point is Italy, where income distribution is particularly uneven, confirming the country's bipartition into two distinct geo-economic realities: the prosperous North, close to the European core, and the deeply recessive South, which continues to show significant asymmetries compared to the average performance of the EU area.

In this situation, policy interventions must be framed within a general policy of revitalisation aimed at reducing structural gaps, which, in the case of the analysis conducted here, aims at eliminating

conditions of initial disadvantage and forms of social polarisation, guaranteeing citizens greater accessibility (not only geographical) to resources and greater upward social mobility.

Macro-region 3: The overall positive performance in terms of constant productivity growth recorded in the EU is largely influenced by the results produced in the Union's eastern quadrant, as a result, it can be inferred, of the results of the convergence policy of the last programming cycle. Within this territorial context, which, it should be noted, is on a path of convergence towards the EU's average standards, it is nevertheless possible to make a further differentiation between States: the countries of the Visegrad bloc represent the most solid economies of the Eastern Union, where not only is there greater GDP growth in absolute terms, but also a more balanced distribution of incomes. On the other hand, the South-Eastern backbone of the EU is markedly fragile: in Romania and Bulgaria the correlation between poverty and inequality is worsening; it is in this quadrant that material and social deprivation is exacerbated in absolute terms and is accompanied by forms of exclusion from even essential goods and services, drawing attention to the need to implement more incisive sectoral policies in terms of equalisation and accessibility to resources.

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7. Social-economic Aspects of Sustainability

7b. The future of employment and good work

Abstracts

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Integrating Employee Engagement factors to enhance Sustainability in organisations

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Abstract

Employee engagement (EE) is a fundamental element for implementing sustainability in organisations. Nine EE sustainability factors can be identified: (1) training; 2) involvement; 3) engagement; 4) diversity and inclusion; 5) incentives; 6) formal rules and norms; 7) informal rules and norms; 8) supporting employee volunteering; and 9) communication. Most research on EE factors for sustainability has been on companies, with a few researches on civil society and public sector organisations (PSOs). The purpose of this paper is to analyse the importance of the EE factors and their interrelations. A survey was sent to 5,299 organisations, of which 305 responded. The survey responses were analysed using descriptive statistics, rankings, comparison between organisation types, correlations, centrality and cluster analysis. There were no statistically significant differences between different organisation size or type.

The ranking shows that communication, involvement, and having formal rules and norms were ranked highest. The results indicate that the nine factors are interrelated, though some more than others. The ones with the highest interrelations were: involvement and engagement, and training and engagement. The analyses show a number of groups of EE factors that can help to better combine them. A holistic combination of clusters of EE factors appears to be the most effective way to embed sustainability and address SDGs in organisations.

This research is related to SDG8, target 8.3 (Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services) and 8.5 (By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value).

This research provides insights into better refocus on EE factors and clarifies the SDGs' connection to the organisations' sustainability efforts and strategies. EE factors can help to contribute sustainability and achieve SDGs in organisations, yet they need to be combined efficiently in order to address holistically sustainability.

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Quality of working life in the Circular Economy

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Abstract

One of the often-cited benefits of transitioning to a Circular Economy are the opportunities for job creation. While research shows some evidence of job growth in certain sectors and industries (as well as losses in others), little research has been done to understand the quality of work that is created. In this study, quality of work is analysed through a multi-dimensional framework, which brings together literature on good work, quality of employment, and quality of working life together with social sustainability principles to develop a context and assessment structure for quality of working life in the Circular Economy. This framework is used to explore the case of the repair service sector in Hull, UK as an opportunity for (quality) employment. Hull has been characterised as a structurally disadvantaged city, which might benefit from job growth in this sector. This qualitative study uses data from interviews with repair service workers in textile, electronic, and domestic appliance repair to assess the structure of employment that exists in the sector, the skills required, and the motivation for working in the sector. Preliminary results indicate that in Hull, there is a high prevalence of independent sole-proprietor businesses in the repair sector, often comprising zero employees. Mentorship and on the job training opportunities are limited, primarily due to the nature of small business and limited excess capacity. Experience is often valued over formal education in repair services. Trade-offs in quality of working life dimensions are identified between employment structures. In particular, agency and flexibility are highly valued in owner-operated businesses, despite the uncertainty and inconsistency of work/income. This is juxtaposed to larger businesses (often associated with a specific manufacturer), where employees identify security in employment, while lacking agency in their day-to-day workflow. This study contributes to an understanding of the CE employment landscape, particularly in terms of a just transition.

Abstract most directly relates to SDG's: 8.2, 8.3, 8.4, and 8.8.

This study contributes to the topic of 'Accelerating progress towards SDG's in times of crisis' by acknowledging the uniquely precarious position that the pandemic has placed much of the labour force, uncovering some of the ways in which CE employment is vulnerable, and recommending interventions which support good work into the future.

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Transition in the European labor market: Flexible employment in selected EU countries

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Abstract

As a result of ongoing socio-economic developments, one of the observed trends is changes in the labour market. For several decades there has been a systematic increase in demand for employees in the service sector, where temporary work consisting of the execution of orders and projects is becoming more prevalent. New non-standard forms of work are related to such concepts as the gig economy, the sharing economy, collaborative economy, on-demand economy, as well as platform economy. These concepts define the modern economy based on the realisation of tasks and projects executed on digital platforms, and not in the form of full-time jobs. The growing importance of alternative forms of work poses a challenge to traditional work organisation. This has profound implications for the division of labour in companies. The growing demand, as well as supply of temporary workers, are shifting emphasis from position-based work to skill-dependent jobs. However, the knowledge of new forms of work arrangements is still fragmented. Therefore, the aim of the article is to analyse and assess the developments of selected alternative forms of work in EU countries. Based on this, the following research question will be answered: to what extent is labour market flexibility developed in European Union countries? In order to assess the potential of current changes and trends in the labour market, this paper will contain both theoretical and empirical research on flexible work forms in selected EU countries. This research will be based on publicly available statistics on the labour market transition. Bearing in mind the growing development potential of flexible forms of employment, it should be noted that in truth they create new opportunities and are sometimes convenient; however, as a result of their use, new challenges arise, which results in a high degree of employee turnover, as well as fragmentation of work (larger jobs are divided into micro-tasks), changing working conditions and insufficient social security guarantees. The study contributes to expanding the scope of the knowledge on the flexibility of the labour market that is currently the subject of national and European policy debates.

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Is it automation and IT replacing the workforce?

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Abstract

In an age dominated by the consumer, implementing technology that can track, measure and respond to the key shifts in consumer behavior could well make or break a business. Automation and IT are supplementing the workforce to provide greater levels of efficiency an insight and consumer obsession on the foundation of organizational success in 2019. Digital transformation on the agenda of the organizations for years and in 2020 it is predicted to be a crucial time for leaders to plan for and implement it across industries. So, what does the future hold for digital transformation and what do leaders need to take into consideration in order to plan for its development and implementation?When it comes to a timeframe, 85% of key decision makers feel they have only 2 years to get to grips with digital transformation. While the past few years have seen some movement in digital transformation, there's now an urgency, and considering that 59% of business leaders worry that it's already too late for them to adapt, time is of the essence.

By preparing for these changes, business leaders will be able to remain one step ahead of the consumer, retaining the capabilities to form long-lasting relationships that stand the test of time. It seems the time to strike is now. Is it necessary for the organizaions to acquire the knowledge they need on emerging digital technologies understand? How their plan will affect the business as well as the end user, leverage data to their advantage, inspire others to move in the right direction? How they will avoid being left behind?

In this paper will be done an analyse if is it necessary the upskilling of the staff with relevant digital courses by giving them the tools, time as well as resources to keep building upon their talents. If the organizations will ensure that digital transformation remains at the core of their business strategy?

Keywords—Economic Effects, Developing Strategies, IT, Leaders, Organizations

Full papers

Ergonomic study of strawberry production in family farming

Ergonomic study in family farming

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Abstract

Agriculture is the main source of food supply in the world and makes up the main axis of the global economy, however due to the lack of mechanization, it poses risks to workers' health. The study of ergonomics in agriculture is still not as widespread, thus, the objective of the study was to evaluate the working conditions of strawberry farmers in family farming, with a focus on strawberry production. This is a series of cases, with a quantitative approach, in which 4 properties distributed in the states of Santa Catarina and Minas Gerais were evaluated. The assessments were performed using the Body Discomfort Scale and the OWAS Method. The main discomforts reported were back pain, followed by pain in the legs and arms/hands. Counselling and ergonomic education is essential for these workers. Labor gymnastics is an intervention that influences the reduction of injuries and bench planting becomes the most appropriate in relation to ergonomics, due to the fact that the worker is in a more upright and correct posture. Finally, the research and their coherence with the sustainable development goals established by the United Nations in the 2030 Agenda were analyzed.

Keywords: Ergonomics, Family farming, Farmer, Strawberry production, Sustainable development goals.

1. Introduction

Ergonomics, according to IEA (2019), seeks to understand the interactions between humans and elements of a system, and the application of theories, principles, data, methods and projects in order to

optimize human well-being and global performance of the system (IEA, 2019). It brings together knowledge of subjects such as anatomy and physiology, psychology, engineering and statistics, in order to optimize strengths and minimize the effects of limitations (Capodaglio, 2020; Helali et al., 2008). That is, instead of workers adapting to uncomfortable, stressful or dangerous postures, ergonomics specialists must adapt the work environment to workers (Bligard and Osvalder, 2012; Dzissah et al., 2005; IEA, 2015).

In the world, it is estimated that 1.1 billion people are related to agriculture, which generates about 300 to 500 million salaried workers, where many depend on income from employment in the plantation sector. They often cultivate in the format of family farming, where unpaid family members perform agricultural work to support their families (ILO, 2014).

Agriculture is the main source for global supply and is extremely important for the global economy (Benos et al., 2020). Brazil is one of the largest food producers and most productive agriculture in the world, with more than 5 million farms, with 84.4% of them having family farming, which occupies less than 1/4 of the cultivated area in the country and more than 3/4 of agricultural workers (Abrahão et al., 2015; IBGE, 2012).

Baron and his collaborators, in 2001, already pointed out that the work in agriculture is intense and the workers express that the pain in the back, arms, shoulders and hands are the main discomfort (Baron et al., 2001). A quarter of the injuries that make the workers absent from work are back injuries, which is also one of the most common causes of disability, most often caused by lifting heavy objects. According to Raczkiewicz et al. (2019), Work in agriculture is associated with frequent lifting of heavy objects, exposure to extreme weather conditions (low and high temperature, severe rain and wind) as well as unusual postural positions during work (Raczkiewicz et al., 2019).

However, according to Koehncke (2018), over the years, some types of work in agriculture remained the same (Koehncke, 2018). It is a risky occupation in relation to health and safety, with long hours in postures with inclined trunk, kneeling, carrying weights in difficult positions or with arms above shoulder level with frequent repetitive movements of the hands and wrists. This demonstrates the growing need of more prevention research and strategies to mitigate risks in this area, including ergonomic interventions (Benos et al., 2020).

Abrahão et al. (2015) explain the reasons for the lack of ergonomic studies in agriculture: 1º) the great variability of tasks and jobs; 2º) the product develops itself independently of human work; 3º) the work happens outdoors, with uncontrollable environmental conditions; 4º) the use of various tools, utensils and techniques, making it highly physical, as well as long working hours, excessive commuting, great diversity of activities, lack of training, among others (Abrahão et al., 2015). ILO warns that the inadequacy of personal protective equipment used in agriculture is a relevant factor in precarious working conditions (ILO, 2019).

Barth et al. (2016), in addition to the great physical effort, due to the lack of technology, the small farmer is subjected to several accidents at work, the harmful effects of the sun rays, extreme

temperatures and the risk of suffering attacks by venomous animals, ie, have unhealthy and critical ergonomic working conditions. All these conditions still depend on the quantity and type of products that are grown, as the producer needs to dedicate himself fully and, often, even on weekends and hardly take some vacation during the year, causing a physical and psychological overload on the farmer.

Inadequate working conditions in agriculture, where labor is heavily manual, such as horticulture, are well known and documented around the world. Many tasks and tools have been mechanized, improving cultivation methods, but manual work with unwanted postures is still necessary in some cases, which is a risk factor for musculoskeletal disorders, as they cause excessive loads on the back, hips, knees and feet (Pinzke and Lavesson, 2018).

Fethke et al. (2020) reinforce the conclusions of Pinzke and Lavesson when stating that more than half of the agricultural activities, in a sample of farmers, exceeded the mechanical load exposure limits proposed for wrist movements, which suggests excessive risks for musculoskeletal injuries (Fethke et al., 2020).

2. Methods

This study presents a qualitative and descriptive approach and involves 20 workers of four properties with strawberry plantations, linked to family farming, in three cities in Santa Catarina - Brazil, called: Içara, Rancho Queimado and Lages, and one in the state of Minas Gerais - Brazil, in the municipality of Extrema. The localization of the cities can be seen in Figure 1.

Figure 1*. Brazil Map highlighting the states of Minas Gerais and Santa Catarina.*

The methodological framework of the present study is based in the Ergonomic Work Analysis of Guérin et al. (2006) (Figure 2).

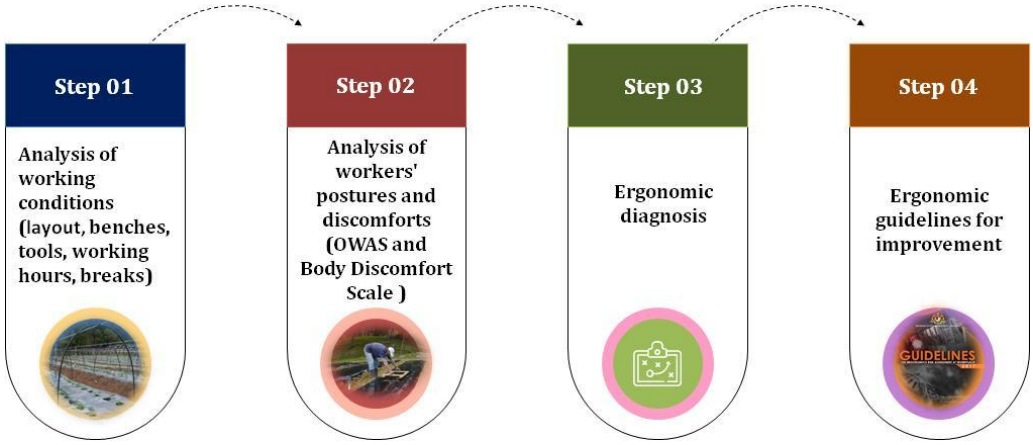

***Figure 2**. Methodological framework. Guérin et al. (2006).*

In order to raise the physical requirements of the worker tasks (gestures, postures, displacement and lifting loads), in the strawberries production, two ergonomic methods were used: a) The Body Discomfort Scale, published by Corlett and Bishop (1976); b) The OWAS. The great intention of the two methods is to subsidize the redesign of machines and workstations.

To assess the physical demands (gestures, postures, displacement and lifting loads) of the tasks of the 20 workers in the production of strawberries, two ergonomic methods were used: a) Body Discomfort Scale, published by Corlett and Bishop (1976); and b) The OWAS method.

The Body Discomfort Scale, published by Corlett and Bishop (1976), aims to assess body discomfort and subsidize the redesign of machines and workstations (Corlett and Bishop, 1976). This scale consists of the application of two instruments, one for the general assessment of discomfort and the other for the identification and ordering of discomfort by body region (Corlett and Bishop, 1976). The ordering by body region is classified in 5 levels, "None", "Some", "Moderate", "Enough" or "Extreme" discomfort or pain, numbered from 1 to 5, respectively, for each region of the body described, totaling 29 body segments evaluated.

The Body Discomfort Scale, published by Corlett and Bishop (1976), aims to assess workers' body discomfort, seeking to identify the body segments affected by pain or discomfort, as well as their intensities. The intensities of pain or discomfort are measured using 5 levels - 1 being 'not uncomfortable' and 5 'extremely uncomfortable' (Figure 3).

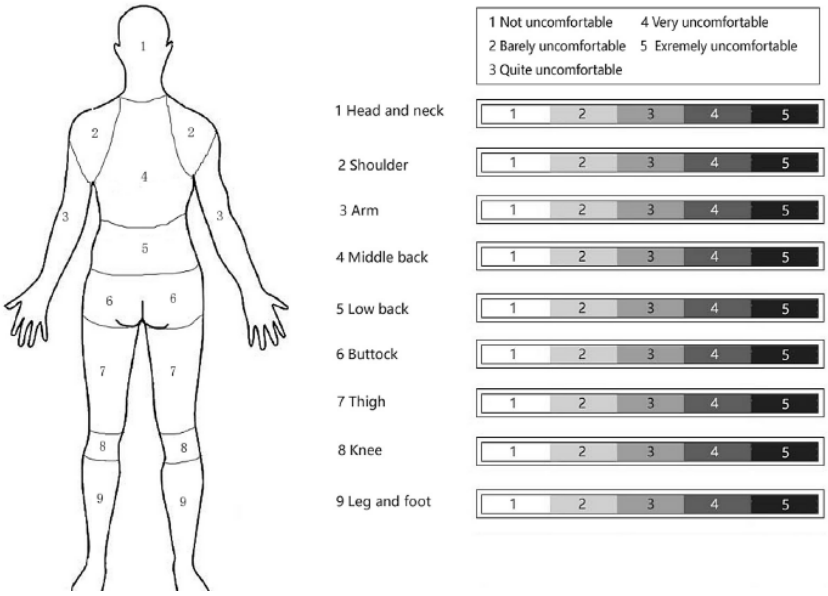

Figure 3*. Body Part Discomfort Scale. Corlett and Bishop (1976); Li et al (2017).*

The OWAS method is an ergonomic tool, which seeks to define the risks of injuries in relation to the postures adopted during work activities, and stipulates ergonomic rules and recommendations that determine the class of correction of postures exercised in activities. Its developers were three Finnish researchers, Karku, Kansi and Kuorinka in 1977. The beginning was through photographic analysis of the main postures, which could be observed in heavy industries, with 72 being found. It results from different combinations of back, arms and legs and also the load that the worker carries during his workday (Cruz et al., 2015). 4 postures were identified for the "back", 3 postures for the "arms", 7 postures for the " legs" and 3 types of load or force exerted. After identifying the postures in each topic, the necessary correction levels are defined, ranging from 1, where corrective measures are not necessary, to 4, where corrective measures are immediately necessary.

To collect information, some visits were made to the properties, aiming at dimensioning the work spaces, benches, tools and equipment and, still, describing the organizational conditions. Document analysis was performed to obtain data such as production volume, number of workers, size of the property. In addition, interviews with producers were used, seeking to analyze and quantify their perception of their working conditions. From the data collected in relation to the working conditions of strawberry production, a diagnosis of the properties studied was made pointing out the deficiencies of the technical, environmental and organizational conditions that could harm health and worker safety. During the visits, the 20 workers were also asked about their discomfort when working on strawberry production, with the support of the Body Discomfort Scale and also their postures were assessed whit OWAS method. Regarding the age of workers, there was a variation between 18 and 65 years, with a greater concentration between 30 and 45 years. There is a turnover of workers in this type of work activity.

3. Results and Discussion

3.1. Results presentation

The Body Discomfort Scale (EDC) was applied, as well as the OWAS method in all properties workers. With EDC it can be seen that in the Rancho Queimado property, which has plantations both on benches (suspended) and on the ground (Figures 4 and 5), 75.9% of the indications are located with “Not” or “Barely" report for pain or discomfort, 17.9% are in "Quite" pain or discomfort and 6.2% indicate pain or discomfort classified as "Very" or " Extreme ", showing the neck and the cervical regions as the main problem of pain or discomfort.

Figure 4*. Strawberries production on benches (suspended). Source: The authors.*

Figure 5*. Strawberries production in the soil. Source: The authors.*

At the Içara property, the plantation takes place only on the ground, on the scale it can be seen that 64.1% of the indications are with “Not” or “Barely” report for pain or discomfort, 20% are with pain or "Quite" discomfort. The “Very” or “Extreme” classification presented 15.9% of pain or discomfort. Of these, 87% point to the neck, cervical region and back as the main problem of pain or discomfort.

Based on the scale applied to the Lages property, which has only a plantation in the soil, the results show that 82% of the indications are “Not” or “Barely” reports of pain or discomfort, 7.5% with “Quite” report for pain and discomfort. The classification “Very” or “Extreme” presented 10.5%, with medium and lower related to back and head with pain or discomfort. As for the results of the OWAS method, corrections will be required in all three properties as soon as possible.

At the property in the city of Extremo, in Minas Gerais, producers reported feeling pain in the lower back, however on the body discomfort scale 96.6% reported "Not" discomfort or pain and 3.4% reported "Barely" discomfort or pain. The latter ones, 100% reported the cervical region as the site of "Barely" pain or discomfort. The posture adopted by the workers is straight torso, both arms down, one leg straight and a load above 20 kg, so according to the OWAS method, no corrective measures

are necessary. The results of the Classifications of the Body Discomfort Scale are shown in the Figure 6 below.

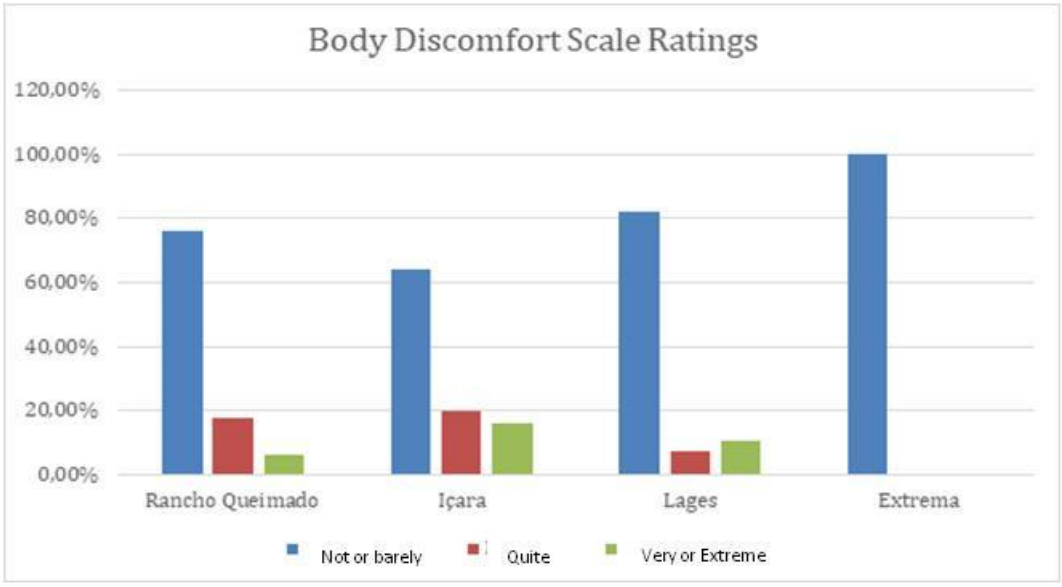

Figure 6*. Classification of discomfort in the four properties. Source: the authors.*

The most physical requirements found with producers, in general, are linked to the following work activities, as shown in Table 1.

Table 1. *The physical requirements found and the work activities.*

Work activities	Physical requirements
Cultivation and harvesting	Predominantly squatting posture, with the trunk facing the soil and the head flexed between 45 ° and 60 ° (production close to the ground). In suspended production, the position is fully upright, requiring the projection of the upper limbs in shoulder flexion between 45 ° and 90 ° and elbow flexion between 60 ° and 100 °. As for the hands, pinching movements are performed between the index fingers and thumbs to select the seedlings and apply pressure from the fingers on the soil to insert the seedlings. For harvesting, pinching movements are performed by the index fingers and thumbs.
Mowing	Predominantly standing posture, with cervical flexion from 45º to 60º. Using hoes, workers perform repetitive movements with their upper limbs to remove weeds from the soil.
Classification	In this stage the worker remains fully in the standing posture, with his head flexed between 45 ° and 60 °. The upper limbs are projected forward, with shoulder flexion between 45 ° and 90 ° and elbow flexion from 60 ° to 100 °. The hands and fingers perform fine handling movements in the selection of strawberries (being pinched by the index fingers and thumbs). Still, movements are often performed with the upper limbs crossing the frontal plane.
Assembly of the packaging	In this stage the worker remains fully in the standing posture, with cervical flexion from 45 ° to 60 °. The

	upper limbs are projected forward, with shoulder flexion from 45 ° to 90 ° and elbow flexion from 60 ° to 100 °. Pinching movements (fine handling) are performed to fold the packaging, as well as applying small pressure so that the cuts in the cardboard fit the templates. In addition, there is a requirement for elevation of the upper limbs from 90º to 120º to accommodate the final packages on the bench.
Labeling	In this stage the worker remains fully in the standing position, with the head flexed between 45 ° and 60 °. The upper limbs are projected forward, with flexion between 45 ° and 90 ° of the shoulders and 60 ° and 100 ° of the elbows. Still in relation to the upper limbs, tweezers are performed (to remove the label from the printed material) and paste it on the plastic packaging.
Regarding the lifting and transportation of loads	There is cargo transportation in some stages of the production process. Preparing the organic compost, it is necessary to handle the bags of fertilizer (40 kg) and transport them to the intended area with the help of a small tractor. During the harvest the strawberries are stored in plastic boxes with a capacity of approximately 40 kg and then transported, with the help of the tractor until the selection area.

Source: the authors.

3.2. Discussion of Results

In properties where there is plantation in the soil, discomfort is more frequent. At the Rancho Queimado property, there is planting on the ground and also on benches, and there is a lower level of discomfort in the items "Very" or "Extreme". In the properties of Içara and Lages, the rates of the items mentioned above are higher, which could be explained by the fact that the producers dedicate themselves entirely to planting in the soil, unlike Rancho Queimado, where workers can alternate the periods between bench and ground.

When planting on the ground, workers are in very inadequate positions, with an inclined trunk, upper limbs down and one or both legs kneeling. Inadequate postures and movements produce mechanical tensions in muscles, ligaments and joints, causing pain in different parts of the musculoskeletal system. Incorrect posture adopted in the long run can cause muscle fatigue and physical constraints such as spinal deformation, tendonitis, among other serious problems (Barth et al., 2016). In the study made by Kahn et al. (2018) it was found that farmers are twice likely to suffer from low back pain if compared to workers in general and they are 8 times more likely to change their work activities due to low back pain (Khan et al., 2019).

At the Extrema property, workers have a low level of discomfort, lower than the other properties, which may be related to planting on benches. Thus, workers remain standing, with the torso erect and with the upper limbs along the body, in less unpleasant positions, which do not cause so much discomfort. Khan et al. (2018), carried out a systematic review about the association between inappropriate postures during work and lumbar dysfunction, where they concluded that there may be

an association between these variables, corroborating with the data presented by the property mentioned above (Khan et al., 2019).

Corroborating with the findings in the properties of Rancho Queimado, Içara and Lages, Pinzke and Lavesson (2018), carried out a study, in which one in five strawberry producers (21%) reported physical discomfort due to manual harvesting work among their employees (Pinzke and Lavesson, 2018). Back pain disorders were most frequently reported (85%), followed by lower and upper limb problems and 41% of producers reported having personal experience of physical discomfort with this manual work.

Strawberries planted in benches are preferable from an ergonomic point of view, as excessive bending is eliminated. Today, the cultivation of strawberries in raised beds is more common and individual variations were observed, as well as working positions that influenced physical tension. The most common working posture was kneeling, causing the knees and feet to be flexed in their most extended positions. Kneeling, crouching or leaning on one knee while picking strawberries means a risk of joint discomfort (Pinzke and Lavesson, 2018).

The results of a study that assessed the risk of musculoskeletal disorders in hand-harvested farmers, showed that 77.9% of participants reported pain in at least one part of the body, which proves that musculoskeletal disorders are prevalent among hand-harvested farmers (Jain et al., 2018). Individual factors, including gender (male), age (over 25 years) and education (less than or equal to high school) were noticed in the study by Jain and his collaborators (Jain et al., 2018), in 2018, where it can be concluded that a lower level of education results in a higher prevalence of musculoskeletal disorders, as producers are less aware of appropriate working methods compared to producers with higher education. Factors related to work, such as 5 years of work, are also related to musculoskeletal disorders, emphasizing the need for ergonomic interventions to improve the quality of life and the work environment (Jain et al., 2018).

Pinzke and Lavesson (2018) and Rocha (2014) point out that farmers often come into contact with poisonous animals and plants that can cause allergies, infections, stings, among others (Pinzke et al., 2018; Rocha et al., 2014). They face arduous journeys, with great physical demands, such as muscular strength, permanence in stressful environmental and work conditions, repetitive movements, use of work instruments, with exposure to continuous workloads, which can generate injuries, illnesses and accidents at work. As well as working in cold or hot environments, increasing the risk of accidents and injuries. And when performed, these tasks result in above average pain and injury to the musculoskeletal system.

The stress imposed by long working hours, combined with bad postures and repetitive movements result in occupational diseases. The diagnosis of back pain highlights the concern with the increase in the number of workers that are away from duties due to WMSD (Work-Related Osteomuscular Disorder). To reduce the risk of musculoskeletal injuries, the working hours of employees in these jobs must be reduced. It is up to the farmer to make choices on how to carry out his work and adapt

techniques that minimize the workload (Lima and Nogueira, 2018; Pinzke and Lavesson, 2018; Rocha et al., 2014).

The improvement can be done through training and an orientation campaign, so that it is possible to increase productivity, as well as the health and safety of workers (Widyanti, 2018). Occupational gymnastics is seen as a strategy to promote worker health, with the practice of specific physical exercises to compensate the most demanded muscle groups during the workday. In addition, it promotes a healthier work environment, as it encourages the adoption of a more active lifestyle, as well as preventing occupational diseases and reducing stress.

As a result, there is an increase in the company's productivity, which is why organizations invest in quality of life programs, which include actions aimed at physical and mental health, aiming at the well-being of workers (Laux et al., 2016; Lima and Nogueira, 2018). Therefore, we can say that gymnastics at work is effective in preventing RSI/WRMSD, as well as reducing absences, and consequently, increasing productivity. Awareness of the ergonomics approach is essential, as farmers often adopt postures during work, which at the time can be comfortable, but are actually considered risky positions. It is also advisable to work in a specific posture for 20 minutes and walk for 10 minutes to compensate for the unwanted posture (Jain et al., 2018; Pinzke and Lavesson, 2018).

3.3 Ergonomics and Sustainable Development Goals

According to Brunoro et al. (2020) since 1972, the United Nations (UN) documents that it has become the hallmark of corporate action in the sphere of sustainable development and has addressed several direct or indirect issues related to work from different perspectives. Since 2004, federal public health authorities in the United States began developing the evidence base to support comprehensive, integrated models for worksite programs to advance worker health, safety, and well-being (Nobrega et al., 2017).

More recently, the latest United Nations documents proposed the concept of decent work, which involves the Fundamental Principles and Rights at Work. The emergence of this concept resulted, above all, from the need to confront the precarious working conditions, especially in developing countries (Nobrega et al., 2017). The 2030 Agenda, composed of 17 Sustainable Development Goals (SDGs) and established 169 targets to be achieved (Bolis, Morioka, Brunoro, Zambroni-de-Souza, & Sznelwar, 2020). Therefore, understanding the SDGs is essential for estimating improvements in the three pillars of sustainability and directing future developments (Giannetti et al., 2020).

Therefore, it is extremely important to conduct research involving ergonomics and SDGs for the health and quality of workers, both in the city and in agriculture. Among the United Nations' Sustainable Development Goals, number 8 is related to the promotion of inclusive and sustainable economic growth, employment and decent work for all (UNDP, 2015). The consideration of workers'

needs is not new and since the middle of the last century, the specific discipline of ergonomics, with the main mission of considering the design and organization of work, has grown (Bolis et al., 2020). According to Bolis et al. (2020), ergonomics and sustainability have different roots but tend to converge in terms of the specific issue of work, as they consider aligned end-goals (in terms of the need for work changes and improvements) and aligned values (in terms of the focus on health and people's well-being) (Bolis et al., 2020). Likewise, considering the ergonomics and health of the worker and their work environment, Figure 7 addresses some of the SDGs, such as 8 and 12.

Figure 7. *Ergonomics, family farming and the Sustainable Development Goals. Source: Authors.*

Thus, we highlight goals: a) 8.2 which aims to achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labor-intensive sectors; b) 8.3 which aims to promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services ; c) 8.4, which aims to improve the efficiency with regard to the consumption and production of global resources and to dissociate economic growth from environmental degradation; and c) 8.8 which aims to protect labor rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment (UNDP, 2015).

SDG 12 (Responsible consumption and production) has several interesting objectives that can be related to family farm workers. Thus, we highlight goals: a) 12.1 which aims to implement the 10 - Year Framework of Programs on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and

capabilities of developing countries; b) 12.2 which aims to achieve the sustainable management and efficient use of natural resources; and c) 12.3 which aims to halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses (UNDP, 2015).

4. Conclusions

Finally, each ergonomic intervention must be addressed individually, as there may be different anthropometric characteristics in each country, where in one country a given intervention is beneficial, but in another, it is not. In the near future, machines are expected to replace even more manual agricultural operations (Benos et al., 2020). In Brazil, NR 12 already provides guidance on the use of anthropometric and biomechanical data from the Brazilian population for the construction of machinery and equipment, which facilitates the operation by parts of workers, avoiding unnecessary physical efforts.

It is concluded that planting strawberries on benches results in less musculoskeletal disorders, being more recommended from an ergonomic point of view, when compared to planting in soil. However, planting in benches does not have all the substances that the soil itself has, making the strawberry not adapt as well as planted in the soil, perhaps this is a reason why planting in soil is even more common, as it needs a larger investment and an entire adaptation of the plant to move from the soil to the bench.

It was observed that the most frequent complaint of workers was in the cervical region, head and back, which we can associate with the adoption (sustained or repeated) of body posture in cervical and trunk flexion during the harvests, which increases the demand muscle and joint in these body regions. With the research of articles, it was possible to perceive that the gymnastics at work is beneficial and widely used, as well as the education and advice of producers, to make them aware of the correct postures to be adopted during the working day, in order to avoid further complications in the future.

As a limitation we have the subjectivity of the applied scales, and so, it is suggested for future work, to apply the tools presented together with other more specific tools for the assessment of posture, strength performed, in other scenarios within the field of agriculture and in other regions of Brazil, with an interval of years, doing a follow-up with time cut.

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7. Social-economic Aspects of Sustainability

7c. Sustainable economic models

Abstracts

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Sustainable Development at the Crossroad: Comparing policies and performances towards the SDGs in China and Europe

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Abstract

Most policymakers, aware of the economic and social imbalances and environmental pollution, have reacted by proposing a political strategy oriented towards more sustainable form of development. However, the commitment of big players, as Europe and China, towards the UN Agenda 2030 for Sustainable Development is crucial. Both Europe and China are launching one after the other policies towards a more sustainable development.

In Europe, on the one side, the efforts devoted by the European Commission (EC) for sustainable development started during under the Juncker presidency (2014-2019) as well as in the new political guidelines and priorities currently pursued by the von der Leyen presidency (2019-2024). The former include the EU Sustainable Development Strategy and the related monitoring system, along with its implementation actions, such as the European Pillar of Social Rights, the Investment Plan for Europe, the Horizon 2020 programme, the Circular economy action plan, the EU plastics strategy, ect… . The latter embrace striving to be the first climate-neutral continent (through the European Green Deal which includes a new industrial strategy as one of its multifaceted elements), promoting social fairness and prosperity in our economies, empowering all people through new technologies, ensuring equality of opportunities and strengthening democracy, among others. In 2020, the EC announced “A New Industrial Strategy for Europe” for driving a twin transition towards both digital leadership and climate neutrality as well as, the new “Next Generation EU” (NGEU) recovery plan was adopted in response to the coronavirus pandemic, leveraging on the green and digital transition (EC, 2020).

On the other side, although Chinese development outcomes recorded impressive economic achievements and progress across social domains, but this progress achieved to date has not always been harmonious because of unsustainable features, rising inequality, environmental pollution and strong provincial disparities. Environmental and social sustainability have become part of the domestic political debate only more recently (Kuhn, 2016). Recently, Xi Jinping introduced in his Chinese Dream project the realization of a “moderately prosperous” society, a target widely mentioned in the National Development and Reform Commission reports (2019, 2020).

The aims of this paper are two. The first is to explore Chinese and European policies. The second is to measuring and comparing their progresses towards SDGs.

The Chinese dataset is based on official statistics from the Chinese Statistical Bureau (various sources) and consists of 42 variables measured at provincial level covering all the 31 provinces for the period

2010–2017. These variables are grouped into the 17-unidimensional SDGs domains. The data are comparable with the European countries and regions data from Eurostat. The Multidimensional Synthesis of Indicators (MSI), a new method for aggregating SDGs performances, is used to capture synergies and heterogeneity of results over time.

The empirical analyses provides Chinese and European policy-makers a better understanding on how policies may influence positively or negatively different SDGs and offer further monitoring tools to shape policies - at country level for Europe and provincial level for China - in line with the Agenda 2030 for the humanity and its common future.

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Ecosystem Collaboration in the Energy Transition: Building cooperation through multiple value creation

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Abstract

In the energy industry, energy network providers are crucial to the transition to sustainable energy. But these firms do not work alone. In fact, they are constantly collaborating with governments, communities, and other firms in their environments. As such, it comes as no surprise that Jonker and Faber (2019) take the stance that "impactful sustainification, either in value chains or closed loops, and a simultaneous realization of social inclusion is, by definition, the result of a collective inter-organizational effort." In the context of the energy industry, this means that the only way to achieve impactful and sustained change towards a more sustainable energy grid is via inter-organizational collaboration.

To further investigate the processes that allow for such collaborations, we must take a close look at the business models involved. As they work towards joint sustainability goals, organizations must function within a structure that allows them to be an active and contributing member of their greater ecosystem. Currently, the business model literature focuses on fragmented improvements and individualized solutions meant to address acute challenges. These types of solutions may work in the short term but do not address the structural issues that lead to these challenges in the first place. Jonker and Faber (2019) point out that conventional business models are inherently organization-centric, making it challenging to deal with wicked problems, which are inherently complex and inter-organizational. To adress these so-called wicked problems, we employ the concept of multiple value creation – using single means to obtain multiple goals. Multiple value creation demands collaboration between a variety of constituents. Could this mean that we are looking at a transition from the long-time dominant organization-centric model? Organizations are embedded in ecosystems. Ecosystems focus on modularity and complementarity, building on ideas that encourage adaptation and collaboration. As previously described, collaboration is crucial to the energy transition, which is rapidly evolving, requiring organizations to adapt. In this way, the ecosystems perspective can serve as a complement to the dominant business model literature, particularly in the energy transition context.

In light of emerging evidence for the need for inter-organizational collaboration, a new generation of business models is already emerging – business models that are specifically constructed to address, through multiple value creation, the wicked problems that comprise societal challenges through inter-organizational collaboration. However, it is yet unclear how this new generation of business models can benefit large incumbents, who are currently already operating under existing old-school business models. Furthermore, it is unclear how these incumbents can identify and seize opportunities for multiple value creation to improve their collaborative efforts without the high risk of failure associated with redesigning their business models from scratch. This paper seeks to develop a tool for established firms to better collaborate on energy transition initiatives, focusing on multiple value creation.

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Explaining pre- and post-1970 Changes in Energy and Economic Trends via the HARMONEY model

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Abstract

Background

In the 1970s OECD countries transitioned from a period of increasing to one of steady (or declining) per capita energy consumption, and in the 2000s they reached a constant level of total primary energy consumption. Many social and economic changes occurred directly from this transition. To understand possible transition to clean energy and an equitable economy, we must understand how and why the energy-related constraints in the 1970s preceded declines in income equality and increased private debt. Only in this way can we avoid continuing these trends in the current and future clean energy transition.

Methods

This work uses an existing long-term economic growth model, HARMONEY (Human and Resources with MONEY), to explain relationships among biophysical and economic variables. The model consists of two industrial sectors, namely *Goods* production and *Extraction* of natural resources. It uses a stock and flow consistent post-Keynesian framework compatible with ecological economic principles. Thus, model tracks physical and monetary flows associated with resource extraction and consumption by capital and people. As the natural resources deplete faster, extraction costs increase, causing a negative feedback on growth, and ensuing changes in distribution of money among banks, owners of industrial capital, and labor.

Key Findings and Implications

We use the HARMONEY model to discuss how the distribution of economic proceeds changes when the economy moves from the period of increasing to one of constant resource extraction. For example, when resource extraction reaches a steady state, because investment in new capital requires physical resources, investment is restricted. Subsequently, given resource consumption constraints, if wages remain indexed to inflation, then wage share increases (or remains constant), and capitalists settle all debt but maintain zero profits. However, this pattern was not observed in the OECD countries, particularly in the U.S. where income inequality started increasing in the 1970s. Thus, we are able to demonstrate, considering resource constraints, the capitalist imperative to maintain profits by reducing labor costs by (1) no longer indexing wages to inflation and (2) increasing the labor force, via globalized investment, a larger labor force translated to a lower employment rate which again pushes wages down. Additionally, we show how resource depletion, and the lack of exponential growth in resource extraction leads to rapid increases in private debt that pushes wages down further, even when

consumption continuously increases. While these factors of loss of “bargaining power” and debt are generally accepted as drivers wage cutbacks in many OECD countries, formal discussion of these factors, explicitly via a growth model, is often separate from economy’s biophysical and ecological basis.

We also use HARMONEY to discuss insights in the global economic trends on decoupling of energy consumption from GDP. Thus, this paper demonstrates the important linkages among resource consumption and depletion to economy’s financial (private debt) and real (productive capital, labor) aspects.

This work is relevant to the following SDGs: 7-Affordable Clean Energy, 8-Decent Work and Economic growth, and 10- Reduced Inequalities. We have internet access to present this work live via Zoom, as the likely conference platform.

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Tourism's socio-economic contribution: A UN-SDG perspective

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Abstract

Studying the economic impact of tourism with *Input-Output* (IO) methodology and extensions, like *Computable General Equilibrium*, is widely established within tourism science (Comerio & Strozzi 2019). However, the analytical focus of the majority of impact analyses remains on aggregated indicators, such as total output, employment and income, respectively. However, this reductionist view in line with economic orthodoxy provides an oversimplified and biased perspective on regional development missing out important socio-economic issues (Gallagher et al. 1999). In particular, the concept of sustainability has not (yet) played a prominent role in estimating tourism's economic impact. Though, the UN Sustainable Development Goals (SDGs) explicitly address *decent work* (SDG 8) as well as *reduced inequalities* (SDG 10) (UN 2021). Accordingly, a growing number of tourism scholars argue that regional tourism development should focus on the principles of steady-state economics by prioritizing local communities as well as employment-related issues, which are widely neglected by debates and works on sustainable tourism (Baum et al 2016; Higgins-Desbiolles et al. 2019). In the same way, we argue that traditional economic impact measurement approaches contributed too little to address sustainable regional development. Therefore, we extend the traditional practice of tourism economic impact measurement by considering '*new monetary measures*' beyond growth-focused aggregates (Söderbaum and Brown 2010). More precisely, our IO-based regional impact study estimates economic leakages, import shares as well as taxation effects from tourism over a 10 years period (2008-2017). Most importantly, we dis-aggregate employment and income effects into diverse occupational areas (Daniels 2004). This allows us to study tourism's contribution to decrease sectoral income inequalities among particular occupation types. As a narrow view on monetary indicators risks to dis-embed markets from its underlying rules and social institutions, socio-economic impacts can hardly be understood solely by numbers. Accordingly, our study also considers the perspective from major tourism-related institutions, like branch associations, labor unions and regional public institutions. A mixed-method approach, finally, complements quantitative findings from IO with additional qualitative insights thereby obtaining a holistic understanding on the socio-economic impact of tourism in the region of Jämtland Härjedalen with a focus on tourism employment- and income. As highlighted by the UN-SDGs, the proposed analysis broadens the view of conventional tourism economic impact approaches in tourism.

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Controlling rebound effects: Green growth, decoupling and post-growth

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Abstract

The European Environment Agency has recently addressed the need to move beyond GDP growth: "Could the European Green Deal, for example, become a catalyst for EU citizens to create a society that consumes less and grows in other than material dimensions?" (EEA 2021). In this paper we explore decarbonisation trajectories which are not contingent on GDP growth, hence we take post-growth approach, including "a-growth" and degrowth (Van den Bergh & Kallis 2012, Parrique et al. 2019). We critically and constructively analyse the EU green deal from a short and long term perspective. The EU Commission presents its Green Deal as "a new growth strategy that will transform the Union into a modern, resource-efficient and competitive economy, where there are no net emissions of greenhouse gases by 2050, economic growth is decoupled from resource use, and no person and no place is left behind." We agree that one challenge is to catalyse technological development and innovations to accelerate decarbonisation and maximise decoupling, understood as the difference in rate of change between GDP and CO2 emissions. Hence, decoupling means increased efficiency and is a necessary part of any climate policy. However, rapid decarbonisation also requires that we control rebound effects. Global decadal average decoupling has historically never exceeded 2.7% (Holz et al. 2018) and the most optimistic scenarios for decoupling may be 4 percent annually, assuming aggressive possible abatement policies (Hickel & Kallis 2020). In the EU, GDP has lately (2014—2019) increased by about 2% annually. If this is expected to continue, then 4% annual decoupling will only result in 2% annual decarbonisation. This jeopardises the absolute emission cuts needed to meet the Paris goals and SDG 13.

Method: We first start with a review of the literature of green growth, decoupling and rebound effects. Second, we develop scenarios following IPBES ECA (2018) which go beyond the green/sustainable growth paradigm, which we regard as an adaptation within the GDP growth regime, not a real transformation. Third, we conduct a discourse analysis (Gee 2014) on the paradigm of green growth and decoupling, which seem to constrain not only policy development but also the policy discourse. We conclude that post-growth narratives can only become attractive visions if sustainability transformations are combined with economic security and fairness which enable more liberty, equality, leisure and security concerning both individual and global risks.

Although the analysis focuses on decoupling and rebound effects of CO2/GDP (SDG 13), the post-growth approach has been endorsed by the IPBES (2019) and a key leverage point is "steering away from the current, limited paradigm of economic growth... reducing overconsumption and waste" (p. 10). Hence it's also relevant to SDGs 14-15. The reduced stress and increased equality, embedded in visions for post-growth, also address several other SDGs. I will use powerpoint presentation.

Full papers

Sustainablity aspects of the low-key bioeconomies

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Abstract

This paper discusses the bioeconomic processes of small production and small distribution modes in East Yorkshire, UK. In particular, the focus is on whether and how this small-scale bioeconomy is connected to sustainable practices and in what way those practices are supporting the local ecosystems, including the human ones. The paper is related to the wider debate about the character of the bioeconomy as a sustainability initiative. We take a critical position concerning this issues. We do not consider the bioeconomy in general as an inherently sustainable way for organising production and distribution of goods and services. Within this framework, we investigate in our research project, whether small production and small distribution as bioeconomic processes include any practices that can support both environmental and social sustainability. The paper (part of the Research England funded THYME project, dedicated to the bioeconomy in the North East of England) focuses on farmers' markets in the East Riding of Yorkshire. Using data from interviews and observations we present and discuss findings about the local small markets and how the producers, traders or even consumers involved with them are linking their market activity to greater sustainability efforts. The major finding is that at least the food part of the small markets in East Yorkshire is very locally embedded. The nomadic character of the market traders and producers means that locally produced goods reach small places without the customers needing to concentrate in a nearby big trade centre, like a city market or a big supermarket. At the same time, the traders and producers try to avoid wasting produce as much as possible by adopting various practices, including sharing, non-monetary distribution and donations. The paper contributes to the discussions related to SDGs 2 (zero hunger), 11 (sustainable cities and communities), 12 (responsible consumption and production), 13 (climate action).

Keywords: bioeconomy, farmers' markets, sustainability, small production, small distribution.

1. Introduction

The paper explores the sustainability aspects of the farmers markets and small markets in East Yorkshire and the city of Hull, UK. The local small markets are examined as forms of the bioeconomy that are

not usually included in policy documents or academic accounts relating to bioeconomic processes. Yet these economic activities not only fulfill the criteria for inclusion in the bioeconomy, but they also have potential to promote sustainability in production and distribution processes. Through field research we explored what is happening on the ground, in the small markets of the study area and we report some main findings that show the sustainability potential of this economic activity.

The following section two presents the definitions and the sustainability potential of the bioeconomy and section three presents our approach and research methods. Section four is presenting our research findings, both generic and those related to the sustainability potential of small markets. Conclusions are presented in final section five.

1. Definition(s) of the bioeconomy and the debate about its sustainability

Broadly, 'bioeconomy' refers to economic activity directly drawing on biogenic material (derived from recently living plants and/or animal matter), to be distinguished from non-biogenic based resources and fossil fuels (Sotiropoulou and Deutz in review). Bioeconomy, or bio-based economy, is a term created in relatively recent years by academics and policy makers in order to integrate into a single term the economic significance and the awareness of the type of resources to be utilised (Allen *et al*, 2017; Begley *et al*, 2011; Lewandowski et al, 2018). Addressing environmental degradation and socio-economic challenges simultaneously (Barben *et al*, 2016; Birch, 2007; European Commission, 2018a; Kautto and McCormick, 2013; OECD, 2009, 2018; Viaggi, 2016), the term 'bioeconomy' responded to the needs of a time when many countries were facing economic challenges in particular after the financial crisis of 2008.

This paper understands the bioeconomy, as developed since the 1990s, to have been mainly a political project concerning the use of research and technology in order to produce a more effective use of natural resources (Birch, 2007; Cooper, 2007; Kautto and McCormick, 2013; Viaggi, 2016). In the 2018 report by the European Commission (2018a, A sustainable bioeconomy for Europe), which is the most recent EU policy document that links the bioeconomy to sustainability, there is some indirect reference to sustainability with respect to forestry, fisheries, food, and feedstock as well as on environmental or energy policies. The report, however, remains mostly within a purely economy-focused framework in contrast to the European Commission (2018b) Staff Working Paper where a major emphasis is given on sustainability.

In academic literature the bioeconomy is seen as either inherently sustainable in some instances, or not in others without this ambivalence being considered as problematic (Allen *et al*, 2017; Boody et al 2007; Caivano *et al*, 2015; Dankbaar *et al*, 2014; OECD, 2018: 25-68; Szekacs, 2017; Viaggi, 2016).

In most cases the lack of evidence about the non-sustainability of the bioeconomy is interpreted as implicitly meaning that the bioeconomy is sustainable (Aurambout *et al*, 2016; Goven and Pavone, 2015; Kautto and McCormick, 2013; Kircher, 2012; Lasserre *et al*, 2014). There is very little empirical research that attempts to judge the sustainability of the bioeconomy (Fror *et al*, 2017; Larsen, 2007). In some cases, the sustainability of the bioeconomy is conflated with the renewability of resources. The sustainability and the renewability of resources are both thought to be equivalent to capital being sustainable and renewable in and for itself. In other words, the ability of capital in capitalist economies to appear as capable of renewing and replenishing itself is considered enough an indication that an economic practice is also sustainable in environmental terms. Capital is perceived as a resource that cannot be depleted and if the capital part of the bioeconomy cannot be depleted, then the bioeconomy is deemed to be renewable (Birch and Tyfield, 2013; Gawel *et al*, 2019).

Finally, the recent policy prominence of the term bioeconomy implies that the previous (if recent) economies were non-, or not adequately, green or sustainable. The way the term of bioeconomy is used in discourse risks erasing the efforts by several social groups or regions to be less extractive and unsustainable through the use of local knowledge and creativity. The environmental knowledge of those communities has recently begun to be appreciated with reference to environmental management techniques (Berkes and Parlee, 2006; Goodall, 2008). The literature and policy approach to the bioeconomy has focused on capital-intensive, technology driven and industrial elements of the sector – as if these are synonymous with "bioeconomy". As a means to approach the existing and non-industrial bioeconomy of the study region, we have focused on the markets used by the small producers of the area to access customers.

2.1 Farmers markets

To the best of our knowledge there is no previous research concerning farmers markets and small markets as bioeconomic spaces or activities. We have therefore drawn on literature we could find that was related to farmers markets both in the UK and also in other countries.

Farmers markets in literature are depicted as a way for small farmers to survive but also for local people to have access to local food and support their local producers (Aguilar et al, 1992; Alkon, 2012; Feenstra et al, 2007; La Trobe, 2001). Farmers markets take place usually in the open air and although they have a regular place and time to run their events, the markets are not a permanent (aka, everyday) economic outlet. The same happens with all open air markets: they can be occasional or regular but the traders are there for the event only with no permanent installations (McEachern et al, 2010; Qendro, 2015; Valpiani et al 2016).

Literature often examines farmers markets with relation to the quality of food and the ecological traits of foodstuff that is produced and consume locally. Food that is local seems to be better quality in all aspects, including taste. (Alkon, 2012; Qendro 2015; Spiller 2012). It seems that both several scholars and farmers markets producers and consumers believe that buying food in a farmers market helps consumers reduce their involvement in big food chains that harm nature and also harm producers both in the locality of the farmers markets but also abroad (Adelaja et al, 1998, Archer et al, 2003, Guthrie et al, 2006; Kirwan, 2004; Spiller, 2012; Youngs, 2003,).

The prices of the farmers markets vary relatively to those offered in mainstream outlets, but they are typically comparable; by selling directly to customers farmers have access to better payments per sale than by selling to big traders that control the big food chains (Alkon, 2012; Behe et al 2020; Becker et al, 2007; Carro-Figueroa and Guptill, 2007; Jilcott Pitts et al, 2020; Kirwan, 2003; Moroney et al, 2009; Murphy, 2010; Valpiani et al, 2016). In other words, even if the quantity sold in each case is small, there is a trade off with prices. The producers who can avoid big traders will avoid them – but at the same time in order to avoid big traders you need not to have high volumes of stock. That is, only small producers can avoid big supermarkets, while big farmers have to deal with them. In reality the producers prefer to sell quality products in the markets because the premium prices they might be able to get are reaching the producers directly or through a small local trader instead of the big trader reaping all the premium price for the quality product.

Similar patterns of activity and discourse associated with this activity are found concerning UK farmers markets. We have found information about Leicestershire, Rutland and Staffordshire (Holloway, 2002), Stroud, Devizes, Warminster, Swiss Cottage, Islington (Kirwan 2003: 80, 2004), North West of England (Youngs, 2003), Wales (Pickernell et al 2004), UK as a whole (Moroney et al, 2009), Newcastle, Durham and Hexham (Spiller, 2012), and Edinburgh and Glasgow (Qendro, 2015). This allows for comparisons of our findings with both UK and international literature.

2. Approach and methods

Within this context we designed this research as part of the THYME project, which is a research consortium among the University of York, Teesside University and the University of Hull in order to investigate ways to support the local economy of the North East of England through the mobilization of bioeconomic processes.

The focus on the economy and in particular on the large industrial mass-production has been a feature of the THYME project itself, from which this paper emerged. Sustainability existed as an objective in the project but was referring to the industries of the region matching the most common understanding of the bioeconomy which is oriented to sustainability of industrial activity (Aurambout *et al*, 2016; Goven and Pavone, 2015; Mustalahti, 2018; University of York, 2017). The small scale production aspects of the bioeconomy are very rarely discussed (Gustafsson *et al*, 2011). Contrary to that, the THYME sub-project "Getting to know the existing bioeconomy in East Riding: The farmers' markets case" focuses on the small producers with a special emphasis on the producers of food in the area of East Yorkshire.

In this study we draw our methodology from two main approaches. One is critical realism as a way to understand discourse and praxis in its historical context. We aspire to present a version of reality that is well founded on actual economic practices. We also aspire to think in terms of the economic and political conditions that affect the practices that we are interested in (Archer *et al*, 1998; Birch, 2017).

The grounded theory approach has been mostly used in the field research of the project because we lack adequate previous research and literature concerning bioeconomic processes that refer to small production modes, self-organised markets and grassroots arrangements for the use and distribution of valuable produce based on natural resources (Charmaz, 2006; Glaser and Strauss, 2006). For this reason, we deliberately avoided to start the project with a hypothesis while we did not have enough data and information about the activity we are interested in.

To do this research, one of us (Author 1) has conducted observation and field visits to farmers' markets and markets that are farmers markets in practice but self-define in other ways. She also conducted open-ended interviews with market members (producers and traders) and managers. The interviews were done mostly outside the market spaces unless the market traders and managers were available at the market. The interviews have been fifteen in total conducted from December 2019 to May 2021, i.e. they comprise interviews before and after the pandemic of covid19 erupted.

The observations produced data that are collected without being judged at the collection stage whether they are irrelevant or not to the project. The researcher records by memory the whole experience and learning of the observation and afterwards analyses the data to find answers to the research questions and/or patterns that were not anticipated but emerged through the observations while attending the markets. The data collected through thick description are analysed in two main ways: one is the quantitative-qualitative one, e.g. what patterns of activity are typical or appear with some regularity? The other way of analysing the observation data is the qualitative-quantitative one, e.g. what types of goods are available in the markets? Who are the people who attend the markets?

4. Sustainability on the ground

4.1. Practices of producers and traders in the small markets

From our research so far, it seems that the farmers' markets and the open-air markets in East Riding not only attract small farmers, but also artisans and small local traders that work with them. The local products are offered at the markets either by the producers directly or by small traders, who undertake the task and hassle to bring the products to the markets. Door-to-door deliveries were available in some few cases before the Covid19 pandemic but they increased after March 2020, although this was possible only for some producers and traders.

In some cases, the traders are people who have permission by the market managers to sell used items, including clothing and houseware or DIY tools. Some markets allow used things to be sold, other markets do not. Some traders are vintage items traders who have a named business specialised in used, vintage and antique items. In different cases, the items are sold by traders who seem more to perform what is called "garage sale". Seemingly valuable second-hand items are usually sold by specialised antique traders, who are not very common to find in the markets unless the event is special (for example a Christmas market).

In other cases, the traders might be local but they bring items produced elsewhere, including imported goods. However, given that a lot of the products offered in the markets are related to food, there is a lot of locally produced and locally processed food. Imported food is mostly related to exotic fruits. The emphasis on food and farmers' produce is very typical in farmers markets (Adelaja et al, 1998; Moroney et al, 2009), although there was a case where all the food, rather than fruit or vegetables, included pastry goods, sweets, savoury food and candies. The processing of the food is done by the producers for the purpose of selling the food at the market although in the case of traders selling the products, the traders can also give information about the processing methods of the food products offered.

Concerning the character of the markets, any observer can see that food is central, even if it is not always fresh fruit and vegetables but locally processed food (such as cheese, bread, dried mushroom, processed meat like sausages and pork scratches, sweets, pickles, jams). Before the pandemic the street food was very popular in the markets, and even if there are still some street food retailers, the demand during the pandemic has been reduced. The other central characteristic is the open air or the open space and the non-permanence of the market. Therefore, the people who hold and sell at the markets do not work there everyday but only on designated days.

The whole activity is very labour intensive. First, those who produce for the local markets are usually one-person or family businesses that works a lot to keep the business going. The market participation is also very labour intensive, because it really requires the whole working day and is exposed to weather conditions and to market hazards like not having a protected space for one's goods. For this reason, the sellers might not be the main producers in all markets: it might be a member of the family, a friend, or another producer that sells products on behalf of a colleague; it might also be an employee, who is employed for the market day(s) in order to sell but has no interference with the production process.

Another very interesting characteristic of the open-air markets at East Yorkshire, is that they have a nomadic function. The same producers and traders might participate in various markets in the region, and might visit other counties as well, depending on the opportunities they find to attend more markets. Customers turn also nomadic and travel to find their favourite products. Many producers announce their attendance of events in advance so their customers know where to go to find them and when.

From the above it becomes evident that the markets have a lot of flexibility in terms of who participates and how. This coincides with the decentralised character of their management. Each market has its own managers. The town or regional councils are not interfering with the markets apart from dealing with possible hazards that might emerge concerning protection of the surroundings of the markets, like disposal of waste. It seems therefore, that the whole activity is decentralised politically and economically. In terms of policy, the traders and producers are working more like a guild rather than an authority or government service, trying to lobby their needs to local and central government. It also means that communities are very much involved with the markets establishing or supporting them.

Class and income affect this economic activity in a direct way: in some markets prices are very low but even then the community might have not enough income to support the market as they would like to (like in Costa Rica, Aguilar et al, 1992; or in North Carolina, Valpiani et al, 2016). In other markets, prices are quite high, much higher than the quality supermarkets of the area, which precludes the customers to those who have some regular and adequate-in-volume income. In many cases, the locally produced products, in particular the food, might have very low prices in relation to the quality and the labour that the products embody but still the prices are too high for many people who live in the region (Adelaja et al, 1998; Aguilar et al, 1992; Murphy, 2010).

Another issue that is also linked to class, is the accessibility to the market venues: apart from the markets that are located in the city centre, most markets in other venues are reachable either by a private car or by public transport. In some cases, the public transport might not be very convenient (in the case of Hull, the bus that reaches a market might be available only at the city centre, therefore, customers have

to use two or three bus services to reach it) and in all cases it is quite expensive. The accessible markets are easier to access for worker class people that might not have a private car or even if they have one, it is less costly for them to visit the market without having to pay for parking lots.

Apart from the accessibility, the means of production are also class-based. You can see in each market what self-produced products exist, what their materials are and how easy it is for each producer to produce. Therefore, one can see huge disparities in means of production: some producers might have a small allotment or garden and some have a farm; some producers have access to looming/weaving machines and others have low-tech solutions for their handicrafts; some producers have access to expensive materials to produce crafts and others recycle or upcycle. Recycling of course is very good for nature and the producers in all cases, but the question is whether some producers are limited to recycling only because they have no other means of production and raw materials available to them.

One of our research key informants describes their upcycling creative practice that is also their craft production that sells in one of the local markets:

"Yeah, I make the book covers for my mini albums from boxes, do you know like cereal boxes, biscuit boxes? A lot of the things I use, like oddments of laces, make them into flowers and turn them into hair clips, so yeah, it's just things I've got lying around my house that I, that some people look at as rubbish but I look at and think ooh I can turn that into a pin cushion or I could turn that into a hair clip or a card or, you know, things like that… I mean we've all had that bit of lace that's not long enough to wrap round something or tie into a bow, so I use it as decoration in my mini albums, you know, rather than just throw it in the bin".

Another issue is the perceptions about food and how the limited lack of time for food preparation and the culture of fast-food has affected the markets and the food offered there. Street food is prominent possibly because this is closer to the quick-eating culture that exists in the area, while not all people are interested in fresh vegetables, fruit or other types of food, like dairy products, honey, or meat. However, fresh and unprocessed food is also existent and in a greater variety and better quality than the biggest supermarkets. In some markets the first of the authors has been advised especially about the food by the locals, who seem to appreciate quality at good value (McEachern et al, 2010).

Most of the people who participate in the farmers' markets are selling local raw materials, or a major part of their produce is based on local raw materials. Several traders are recycling or upcycling materials that under usual market terms are waste or too expensive to be reused: metal scrap, fibres like wool, tin cans, yarn scraps, etc. There are several sellers at the farmers markets who are just traders and in some cases their products have been industrially produced overseas. However, many are creating goods for

themselves from raw materials. For using local materials and resources, whether newly produced or recycled, labour (intensiveness) is the major part of the value of the products available at the farmers' markets.

Moreover, organic materials are not the only ones that can be part of a bioeconomic process. For example, the blacksmith who re/upcycles metal scraps to artwork does not belong to the usual bioeconomy process according to the existing theory. Yet, he has saved ecosystems from both the metal waste of the scrap but also from new extractive activity. In that sense, with his intensive labour and skill he has "produced" the ecosystem which stayed unaffected because the metal used was recovered from supposedly waste material. Recycling metallic scrap is also a case of circular economy (Bocken et al, 2016, Geissdoerfer et al, 2017). Circular economic processes are not rare in the farmers markets, although the circularity is performed with simple means and in ways that the producers do not claim to abide with circular economy but in practice they do. This activity is interdependent with the bioeconomy activities.

Many of the producers and traders do not participate at all in the mainstream economic networks or food chains with the products they sell in the farmers markets. A very few number of them have a collaboration with a city store, which is also a neighbourhood venue for selling local products, organic food and other artisan items not available in the big grocery chains. The producers sometimes say this explicitly, i.e., that they do not want to sell to supermarkets or city stores and prefer the markets or private customers as their marketing outlets.

Another feature of the markets is that that producers themselves try not to produce more than what can be really in demand in the markets. This is fundamental for producers of fresh food, whether raw or processed. It seems that especially about food, there is a lot of sharing in the markets, particularly among producers and traders. There is also a lot of sharing with the community, because from our observations and from the interviews we conducted, the excess food that cannot be sold or shared otherwise, is donated to organisations who distribute food to the community.

4.2. Low-key bioeconomies and sustainability in practice

Critically viewing the bioeconomy from the point of view of a farmers' market gives a broader understanding of what the bioeconomy can be. The local bioeconomy provides a holistic way of understanding economic activity. This compares to focusing only on the production methods whilst forgetting about the complex conditions by which a product been processed, distributed and marketed. Small-scale production has a comprehensive way of advancing certain types of the bioeconomy missing

from the academic literature, and even more so from policy documents. From the point of view of the markets, it also seems that the farmers' markets are not bio- and the people who sell their products there do not use the term "bioeconomy". This type of market does not need to emphasise the organic origin or the sustainable character of the produce, the local scale and relatively non-energy intensiveness of production sustainability for themselves. In other words, the big industrial complexes might be more in the need of bioeconomy as a term to re-establish (or re-brand) themselves as aware of the organic character of their raw materials.

Given the limited volume of production and income that the small producers and traders can make through the markets, they are forced to be efficient and adapt their production and distribution so that they avoid waste and unsold stock. This is important because it can be a necessity for small producers to avoid waste in ways that are too expensive as an administrative procedure for a big food company. That is, the small producers cannot afford to overproduce and they cannot afford to produce waste either. It is not a coincidence that they prefer to donate the food that is not sold rather than throw it away, because for them their relationships with the community but also to their own labour that is integrated in the unsold food are also parts of the production process. Their decision-making processes take into account more variables than profit-making only and the community around them is both a supporter of their economic endeavours but also a force to be accountable to in a very direct way.

A key informant, who has worked as a producer and was selling their products at farmers markets, describes in detail the whole process of avoiding unsold stock and waste:

"Well I was quite good at managing …the amounts that I use because what I did, a lot of it I would prepare ahead of time and freeze, even, I could even do that with like the avocados, I found a way to do that so they wouldn't turn brown and so I was quite good at that. If I ever really badly misjudged it, which I, I didn't really ever do to be fair, [laughs] I was always quite good at judging and I didn't have a whole lot of waste. What I would do usually if I had a bit of waste at the end of the day, was I would just make things for the fellow, my fellow farmers market people, so the other people on the market I'd just give them, make them some food for free. .., But there was never very much waste, I didn't have to throw away very much food".

The small markets were greatly affected once the lockdown started in the UK on March 23rd 2020, which meant that all small markets had to close down[1] along with highstreet stores and markets. The super markets and other stores selling house essentials were allowed to remain open under strict rules of safety. During March 2020 the UK experienced an unprecedented panic buying in the supermarkets, that was also observed in other countries in Europe and North America (Agha et al, 2020; Laborde et al, 2020; Price, 2020). With the local small food markets closed, part of the bulk buying in super markets and possibly part of the panic might have been justified (Baldry et al, 2020), given that many people had to shield or isolate and stay away from crowded spaces because of corona virus. It also seems that the super markets were not ready for this upheaval, although the extra purchases did not exceed a week of consumption at home (Smith, 2020).

The stores and the economy were allowed to resume activities in summer 2020. In early November 2020 and in January 2021 new lockdowns were imposed. In those cases, some small markets remained open only for food (for humans and pets) but items other than essential ones were not allowed to be sold (while they were allowed to be sold in supermarkets). Those lockdowns were not accompanied by panic buying: either super markets were better prepared, or consumers, by seeing that local open air markets would remain open for food and other essentials and by having the experience of the previous lockdown did not rush to buy – or all those reasons contributed to smoothing out demand.

To the extent that the markets were allowed to function, they seemed to cope more or less well although the difficulties they are experiencing are huge, prices were kept at same levels and people had outlets for shopping in the open air, allegedly being much safer than closed spaces of shopping centres and supermarkets. However, the usually low income of both traders-producers and consumers in the small markets meant that the pandemic created several problems for them that lost their income and access lifelines for basic goods, because of closed markets or reduced trade. The question how well the farmers markets and other small markets in East Yorkshire coped with the Covid19 pandemic is something that goes beyond the scope of this paper and we are already preparing a separate study dedicated to that question only.

Concerning the term of bioeconomy, the local producers and traders do not use it, although their activity falls within the definition. A lot of the activity falls also into the sustainable side of the bioeconomy, exactly because this is local production and distribution and the producers try to economise local resources. This practice is quite distinct from top-down policy versions of the bioeconomy, which also

[1] In the survey of May 2020 conducted by NMTF (2020, p. 2) it is mentioned that some markets remained open. To the best of our knowledge, in East Yorkshire all markets closed and only few out of the markets that existed before March 2020 resumed business in summer 2020.

predominantly frame the academic literaturefor the centralised character of the activity. The whole concept of the farmers markets has integrated production, processing and distribution of products derived from natural resources along with the creation and/or capturing of value for the local producers.

Likewise, local consumers can access basic items at a reasonable price and often without many negative environmental implications, because locally produced goods do not travel far to reach the final consumers. This also raises a huge question about items that seem to be imported and then distributed through the local small markets, like clothing and shoes. It seems that more investigation is needed to define how can local producers can undertake production in those sectors of necessities that can be sustainable for them and the environment in the same time.

Nevertheless, the markets are a small-scale activity compared to the big industrial plants and distribution networks that other sectors of the bioeconomy use, and more linked to the local economy. It is also an integrated approach to the local production abilities by providing opportunities of usinglocal resources and local skills and bringing wealth in the form of quality products and income to the people who live in the area. The markets are linked to the local producers and consumers while big industries need other processes to reach the consumers after the product has been designed or produced (McEachern et al, 2015). The big-scale activity does not guarantee neither the production of the goods at a profitable rate that will persuade big producers to proceed with an innovative item, nor that the big companies will stay long in a locality creating jobs for the local people.

Another very important trait of this type of the bioeconomy is that it might have a sustainability potential that can be at least much easier checked and investigated than the sustainability capacity of the big industries and big distribution networks. The waste avoidance and “save-everything” attitude of local producers, traders and consumers means that people create value by using their resources as efficiently as it is possible for them, given the constraints they might have in equipment, income and public infrastructures that are adequate for their activities. The packaging is much less in a farmers market and you can also see not-so-beautiful foodstuff that can be equally (or more) tasty as the “perfectly looking” goods in the food section of a supermarket (Spiller, 2012).

The reduction of travelling for reaching basic necessities is an important factor to account for: many consumers do not need to rush to the nearby city (Hull) to buy necessities (mostly food including clothes, accessories or stationary and petty machines). Food that is locally produced travels very short distances compared to the food that the supermarkets have to exhibit on shelves. The drive for as much profit as possible means that a supermarket will not buy locally if it is not profitable and the local producers might not afford to sell at the very low bulk prices that big food chains offer. This explains why the local foods that one can find in a market are not available at the city supermarkets. The small

markets, therefore, sustain the local bioeconomy while the big trade chains cannot or are not interested in facilitating the local producers to reach consumers (McEachern et al, 2010; Szmigin et al, 2003).

5. Conclusions

This paper has shown that there are bioeconomies that are organic in a local economy and have a sustainability potential that should not go unnoticed because the volume of the production for each producer is small. It seems that as far as it concerns food, the small markets have an important potential to support sustainable production and distribution and also to provide local consumers with good quality food items.

The same markets are also an outlet for crafters and artisans to create opportunities for themselves to produce by using recycled or upcycled materials. They are also spaces for traders to sell second-hand items instead of those items filling the recycling bins or the landfills.

The lack of public infrastructure and also the lack of private means of production is of utmost importance, also linked to policy: if there are people who want to become producers but lack access to land, equipment, training, small capital or other means of production, they should be given support to become producers. Support in terms of public infrastructure, in particular public transport services, and of small business needs is an issue that further investigation and also policy can effectively resolve.

If there are people who want to create things out of recycling other materials, they should be given the adequate equipment, training and support. The authorities could connect the producers who recycle or upcycle with the local people who can be encouraged to give away their recyclables locally and directly to producers. Generally, the local supply chains, because they consist of low and middle income producers with very little capital, although they are resilient because they have to (in order to survive), they need public infrastructures of all types in order to perform their capabilities in full (Kumar et al, 2020).

This research showed that the small markets are a good starting point to proceed with an economy (and probably with a bioeconomy) that is locally embedded and with potential to support local producers without harming the environment. It also showed the limitations that the small producers and traders face nowadays. More research is needed to contribute further into how the small markets can have an even more positive impact for the local economies and environment and how policy-makers can facilitate this process.

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Degrowth Niches in EU Institutions

The beginning of the end of economic growth

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Abstract

The concept of economic growth is arguably the most defining feature of twentieth century economics. In the twenty-first century however, the harmful consequences of ever more growth have become a danger to planet and people. And while the dominant role of growth in the economic system has always been criticized, those voices used to be few and far between. Yet, in recent years critics of growth have not only become significantly more vocal, the debate has also reached international organizations (IOs). And while no IO has abandoned growth as a major policy objective yet, it now usually comes with a qualifier such as "green", "sustainable", "inclusive" or "balanced". Moreover, there are organizational niches in which post-growth already exists, including ideas on "beyond GDP" approaches, wellbeing economics and the reduction of the EU's material and consumption foot print. This paper conceptualizes this emerging ideational change within IOs as niche-regime interactions and traces the concept of degrowth within the European Union (EU) using a combination of desk research, document analysis and participant observation. Combining the literature of post-growth with insights from transition studies, the article analyzes the evolution of degrowth within the EU. It thus contributes to a better understanding how post-growth ideas are currently perceived and also presents a new approach to the study of ideational change in organizations.

Keywords: Degrowth, European Union, Niches, Sustainability, Transition,

1. Introduction

In May 2016 the South Pole was the last place on earth to reach the sad milestone of an atmospheric CO2 concentration of 400 ppm according to the National Oceanic and Atmospheric Administration (NOAA, 2016). Five out of the nine planetary boundaries identified by earth system scientists are at high or increasing risk of "tipping" and thus irrevocably altering earth's climate (Steffen, Richardson, et al., 2015). The last time polar regions warmed at a similar rate than they do today was 125,000 years ago and caused a sea-level rise of 4– 5 meters (Pittock, 2010). The fact that these alterations of the earth's climate system are caused by human economic activity is well established in the scientific literature. Already in 2007, the Intergovernmental Panel on Climate Change (IPCC) concluded that there was a 90% certainty of anthropogenic climate change (IPCC, 2007), and more recent surveys of peer-reviewed literature consistently place the scientific consensus at 97-98 % (Cook et al., 2016).

Yet climate change is not the only development that should have us worried. Biodiversity loss, albeit related to climate change, is mostly driven by the continued destruction of habitat and unsustainable agricultural and fishing practices. A 2021 review by the UK Treasury (also known as the "Dasgupta Report") concludes that the accelerated depletion of species presents an "extreme" risk to the world and that radical action is needed to avoid "catastrophic breakdown". Simultaneously, the distribution of wealth has become more and more unequal, a development that has been thrown into stark relief by the Corona pandemic. According to an Oxfam study (Morales et al., 2021), it took only nine months for the 1.000 richest men to recoup the losses they suffered because of the pandemic and "worldwide, billionaires wealth' increased by a staggering $3.9tn (trillion) between 18 March and 31 December 2020" (p. 12).

Conventional economic logic dictates that the plights mentioned above could be overcome by more growth. The rising tide of growth would lift all boats out of poverty and once a country reaches a certain level of economic development, growth would ensure that it would gradually lead to a cleaner environment according to the widely cited environmental Kuznets curve. Reality, however, paints a picture that is less straight forward if not at odds with these standard views. While economic growth led to some remarkable achievements, it has also caused despair and destruction. The acknowledgement that growth by itself might not be the ultimate panacea for all the world's ills has begun to enter not only national policy debates and discourses but can also be found within international organisations (IOs).

Existing research generally regards IOs as staunch proponents of economic growth. However, the European Union has already engaged with degrowth ideas at several points in time and the Green Deal, while not outright questioning the growth logic, aims at making Europe a "climate-neutral continent", —a goal that can arguably not be reached with a further intensification of resource use. To what extent the Corona crisis contributes to these developments or rather results in a return to

business as usual remains to be seen, but if one is to believe the calls to "build back better" or the surprisingly growth-critical statement by the President of the European Parliament David Sassoli[1], economic growth is no longer fit for purpose.

Yet, economic growth is more than just a policy choice. At the moment, it is not only at the heart of our entire economic system, it also affects social relations and welfare provisions. Hence, moving beyond economic growth requires nothing short of system change. Transformation research and the study of organizational change offer valuable insights into how such system change might occur, what dynamics are at play and what possible trajectories it could take. This promising discipline has thus far been neglected by post-growth scholarship (but see Buch-Hansen, 2018; Vandeventer et al., 2019) even though it could not only enrich our understanding of change within organizations but also connect them to long-term trends of more fundamental societal transformation.

This paper identifies degrowth niches within EU institutions and considers possible transformation pathways. The analysis is based on conceptual work on the sustainability transition in IOs as well as empirical research including document analysis and virtual participant observations. The following section introduces the theoretical underpinnings of sustainability transitions. Subsequently, the paper briefly discusses the growth paradigm in global governance before tracing the concept of degrowth through the different EU governance bodies.

In examining degrowth niches in the EU, this paper contributes to a better understanding of how IOs engage with the increasing growth criticism and provides insights regarding the transformation processes in global economic governance. In that sense, the results contribute to three main fields of research, namely the study of IOs, degrowth, and transformation. Considering the crucial role intergovernmental organizations play in positioning, framing and ultimately governing global challenges, understanding how they interact with post-growth ideas is an important step towards developing a future-proof economic, social, and political system.

Sustainability Transitions: Paradigms, niches, and their interactions

It has become increasingly clear by now that our current economic system is incompatible with planetary boundaries (Hickel, 2019; O'Neill et al., 2018; Steffen et al., 2015). Hence, what is needed to put us back on the track of sustainable production and consumption is nothing short of a complete system overhaul. Transformation research tackles this challenge and in order to do justice to its complexity, it incorporates a variety of different disciplines, including history, economics, science and technology studies, sustainability science, organization studies and transitions research. As Wittmayer and Hölscher (2017, p. 13) put it so aptly: "Transformation research is emerging as conceptual glue

[1] Speaking at a public event on October 17, 2020, Sassoli said *"A certain ideology wanted us to believe that our planet was destined for infinite growth, that the world had infinite resources, […] The truth is that in recent years "growth" has been only for the few. Only the markets have grown, where people play the role of consumers or spectators."* (European Parliament, 2020)

between these strands [of literature]." The following section briefly introduces key concepts for the study of transformational change.

One of the more common concepts explains change as shifting paradigms, implying the existence of a dominant set of ideas and assumptions which is first challenged and eventually replaced by a new framework of different ideas and assumptions. Donella Meadows (1999), expert on system dynamics and systemic change, even considers changing and eventually transcending paradigms as the two most influential leverage points for system intervention.

The idea of paradigms and change as the shift from one paradigm to another can be traced back to Kuhn's understanding of scientific progress (Chalmers, 1999) but as a heuristic, paradigms can also be usefully applied to other domains. Hogan and Howlett (2015, p. 3) for example, define a policy paradigm as "a theoretical tool to specify and understand the guiding principles, or ideas, for creating public policy, why the various actors involved are involved, and why they pursue the strategies they do". Central to a paradigm is a certain degree of coherence and logical consistency (cf. Daigneault, 2015, p. 50). However, it is exactly when this consistency begins to break that paradigms lose their power and may eventually be overcome or replaced by a new paradigm.

Paradigms play a significant role in determining the shape of the dominant regime in a system because they promote and support the structures, practices and actor constellations that are conducive to it. In opposition to the dominant regime are niche innovations which provide a space for engagement with new or diverging ideas and experimentation with new practices. There is a considerable body of literature that deals with strategic niche management (SNM) including market niches (Kemp et al., 1998), technological niches and socio-technical regimes (Smith, 2003; Smith et al., 2005) and social innovation (Witkamp et al., 2011). Raven (2012) considers niches to be important spaces for experimentation and learning as well as the articulation of expectations and the formation of new actor constellations.

In the context of global governance, the idea of functional niches is often used as a heuristic to analyse inter-IO relationships and dynamics (Brosig, 2014; Gest & Grigorescu, 2010; Kranke, 2020; Stokke, 2013). Usually however, such niches are assumed to exist *outside* the organization. Yet, tracing the emergence and evolution of degrowth in and through institutions of the European Union indicates that such niches also exist within the organization.

Management and organization studies with a focus on private sector organizations have considered internal niches before, for example in the context of intrapreneurship (see e.g. Lages et al., 2017; Rivera, 2017). However, IO-literature has thus far neglected to utilize such findings even though a better understanding of niche-regime (paradigm) interaction could contribute considerably to the much-needed transition towards sustainability.

Concepts such as niches, regimes and paradigms are important in understanding organizational system dynamics. However, it is especially the interactions and interdependencies between these concepts that determine transition processes. The widely used Multi-Level Perspective (MLP) offers a framework to do exactly that (Geels, 2004, 2011; Grin et al., 2010). It consists of a dominant socio-technical regime, niche innovations and the overall socio-technical landscape. Beginning at the landscape level, there are different types of landscape changes that determine the dynamics within the MLP (Grin et al., 2010). For instance, regular change would be characterized by low intensity disruptions and slow, gradual change, such as demographic change or the slow rise in inequality. Specific shocks, on the other hand, are narrow in scope and rather rare but extremely impactful, such as the burst of an economic bubble (sector-specific) or natural disasters. A third type of landscape change is an "avalanche" which occurs very infrequently but is characterized by high intensity and high speed and simultaneously affects multiple dimensions of the system environment (ibid.). Good examples of this type of change are the global financial crisis in 2008 or the spread of COVID-19 in 2020.

Apart from these landscape development, Grin et al. (2010, p. 55) also distinguish different niche-regime interactions. These can be competitive if the niche aims at replacing the regime or it can be symbiotic, if the niche innovation can be incorporated into the dominant socio-technical regime. In the case of the post-growth transformation, the latter is rather impossible, since in its pure forms, growth and degrowth are polar opposites and mutually exclusive. A good example for a symbiotic process, though, would be the concept of "green" or "sustainable" growth as it amends the dominant regime of plain growth but does not attempt to replace it.

Based on the different types of interaction and landscape changes, a number of different transformation pathways open up, depending on the respective state of the niche innovation and the dominant regime. Out of the four types of pathways distinguished by Grin et al. (2010), only two will be discussed here as particularly promising for the analysis of the post-growth transformation. It is important to note, however, that these pathways are not exclusive or deterministic but can also occur in combination.

The first pathway is what Grin et al. call the "transformation pathway" and is defined by regular changes in the overall socio-technical landscape (i.e. low-intensity disruptions and slow, gradual change), outside pressures e.g. by actors critical of the mainstream and expert input on possible change trajectories but does not change the "basic architecture" of the system (ibid. p.72). One could argue that the "Beyond GDP" debate, which is mainly driven by experts, or the slow but steady incorporation of the SDGs into EU policy-making could constitute examples of such a pathway.

The second pathway relevant in this context is the notion of de-alignment and re-alignments of systems. This pathway is triggered by avalanche change at the landscape level which brings to light

the failures of the existing regime and causes regime actors to lose faith. The dominant regime thus erodes and "opens a space" for niches (ibid. p. 63). Depending on how mature niche innovations are at this point, they could either gain momentum and move to replace the mainstream (re-alignment) or if they are not yet sufficiently evolved, would co-exist along the failing regime for a considerable time (de-alignment). This pathway also shows some similarities to the current situations. Crises such as the global financial crisis and the Corona pandemic, but also slowly-building catastrophes such as climate change and biodiversity loss, are beginning to put a spotlight on the failings of the current socio-economic system and provides windows of opportunity for niche concepts such as degrowth or related approaches.

How the Multi-Level Perspective applies to growth-degrowth dichotomy has been beautifully explained by Vandeventer et al. (2019) who not only contributed to the conceptualization of the capitalist-growth system as a regime but also consider similar pathways for change.

Linking these general insights back to the study of IOs, it is not only important to consider their role within the larger system (e.g. as incumbents of the dominant regime) but also to acknowledge that the system dynamics outlined above, are likely to be found within the IOs themselves as well. IOs are not monolithic. And just like any other complex system, IOs too, contain a dominant regime, non-mainstream niches and are influenced by overall landscape trends. The following section characterizes the pursuit of economic growth as the dominant paradigm of EU policy-making before turning to the search for degrowth niches within the institutions of the EU.

The Growth Paradigm in Global Governance

Our current economic system is neither natural nor God-given but was created by human beings. And while the study of economics was originally closely related to philosophy and broad social and moral questions, by the end of the 20th century, its models and formulas were taught as if they were linear mechanisms governed by natural laws (Raworth, 2017). A comprehensive account of the history of the growth paradigm can be found in Borowy and Schmelzer (2017) but for the purpose of this paper, it is sufficient to acknowledge that "[e]conomic knowledge, ideas and concepts have a huge influence on society" (Maesse, 2022, p. 19) and that growth, as one such concept, is arguably the "most important idea of the twentieth century" (Schmelzer, 2015, p. 262).

In fact, one can argue that growth is the main ordering principle in the anarchic world of International Relations (IR) as Purdey (2012) does. At first glance, this claim might seem rather bold, but when one compares the pursuit of economic growth with other political endeavors, such as e.g. environmental protection, human rights or even peace, it becomes clear that no other concept is equally uncontested. This become especially apparent, when one considers that many of the objectives mentioned above are assumed to be achieved through growth. The environmental Kuznet's Curve suggests that more growth will eventually clean up the environment. Human rights would be ensured by social progress

which is realized through growth. And eventually even peace could be "bought", since conventional wisdom assures us that prosperous societies do not go to war with one another. In a world culture whose overarching objectives are progress and justice (Finnemore, 1996), economic growth has become the universal instrument to achieve, or at least appear to achieve2, both (Purdey, 2012).

Explanations for the pervasiveness of the growth paradigm can generally be divided into realist-materialist arguments and constructivist-ideational reasoning. The former focuses on human nature and people's desire to out-do one another, while the latter adopts a more systemic viewpoint, arguing that structures, beliefs and practices continuously enforce the dominant paradigm (Dale, 2012). What both approaches have in common, however, is the acknowledgement of the powerful position growth has in the current socio-economic system, leading scholars to speak of "growthism" or "growthmanship" (see Schmelzer, 2016, p. 7).

By adopting a more structuralist perspective, it becomes possible to develop a nuanced understanding of the role of growth in global governance and tie it to existing research on organizational change by looking at the influence of ideas and discursive practices. Purdey (2012) for example identifies systemic as well as state-level factors that contribute to the global commitment to growth and develops a coherent account of the paradigm's "ideational superstructure" (ibid. ch. 3).

Interestingly, there seems to be hardly any research on the perception or discourse of growth in the context of the EU institutions. Only with the advent of "green growth" did the concept receive scholarly attention (see e.g. Eckert & Kovalevska, 2021; Jacobs, 2012; Šneiderienė et al., 2020; Stegemann & Ossewaarde, 2018) and the emergence of degrowth has contributed additional perspectives for the analysis of EU policies (see e.g. Pollex & Lenschow, 2018).

Looking at current discourses in the EU, green (or otherwise qualified) growth has superseded conventional growth as a policy objective and has become the new dominant paradigm. Reconciling the tension between economic growth, planetary boundaries and social justice becomes the defining issue of our time. Or as Nicholas Stern, author of the famous "Stern Report" of 2006 put it in a recent presentation to the European Commission's Directorate-General for Economic and Financial Affairs (DG ECFIN), "the sustainable growth path is the story of the century" (Stern, 2021).

Especially in the context of the Corona pandemic, economic recovery is at the forefront everybody's mind. And while e.g. the Commission's Spring Economic Forecast 2021 still relies heavily on metrics such as GDP and increased private consumption (concepts conventionally associated with growthism), the EU's recovery plan "NextGenerationEU", and particularly the European Green Deal, acknowledge that the much needed economic transformation has to be socially just and ecologically sustainable.

[2] Especially questions of distributional justice can easily be evaded as long as everyone is still getting more and more.

Under the umbrella of the "European Green Deal", sustainability is the number one priority for von der Leyen's presidency (EEB, 2019). The initiative was introduced as the "new growth strategy" (von der Leyen, 2019) reflecting the assumption that green growth, i.e. an absolute decoupling of resource consumption and economic growth, is possible. However, it implicitly also contains support for degrowth-related practices such as circular economy, and strives to make the EU "the first climate-neutral continent" with an economy in which "no person and no place is left behind" (EC, n.d.). Whether these objectives can in fact be achieved by further economic growth is exactly what many scientists and activists question. If future developments would show that sustained economic growth is not the means with which these policy objectives can be achieved, the window for post-growth economic approaches might open further.

Postulating that green growth is the new dominant regime in EU policy-making, the following section traces the concept of degrowth as an indicator for niche innovation within the different EU institutions.

Emerging Degrowth Niches

The following analysis is based on preliminary desk-research and participant observations in virtual events such as webinars or other digital formats. Data collection from the EU websites occurred at two points in time, first focussing on the Directorate-General for Environment (DG ENV) and subsequently broadening the search to include the Commission, the Parliament and the EU Publications Office. On all sites the same search term ("degrowth") was used and all results which featured the term as part of the main body text—rather than only in the titles of bibliography entries, were included. With these parameters, 19 entries covering the years from 2010 to 2020 were included in the analysis.

The digital paper-trail of degrowth within the institutions of the European Union can be traced back to a publication by the Directorate-General for Environment of the European Commission (DG ENV) in 2010. In a special supplement to its quarterly magazine "Environment for Europeans" it reported on the presentation by Tim Jackson at the 2010 EU Green Week, highlighting his proposition that degrowth "should guide future decision" and taking particular note of the "loud applause" that followed his call for less production and consumption implying widespread support for such a position (DG ENV, 2010, p. 6).

In fact, between 2010 and 2020, the majority of documents that include the term "degrowth" originate from DG ENV. Interestingly, however, there is a gap between 2012 and 2020 in which the European Parliament (EP) has begun to figure more prominently. In 2013, a joint decision by the EP and the Council established the "General Union Environment Action Programme to 2020 'Living well, within the limits of our planet'" but without mentioning the concept of degrowth. Two years later, however,

the EP briefing "The European year for development: Sustainable growth" already includes degrowth positions as opposition to the dominant pro-growth or even green growth approaches.

It is important to remember in this context, that EP Briefings are written by individual authors—usually from the Policy Department, to provide input for the parliamentary work of Members of the European Parliament (MEP) and their staff. Hence they do not reflect official positions by the Parliament but are an important proof that the presence of a degrowth discourse among activists and researchers is being noted within EU institutions.

From External to Internal Content

When further contextualizing the origin of the different documents, it becomes clear that degrowth found its way into EU policy-making through the scientific discourses related to sustainability and environmental policy. Between 2010 and 2012, the most prolific source was the DG Environment News Alert Service "Science for Environment Policy" which summarizes peer-reviewed journal articles for policy-makers. In total, they comprise four of the seven documents published during that timeframe.

After 2012, the research-policy nexus continues to play a significant role in the diffusion of degrowth across EU institutions but now authors seem to engage much more directly with the topic and the presence of DG ENV decreases. Instead of merely presenting summaries of selected journal articles as the News Alert Service had done, in 2016 the Commission's Joint Research Centre (JRC) compiled its own report on concepts related to green growth which also mentions degrowth, albeit only in passing. A few years later, degrowth reappears in the context of "Beyond GDP" and the ecological transition in a JRC foresight study on water-management in the Danube River basin, showing that it has become part of the policy debate.

Together with the aforementioned EP Briefing and some other examples that will be discussed below, the documents referring to "degrowth" now mostly consist of internal content. At this point, documents are produced in the context of EU policy-making rather than as an attempt to bring external research into the organization as in the case of the News Alert Service (see **Figure 1**).

In 2017 the European Economic and Social Committee (EESC) enters the picture and the trend towards more internal content continues. An EESC Opinion published in 2019 explicitly references the Open Letter to EU institutions[3] that was signed by over 200 scientists and activists in 2018. And while not outright supporting the call for degrowth, the authors acknowledge the need for a "new model of growth" that is "qualitatively different" (EESC, 2019a). The fact that the EESC substantially

[3] https://degrowth.org/2018/09/06/post-growth-open-letter/

engages with post-growth related concepts is further corroborated by its references to e.g. planetary boundaries, beyond-GDP approaches, and wellbeing economics (EESC, 2019b, 2019c).

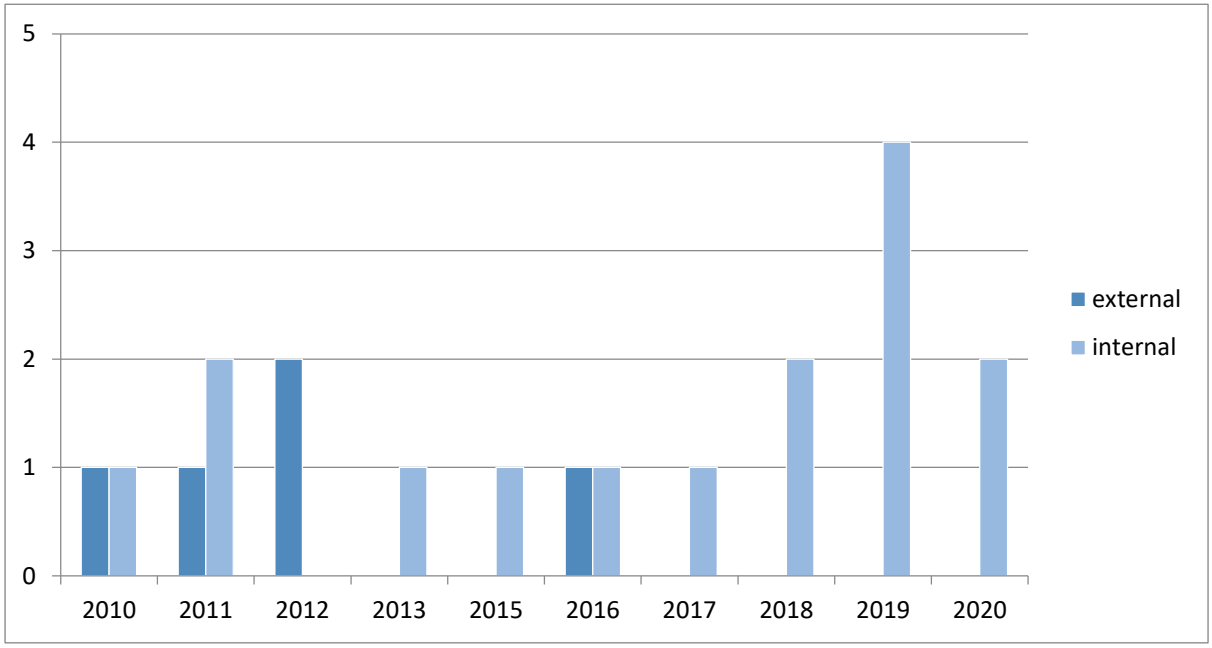

Figure 1 *From external to internal content. Source: author*

From Environment to Economics (and back?)

Over the years, different institutions take centre-stage in the degrowth timeline. The shift from DG ENV to the EESC is particularly interesting because of their different policy foci. Degrowth is deeply rooted in the understanding that further intensification of resource use is incompatible with the limits of the carrying capacity of the earth's ecosystem. Hence, its emergence in the organizational unit most closely connected to the environment comes as no surprise. What *is* surprising, though, is the gap that exists between 2012 and 2020 when no references to degrowth were made in publicly available DG ENV documents.

During that time, the Parliament and the Commission (rather than individual DGs) feature more prominently. Moreover, public opinion becomes increasingly weary of the current economic model, as the results of a 2018 public consultation of the EC indicate. 66% of respondents consider a paradigm shift, including sustainable consumption and production, circular economy and degrowth to be a "key factor" for long-term sustainability (EC, 2018). This trend in shifting values is echoed in societies across Europe with decreasing support for the dominant economic paradigm of growth-oriented capitalism (Inglehart, 2018; Oxfam, 2021).

The observation, that in recent years the concept of degrowth appears more frequently in the context of social and economic sustainability speaks to its diffusion within EU institutions (see **Figure 2**). And in 2019, the EP Directorate General for Translation even included the term "degrowth" in its Multilingual Dictionary of New Words which warrants the assumption that degrowth has become part of the discourse within EU institutions.

Most recently, the discourse seems to have shifted back to a focus on the environmental implications of degrowth when the European Environment Agency (EEA) published a briefing titled "Growth without economic growth"—the most explicitly growth-critical document yet (EEA, 2021). Considering the increasing urgency of multiple converging crises, including climate change, biodiversity loss and COVID-19, this development might very well be correlated with the renewed impetus for sustainable development under the leadership of Ursula von der Leyen, who took over the European Commission presidency from Jean-Claude Juncker in 2019.

What can be established at this point, is the general proliferation of sustainability-focused activities across EU institutions and policy areas as part of e.g. the European Green Deal[4] or the Sustainable Development Goals (SDG). This constitutes a marked change from the focus on jobs and growth under the leadership of Jean-Claude Juncker which was not only highlighted by Anthony Agotha, Senior Diplomatic Expert and Member of the Cabinet of Executive Vice-President Timmermans[5], but was also confirmed by another Commission employee in a private conversation.

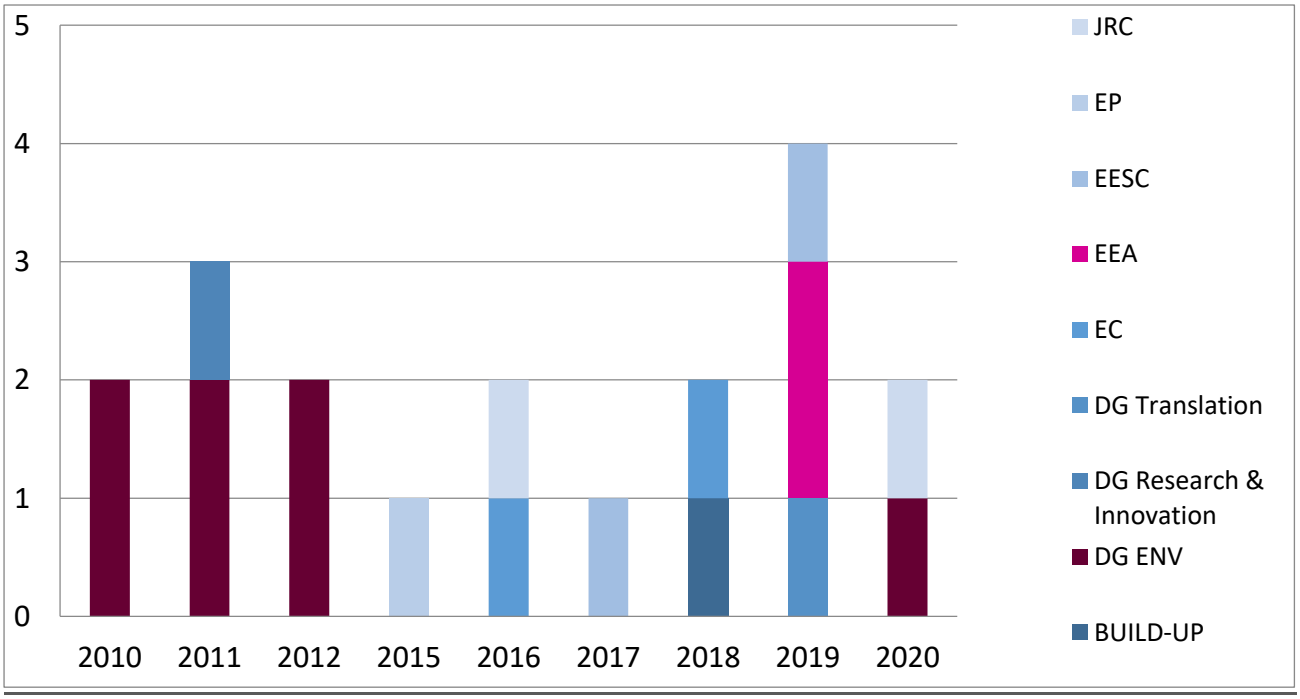

Figure 2 *Distribution by organizational unit. Source: author*

[4] See e.g. the EU strategy for sustainable textiles, the circular economy action plan (CEAP) or the zero pollution action plan.

[5] A recording of the event can be found here https://eeb.org/growth-without-economic-growth-22-february-webinar/

Discussion: Transition pathways and niche-regime interactions

As can be seen from the analysis above, degrowth appears across institutions and in different policy contexts. Using the pathways outlined in the Multi-Level Perspective as a blueprint, two observations can be made.

First, what Grin et al. call the "transformation pathway" and in which change is incorporated in the existing system, is ultimately impossible to occur in the case of the growth/degrowth binary. While it is possible to partly integrate degrowth-allied concepts or policies such as "Beyond GDP" indicators, work-time reduction, material consumption caps, etc. into a growth-based system, its pure forms are incompatible with each other. That means that beginning to incorporate the notion of degrowth would have to lead to changes in the "basic architecture" (Grin et al., 2010, p. 72) of the dominant regime, thereby no longer representing the transformation pathway.

Second, it is generally assumed that regular, incremental change is the norm in niche-regime interactions. While niches are sometimes incorporated into the mainstream, they rarely replace the dominant regime because it is sufficiently stable and functional to address problems that arise within or occur due to landscape changes. What is currently happening, however, rather resembles the beginnings of a de-alignment process where developments at the landscape level lead to an erosion of the dominant regime, cause actors to lose faith in the existing system and thereby opening up a space for niche innovations to take over. Only ten years ago, calling for system change was considered almost radical, while nowadays, even conservative politicians acknowledge that the current system is no longer functional. However, considering the limited presence of degrowth in current policy debates within EU institutions, it seems unlikely that this particular niche concept is mature enough at this point in time to really challenge the existing paradigm. Nevertheless, this should not preclude the possibility of de-alignment altogether, given that the convergence of crises such as climate change, biodiversity loss, pandemics and rising inequality will continue to exert significant pressure on our growth-based economic system.

Clearly there has been no definitive commitment to degrowth by any major political or economic actor (be it state government or intergovernmental organization). However, when framing the current debate about economic growth mainly as a transition away from growth (a point which can reasonably be made given the substantial increase in growth criticism, acceptance of post-growth ideas in public debates and the ubiquitous use of "growth qualifiers" in political communication such as green, inclusive, sustainable, or balanced), a space opens up for more open-ended, less deterministic analysis.

Considering that the increasingly confident vocalization of growth criticism is still relatively young (compared to the decades of staunch pro-growth positions in international political economy) and that

at this moment we do not yet have the benefit of hindsight, it is hard to say when or even if a full paradigm shift is going to take place. What is clear, however, is that the unquestioned reign of economic growth is over. While degrowth itself still exists only in niches, growth criticism and considerations of alternative economic models more broadly, have moved from the fringes of economic and political debate towards the mainstream. This does not mean that growth will be replaced as a policy objective tomorrow, or even one or two years from now, but as this paper shows, degrowth has entered the policy discourse of EU institutions.

Conclusion

This paper conceptualized green growth and degrowth as niche-regime interaction within and across EU institutions. Green growth can be considered the dominant paradigm for sustainability policy-making but as the analysis above shows, the concept of degrowth exists in the niches of the policy discourse. Two major limitations have to be considered, however. First, the overall amount of data only allows for rather tentative conclusions which should be further tested, e.g. with content analysis and interviews. Second, due to a relaunch of the Commission's online presence, though, replicability of the search has been compromised. Despite these considerations, though, some initial conclusions can be drawn with relative confidence:

First, in the context of the EU, degrowth is particularly strong where it has a close connection to environmental concerns, such as in the case of DG ENV or the EEA. However, social aspects are also considered as can be seen in the involvement of e.g. the EESC. Second, degrowth entered the policy discourse through academic literature rather than activist pressure. Given the strong roots of degrowth as a social movement, this is a surprising insight that highlights the important contribution of the academic dimension of degrowth. And third, in terms of transition pathways it is still too early to tell whether a de-alignment will eventually occur if the dominant regime becomes sufficiently unstable. It is likely though that future crises and shocks will continue to put pressure on the current regime. Moreover, existing experiments with degrowth and related concepts at local, national and international levels will play their part in helping the concept develop further which might lead to a degree of maturity at which it presents a viable alternative to a growth-based system.

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Appendix

Year	Date	Organizational Unit	Type of Publication/Series Title	Title
2010	n.d.	DG ENV	Green Week Supplement	Environment for Europeans
2010	16.09.2010	DG ENV	DG ENV News Alert Service "Science for Environment Policy"	Sustainable de-growth: an alternative to sustainable development?
2011	26.04.2011	DG ENV	Project Report	Addressing the Rebound Effect
2011	01.05.2011	DG ENV	DG ENV News Alert Service "Science for Environment Policy"	Special Issue "Global Green Economy"
2011	n.d.	DG Research & Innovation	3rd SCAR Foresight Exercise	Sustainable food, consumption, and production in a resource-constrained world
2012	07.06.2012	DG ENV	DG ENV News Alert Service "Science for Environment Policy"	Degrowth aided by decentralised water supply
2012	30.11.2012	DG ENV	DG ENV News Alert Service "Science for Environment Policy"	Sustain growth in eco-industry for a green economy, study argues
2015	03.06.2015	EP	Briefing	The European year for development: sustainable growth
2016	n.d.	JRC	JRC Science for Policy Report	Some Observations on Green Growth
2016	01.10.2016	FESSUD, EC	European Policy-Brief on voluntary degrowth	A Proposal for Voluntary Degrowth by Redesigning Money for Sustainability, Justice, and Resilience
2017	01.07.2017	EESC	Europe III	The EU must become the world leader in meeting SDGs
2018	15.10.2018	BUILD-UP The European Portal For Energy Efficiency In Buildings	Website "Practices"	Environmental footprint and circularity in the construction sector
2018	28.11.2018	EC	Report on the results of the Public Consultation	Vision for a long-term EU strategy for reducing greenhouse gas emissions
2019	n.d.	DG Translation	Multilingual Dictionary of New Words	
2019	n.d.	EEA	EEA Report	Drivers of change of relevance for Europe's environment and sustainability
2019	01.09.2019	EEA	EEA Report	Sustainability Transitions: policy and practice

2019	26.09.2019	EESC	Reflection Paper	Towards a Sustainable Europe by 2030
2020	n.d.	JRC	JRC Science for Policy Report	Water Scenarios for the Danube River Basin
2020	n.d.	DG ENV	The EU Environmental Foresight System (FORENV)	Final report of 2019-2020 annual cycle

Circular Business models for construction products, in the framework of the Circular Economy in construction sector, focused on the use and end-of-life phase of their life cycle

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Abstract

The construction sector is considered to be the least efficient sector, using around 50% of all extracted materials and responsible for 35% of total European waste production. Greater material use efficiency in the sector could save more than 80% of the related greenhouse gas emissions. The Circular Economy Action Plan released by the European Commission, within the part dedicated to the construction sector, suggests extending the life cycle of an asset. This approach does not only consider increasing the durability of the asset. In the construction sector, the life cycle of a building, and the systems and products integrated into it, depends on multiple aspects. Some of these aspects are adaptability at different scales (building, system, component), and reusability (system, component). Durability is considered as a parameter essential to achieve this potential. This paper is focused on identifying sustainable economic models for construction systems and products, taking into account the before mentioned characteristics as parameters of the potential to extend their life cycle. In order to identify suitable business models (BM), the circular business model (CBM) references were collected from the scientific literature but also from relevant reports and publications from the construction sector. These models were cross-referenced with the circular resource efficiency strategies, in order to determine which of these BMs are applicable by the producers of the construction products and are related to the analysed product characteristics. Multiple potentially suitable CBMs were identified, giving a base for further research in this particular field. Some of the identified BMs were then further analysed in 7 case studies, through semi-structured interviews with construction product producers. The BM case study analysis suggested that the actual implementation of these models is still not feasible in the construction sector, even if there is will on the side of the producers, and confirmed the presence of the barriers encountered in previous research. A more detailed study of the BM patterns and BM innovation in the field is needed in order to help to overcome these barriers. This paper is related to the SDG nr. 8 Decent Work and Economic Growth, nr. 9 Industry, Innovation and Infrastructure, 11 Sustainable Cities and Communities, 12 Responsible Consumption and Production, 13 Climate Action, and 17 Partnership for the Goals. The conference theme “Accelerating progress towards SDGs in time of crisis” is closely

related to the topic of this article as it aims to propose further research and innovation to set up new CBMs in the construction sector, with the objective to speed up the circular economy uptake within the sector.

Keywords: Business model, Construction sector, Circular economy, Product lifespan, Resource efficiency

1. Introduction

The construction sector is considered to be the least efficient sector considering the use of resources and level of control (Achell & Pérez, 2019). Around 50% of all extracted materials are used in the construction sector, which is also responsible for 35% of total European waste production. The emissions of gases that cause the greenhouse effect of the sector account for 5-12% of the total. Greater material use efficiency could save more than 80% of these emissions (Commission, 2020).

- **Circular Economy in construction sector**

Circular economy (CE) applied in the construction sector brings numerous opportunities to optimize its processes, in the environmental sense, but also economically (Ellen MacArthur Foundation, 2015). The efficiency of this sector is historically very low (Achell & Pérez, 2019), which also increases the potential for optimization. Given that the European Commission adopted the circular vision in the New Green Deal strategy, and particularly in the Circular Economy Action Plan (Commission, 2020), it presents an ideal ecosystem to propose new business models (BM), applying the principles of the CE.

The application of CE thinking in the construction sector is not yet established (Eberhardt et al., 2020), and business and ownership models are needed for its implementation (Górecki et al., 2019). The circular business models (CBM) are mentioned as one of the financial enablers in the implementation of CE principles in the built environment, while difficulties in demonstrating a strong circular business case are one of the main obstacles of this process (Hart et al., 2019). The development of the enterprises in the construction industry depends on their innovative potential. Apart from technological innovation, organizational and marketing innovation is required (Gorecki, 2019). The BM innovation is considered an important tool for the transition to the CE (Yang et al., 2018), especially in the built environment with one of the largest challenges for adopting circularity being the unclear financial case (Adams et al., 2017).

The CBMs have not yet been explicitly articulated to investors or construction clients to incentivise a change in this direction (ARUP & Ellen MacArthur Foundation, 2020). This claim is supported by endorsements by several large industry representatives within the publication, referring to “lack of evidence and examples” and the need to “support and incentivise the uptake of CBMs in the future”. According to the latest research (Mhatre et al., 2021), none of the CBMs in the built environment have been validated yet, and present therefore an opportunity to determine an exhaustive CBM.

- **Circular strategies for resource efficiency**

On the other hand, there are numerous resource efficiency or circular strategies to achieve the objectives of the CE and to put them into practice. Analysing the technological cycle of the "butterfly diagram" (Ellen MacArthur Foundation, 2015), which shaped current views on the CE (Velenturf et al., 2019), the most efficient circular strategy is to "maintain and prolong", meant to extend the useful life of products. The second most efficient strategy according to the diagram is "reuse and redistribute". There are multiple product characteristics that can help to implement these strategies. However, the focus of this paper is on the adaptability, reusability and durability of the construction products. These concepts are mentioned in the action plans and other documents relevant to the implementation of CE in the construction sector. In the European Circular Economy Action Plan, as one of the 5 actions listed within the topic "Construction and buildings" it is stated that Europe should be "promoting measures to improve the durability and adaptability of built assets in line with the CE principles for buildings design" (Commission, 2020). Furthermore, the first action proposed within the topic "Designing sustainable products" is defined as "improving product durability, reusability, upgradability and reparability, addressing the presence of hazardous chemicals in products, and increasing their energy and resource efficiency". This action is in its totality applicable to the construction products.

The action strategies according to the RESOLVE framework (Ellen MacArthur Foundation, 2015), one of the first comprehensive CE action plans, include actions aligned with the ones stated in the European Action Plan. The proposed actions are regenerate (1), share (2), optimize (3), loop (4), virtualize (5) and exchange (6). One of the main tools of the action optimize (3), is "prolonging the useful life of an asset", which in our case means increasing the lifespan of buildings and their components. That does not necessarily refer only to the durability of materials. The adaptability of spaces and the independence of construction systems with different useful lives are one of the main determinants of the useful life of a building (Arup, 2016). Another tool within the same concept optimize (3), is "implement reverse logistics", in which re-manufacturing, renovation, repair, reuse and recycling of construction systems and materials are considered at the end of their useful life. These concepts could be summarized as tools to increase the lifespan within the same building (renovation, repair), and ways to reuse, either directly, or indirectly through re-manufacturing or recycling. Within the concept loop (4), the tools "keep products and materials in cycles, prioritizing internal cycles" are mentioned, referring to the same concepts already mentioned above, but during (not at the end of) the life cycle of a building, with a particular focus on disassembly design, which enables other strategies such as reuse or recycling.

- **Adaptability, reusability and durability**

Based on extensive literature research within the construction sector by (Eberhardt et al., 2020), the studied product characteristics, relevant to the resource efficiency, can be defined as follows.

Adaptability, or flexibility, means designing to be able to adapt to available materials, accommodate changes in future use, in function requiring modifications, remodelling or expansion. It is believed to secure easy and low-cost operation and maintenance, and to prolong the lifespan of the building, components or materials. (Eberhardt et al., 2020).

Durability means designing or using high quality durable long performance lifespan components and materials that are easy to maintain and upgrade and can handle several service lives (Eberhardt et al., 2020), also defined as the resistance of materials and components to deterioration overtime while meeting the minimal requirements (Rahla et al., 2021).

The term reusability, or reuse of existing buildings, components or materials, is used to directly reuse existing buildings, components or materials for new construction projects (Eberhardt et al., 2020). Within this concept, the component reuse in other buildings is the process where the building parts are dismantled during deconstruction and are relocated in new contexts and reused in new lifecycles, while material reprocessing consists in the reuse of building components, but a process of refurbishment or reprocessing is needed before the component could be reused in a new lifecycle (Bertino et al., 2021).

The current application of circular design strategies has been assessed in the construction industry (Eberhardt et al., 2020). The results show the presence of the design strategies in literature and the stage of their application. The results include 16 categories, of which 3 are the characteristics studied in this article, and another 7 are closely related to them. The appearance of the adaptability, durability and reusability in the literature was 21, 13 and 11 of 34 analysed publications successively. The most mentioned concepts were assembly/ disassembly (32), material selection/ substitution (25), modularity (17) and prefabrication (17), all closely related to the studied concepts.

In summary, the adaptability, reusability and the durability of construction products are definitely characteristics that allow for maintaining the products within the CE cycles, but the relation between these characteristics and the feasibility of implementation of their potential is not straightforward and has to be further analysed. The feasibility of reuse, and also of designing for adaptability and durability are related to the value of the construction products and systems (Minunno et al., 2018). The value is defined in BM of the products, following the definitions of the BM, which “describes how a firm creates, delivers and captures value for all stakeholders within the value network” (Yang et al., 2018).

Adaptability, reusability and durability are circular product characteristics. In order to achieve them, it is not sufficient to design for adaptability and reusability, there has to be a whole ecosystem established that allows to design, to produce, to sell and to provide services that allow for the exploitation of the potential that such circular products have. In this article, the assumption is that the BMs are the tool needed to exploit this potential and lead to the success of the products/ systems, designed for long or multiple lifespans, on the market.

2. Methods

In order to determine the BMs for the construction products, that would be supporting the value of their adaptability, reusability and durability, first the existing BMs already applied in the construction sector have been analysed through a bibliographical analysis (1a). Consequently, the relations between these models and circular resource efficiency strategies were analysed, identifying those BMs with the searched potential (1b). In the second phase, semi-structured interviews within the grounded theory approach have been conducted in 7 case studies, in order to add more data to understand the actual state of implementation of the CE in the construction sector related production companies and the value that they currently give to the adaptability, reusability and durability of the construction products (2).

Bibliographical analysis (1a).

In order to identify the CBMs already applied within the construction sector, the principal collection of Web of science was searched with the keywords BMs & construction products. The first 100 most cited + 30 newest articles were analysed, first based on titles and abstracts. The search was repeated with the keywords: building materials sector BM, and the first 100 newest articles were analysed. The relevant articles were selected and further analysed.

In order to widen the perspective, a wider search of peer-reviewed articles for BMs for specific categories of construction products, such as facade, partitions and furniture was conducted, as well as a search of peer-reviewed articles in other databases with keywords related to specific topics within this research: BM; construction sector; reusability; adaptability; durability; product service systems; reverse logistic; end of life; lifespan; value chain; and others.

Relating the circular strategies for resource efficiency to the CBMs (1b).

The next step in order to determine the BMs suitable for supporting the selected circular strategies is the identification of relations between these models and the circular design strategies.

3 criteria have been defined in order to evaluate the existing CBMs:

- Their applicability in the construction sector (a)
- The direct involvement of the producers of construction products and systems in them (b)
- Their relation to the studied circular design strategies: durability, adaptability, reusability (c)

    - **Their applicability in the construction sector (a)**

The applicability of the BMs in the construction sector was defined based on the object of the BM, which in some cases may not be related with the activities of the construction sector.

Some BMs with sustainability features being applied in the construction sector already have also been included in the selection and evaluated, although these were not regarded as circular.

- **The direct involvement of the producers of construction products and systems in them (b)**

The focus on the producers of construction products and systems is based on the assumption, that they are the stakeholders that most influence the material selection and product design and assembly methods, being closely related to the resource efficiency strategies.

In order to determine whether these BMs are related to the construction product manufacturers, it should be defined which stakeholders are involved in each of the BMs. In reference to the production companies, some of the BMs can be realised at the company level within its own processes and product development, however, realising circular strategies often needs involvement and coordination with at least one other value chain representative. Only internal loop- material reuse within the point of manufacture is realisable at the company level. The more complex loops are often managed by entirely separate businesses and logistic systems (Nußholz, 2017).

For the purpose of this research, all the BMs with potential implications of the producers of construction products have been considered suitable for further research.

- **Their relation to the circular resource efficiency strategies: durability, adaptability, reusability (c)**

This criterion has been based on the framework developed by (Florian Lüdeke-Freund et al., 2019). Within this framework, 6 different patterns of the CBMs were analysed and cross referenced with the circular resource efficiency strategies. The two resource efficiency strategies of interest are "Design for long-life products: Attachment & trust; reliability & **durability**" and "Design for product life extension: Maintenance & repair; upgradability & **adaptability**; standardization & compatibility; dis- & reassembly".

A direct relation between these two strategies has been established with the first 3 of the 6 identified business model patterns: "Repair & maintenance", "Reuse & redistribution" and "Refurbishment & remanufacturing", linking the BMs belonging into these patterns with the selected circular strategies. The reusability is not mentioned between these strategies but is inherently connected to the Reuse & redistribution BM pattern. This key was used in the BM selection.

In order to extend this consideration and relate it to other approaches present in the literature (Figure 1), the resource efficiency categorisation developed by (Nußholz, 2017) has been used. This categorization includes and interconnects 3 main frameworks previously encountered in literature.

The link between the two publications is the resource efficiency strategies approach developed by (Bocken et al., 2016), included in both publications. This categorisation considers that the resource flows may be "narrowed", "slowed" or "closed". Based on (Florian Lüdeke-Freund et al., 2019), in our case all the studied strategies fit into the "Slowing resource cycle" resource strategy.

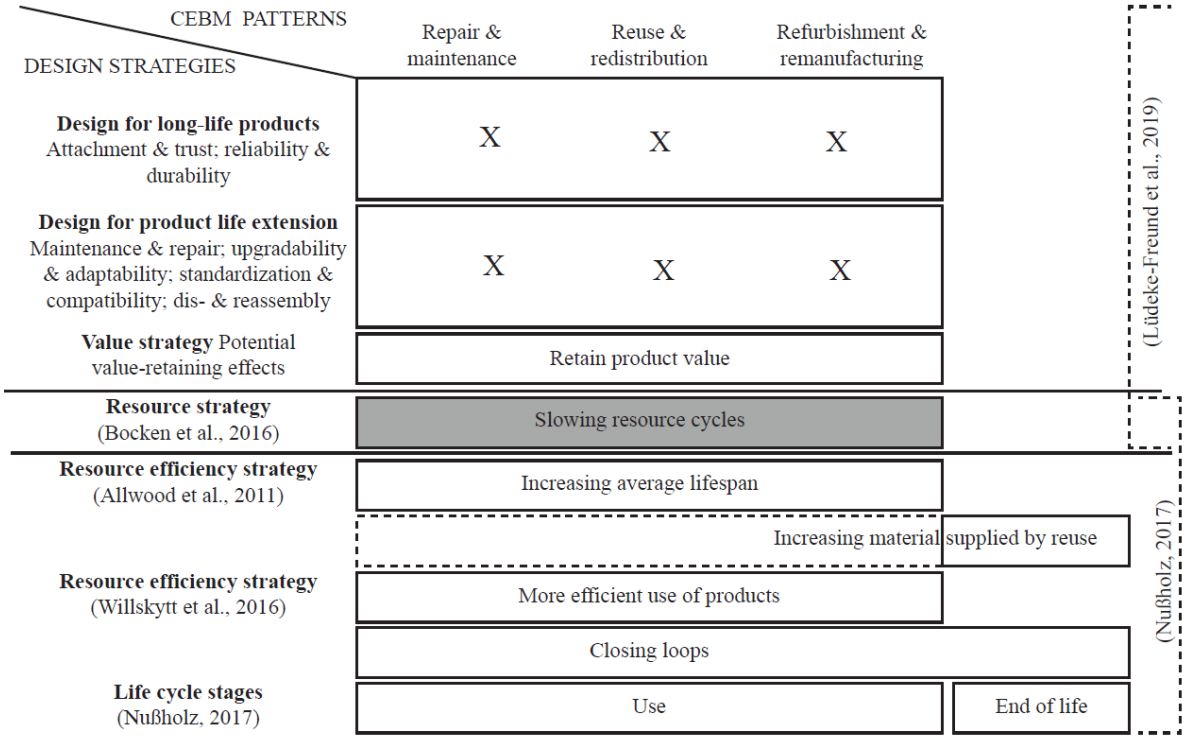

***Figure 1**: Relating circular design strategies, resource efficiency strategies and CBMs (CEBM=Circular economy business models), based on (Nußholz, 2017) and (Florian Lüdeke-Freund et al., 2019).*

This resource strategy is referenced with the strategies "Increasing life span" (*Allwood et al., 2011*), and "More efficient use of products" (*Willskytt et al., 2016*). The latter also considers these strategies as part of the "Closing loops" strategies, that extend to the End-of-life phase, while the other mentioned strategies are positioned clearly in the "Use" life cycle stage. The reuse strategy is not clearly positioned, as enabling a second life for products and parts can be part of "closing the loop" if products and parts are reused by a new user, but if they are reused by the same user, it is regarded as a way to extend product life (Nußholz, 2017).

In resume, all the BMs that are related to the framework defined in Table 1 will be considered as suitable for the purpose of this research.

Case studies (2).

Based on the bibliographical analysis, there has already been an important research conducted in regard to the CBMs in the production sector, as well as there is data in regard to CBMs applied in the construction sector available, however, there is a lack of specific data dedicated to the BMs applied or suggested to the companies that produce construction products and systems, being a specific niche at the intersection of the construction and industrial sector.

In order to fill in this gap, semi-structured exploratory interviews were conducted with 7 producers of construction products, within the framework of the grounded theory (Glaser & Strauss, 1967).

The 7 producers were asked for collaboration as habitual collaborators of the architectural studio where 2 of the authors are active. 3 of them are collaborating on research projects within the H2020 framework with ambitions in the circular construction and are therefore supposed to be more advanced in the implementation of CE principles. The 7 producers represent different company sizes, maturity phases and positions within the value chain, some of them being large international companies (4/7) and one a start-up. All the producers are active in the sector of building envelopes.

The interview questions were determined based on the research objectives and simplified in order to reach clearer results. The interview was optimized based on a pilot interview. It is composed of an initial questionnaire and the interview with 2 parts. The initial questionnaire was to be completed by the producer before the interview, and includes questions that help to categorise the company (company size, maturity, margin), to understand their current BM and their position in the value chain (main products, main suppliers, typical customers, key resources, value proposition and sustainability approach) and finally the yes/no questions on whether they apply the determined CBMs. The CBMs selection is based on the publication by (Accenture, 2014), considered as the most comprehensive and suitable BM categorization for the current research.

3 of these BMs were selected to be further analysed in the first part of the actual interview. These models are Product as a service (a), Product life extension (b) and Reverse logistics (c) (mentioned in the Accenture publication, but not as one of the main BMs). The selection of these particular BMs is due to their relevance to the studied circularity characteristics of the building products and services. The questions are focused on determining the potential to implement the studied models.

The second part of the interview is focused on durability (a), reusability (b) and adaptability (c). The selection of these specific characteristics was justified in the introduction of this paper. The questions are dedicated to understanding whether the producers are aware of these characteristics, if according to their experience their customers appreciate them and if the price of their products is anyhow affected by these characteristics.

The collected data were analysed per topic (1a, 1b, 1c, 2a, 2b, 2c) and cross-referenced with the company categorization, in order to understand the relevance of the company characteristics in the application of the BMs and the appreciation of the circular product characteristics.

3. Results and Discussion

As described in chapter 2. Methods, the article was developed in 2 phases. In the first phase, the CBMs in the construction sector have been analysed and cross-referenced with the circular product characteristics, in order to determine the models suitable to support extended or multiple lifespans of the construction products. In the second phase, more specific and current data have been collected and

analysed, based on semi-structured interviews with 7 producers of the construction products and systems.

Phase 01: CBMs in the construction sector: overview

Based on the literature review, the CBMs have been widely discussed in the recent scientific publications, but also by public authorities at the national and European levels, and by important representatives of the industry, which bring important insights to the current practice as well as to the intended future development.

In regard to the construction sector, the analysis shows that BMs are much less explored, however, there have recently been published some integral overviews and specific BMs focused scientific articles, as well as BM focused reports by important representatives of the industry.

- **Sustainable and CBMs**

(F. Lüdeke-Freund, n.d.) describes a sustainable BM as "a BM that creates competitive advantage through superior customer value and contributes to sustainable development of the company and society". One of the key challenges is designing BMs in such a way that enables the firm to capture economic value for itself through delivering social and environmental benefit (Schaltegger et al., 2012). A CBM defines how a company creates, captures, and delivers value with the value creation logic designed to improve resource efficiency through contributing to extending the useful life of products and parts and closing material loops (Nußholz, 2017).

Accenture suggested five types of CBMs, being the "circular supplies", "resource recovery", "product life extension", "sharing platforms", and "product as service" (Accenture, 2014). This approach has been referenced in several following papers. "Access performance model", "extending product value", "classic long life", "encouraging sufficiency", "extending resource value", and "industrial symbiosis" were identified as different CBMs (Bocken et al., 2016). (Lewandowski, 2016) analysed 26 CBMs based on the RESOLVE framework by the Ellen McArthur Foundation (Ellen MacArthur Foundation, 2015), including specific models for the construction sector. These models were reviewed later by (Camacho-Otero et al., 2018) with a focus on remanufactured products, product service systems and the sharing economy & collaborative consumption.

Also, there are multiple articles referred to specific BMs and case studies that give more specific insights.

- **BMs in construction sector**

The identification of the CBMs in the construction sector is not very extensive, however, there are several publications that make them stand out. One of the most recent publications dedicated to the BM in the construction sector (ARUP & Ellen MacArthur Foundation, 2020) suggest 5 innovative BMs based on the circular principles, "Flexible Spaces", "Adaptable Assets", "Relocatable Buildings",

"Residual Value" and "Performance Procurement", based on previously identified sources of lost value in the sector.

In the publication dedicated to green BMs in the Nordic region (FORA, 2010), BMs specific for the construction industry are also included, specifically "Design, Build, Finance and Operate" (DBFO) model and "Energy Saving Companies" (ESCOs) model.

Particular BMs for prefabricated buildings also appear in the recent literature (Andersson & Lessing, 2020, Minunno et al., 2018), and are relevant to the selected circular strategies.

It is also worth the mention that there are multiple recent articles dedicated to the "Product as a service" models and different "Reuse" oriented BMs, specific for the construction sector.

- **Relating the circular strategies for resource efficiency to the CBMs**

The BMs present in the literature and their suitability for the present research have been assessed (Table 1). In regard to the applicability in the construction sector, almost all of the models have been found suitable, given that the concepts are quite widely defined. The role of the construction product producers has been evaluated next. While in some cases it was clear, there were some particular cases where the producers are not directly involved, however, they strongly influence the implementation of the BM (assigned as Y+ in the table). In these cases, it would not be possible to implement the BM and related strategies without involving the producer, although the producer would not be the main actor. There were other cases in which the producer would not be normally involved, or it is not necessary for them to be involved, however, there is a potential (assigned as (Y) in the table). Finally, the relation to the circular strategies was assessed, resulting in a selection of 17 BMs that are considered suitable to achieve the proposed goals, and are to be analysed further.

Table 1: *CBMs in the construction sector and their relation to the circular design strategies to retain product value*

Nr.	BM	Description	Applicable in the construction sector? Y/N	Producer of construction products involved? Y/N	Related to circular strategies for slowing loops*? Y/N	Source
01	Circular Supplies	Provide renewable energy, bio based- or fully recyclable input material to replace single-lifecycle inputs	**Y**	**Y**	**NN**	(Accenture, 2014), (Lewandowski, 2016) (Nußholz, 2017)
02	Recovery and Recycling Models	Recover useful resources/energy out of disposed products or by-products, Also: Recycling, Recycling 2.0, Resource Recovery	**Y**	**Y**	**NN**	(Accenture, 2014), (Lewandowski, 2016) (Nußholz, 2017)

03	**Product Life Extension**	**Extend working lifecycle of products and components by repairing, upgrading and reselling**	**Y**	**Y**	**YY**	(Accenture, 2014), (Florian Lüdeke-Freund et al., 2019) (Nußholz, 2017)
04	**Reverse logistics**	**The manufacturing entity systematically takes back previously shipped products or parts from the point-of-consumption for possible recycling, remanufacturing, or disposal**	**Y**	**Y**	**Y**	(Accenture, 2014),
05	Sharing Platforms	Enable increased utilization rate of products by making possible shared use/access/ownership, also Collaborative Consumption, Sharing Platforms, PSS: Product renting, sharing or pooling	**Y**	**N**	**YY**	(Accenture, 2014), (Lewandowski, 2016) (Nußholz, 2017)
06	**Product as a Service**	**Offer product access and retain ownership to internalise benefits of circular resource productivity. Can be applied to product flows in any part of the value chain**	**Y**	**Y**	**Y**	**(Accenture, 2014), (Lewandowski, 2016)**
06 b	**Access and performance model**	**Providing the capability or services to satisfy user needs without needing to own physical products.**	**Y**	**Y**	**YY**	**(Bocken et al., 2016) (Nußholz, 2017)**
07	**Repair/ Maintenance and repair**	**Product life cycle is extended through maintenance and repair**	**Y**	**Y**	**YY**	**(Florian Lüdeke-Freund et al., 2019) (Lewandowski, 2016)**
08	**Classic long-life model**	**It is concerned with long- product life, supported by design for durability and repair for instance. The value proposition focuses on high-quality, long-lasting products, and high levels of service (reparable, reusable over time). The upfront price is often "premium," to cover the long-term service and product warranty cost over the product lifetime absorbed by the manufacturer (value capture).**	**Y**	**Y**	**YY**	**(Florian Lüdeke-Freund et al., 2019)** **(Bocken et al., 2016) (Nußholz, 2017)**
09	Reuse	Reusing the product with wider options for the specific BM	**Y**	**(Y)**	**YY**	(Florian Lüdeke-Freund et al., 2019) (Bertino et al., 2021)
10	**Reuse & redistribution: "Reuse / refurbish / maintain /**	**Customers return used products for an agreed value. Collected products are resold or refurbished and sold. In**	**Y**	**Y+**	**YY**	**(Florian Lüdeke-Freund et al., 2019)**

	redistribute / next-life sales	**commercial settings, ownership is usually transferred from the initial user to the second-hand user.**				
11	**Remanufacturing / next-life sales**	**Restoring a product or its components to "as new" quality, also Product transformation.**	**Y**	**Y**	**YY**	**(Florian Lüdeke-Freund et al., 2019) (Lewandowski, 2016)**
12	**Upgrading**	**Replacing modules or components with better quality ones**	**Y**	**Y**	**YY**	**(Florian Lüdeke-Freund et al., 2019) (Lewandowski, 2016)**
13	**Extending product value**	**Exploiting residual value of products – from manufacture, to consumers, and then back to manufacturing – or collection of products between distinct business entities**	**Y**	**Y**	**YY**	**(Florian Lüdeke-Freund et al., 2019)** **(Bocken et al., 2016) (Nußholz, 2017)**
14	Energy recovery	The conversion of non-recyclable waste materials into useable heat, electricity, or fuel	**Y**	**Y**	**N**	(Lewandowski, 2016)
15	Efficient buildings	Locating business activities in efficient buildings	**Y**	**Y**	**N**	(Lewandowski, 2016)
16	Sustainable product locations	Locating business in eco-industrial parks	**Y**	**Y**	**N**	(Lewandowski, 2016)
17	Chemical leasing	The producer mainly sells the functions performed by the chemical, so the environmental impacts and use of hazardous chemicals are reduced	**Y**	**Y**	**N**	(Lewandowski, 2016)
18	Product Attachment and Trust	Creating products that will be loved, liked or trusted longer	**Y**	**Y**	**(Y)**	(Lewandowski, 2016)
19	Bring your own device	Users bring their own devices to get the access to services	**N**	**N**	**N**	(Lewandowski, 2016)
20	**Hybrid model**	**A durable product contains short-lived consumables**	**Y**	**Y**	**YY**	**(Lewandowski, 2016) (Nußholz, 2017)**
21	**Gap-exploiter model**	**Exploits "lifetime value gaps" or leftover value in product systems. (e.g., shoes lasting longer than their soles)**	**Y**	**Y**	**YY**	**(Lewandowski, 2016) (Nußholz, 2017)**
22	**Asset management**	**Internal collection, reuse, refurbishing and resale of used products**	**Y**	**Y**	**YY**	**(Lewandowski, 2016)**
23	Produce on demand	Producing when demand is present and products were ordered	**Y**	**Y**	**N**	(Lewandowski, 2016)

24	Waste reduction, Good housekeeping, Lean thinking, Fit thinking	Waste reduction in the production process and before	**Y**	**Y**	**N**	(Lewandowski, 2016)
25	PSS: Activity management/outsourcing	More efficient use of capital goods, materials, human resources through outsourcing	**Y**	**Y**	**N**	(Lewandowski, 2016)
26	Dematerialized services	Shifting physical products, services or processes to virtual	**(Y)**	**(Y)**	**N**	(Lewandowski, 2016)
27	New technology	New technology of production	**Y**	**Y**	**N**	(Lewandowski, 2016)
28	Residual value	The Residual Value model envisages the creation of tradable futures contracts related to the value of building materials at deconstruction	**YY**	**Y**	**N**	(ARUP & Ellen MacArthur Foundation, 2020)
29	Design, Build, Finance, Operate (DBFO)	It is a form of public-private partnership (PPP).The provider is responsible for the design, construction, finance and operation/maintenance of an infrastructure asset. The model couples the design and construction stages with the operational/ maintenance stages. The provider is responsible also for effectively operating and maintaining the asset over a long-term period.	**YY**	**(Y)**	**(Y)**	(FORA, 2010)
30	**Industrialized building model**	**BMs related to the industrialized construction products with their own particularities.**	**YY**	**Y**	**Y**	**(Andersson & Lessing, 2020) (Minunno et al., 2018)**
31	**Adaptable Assets**	**Adaptable Assets are buildings that can accommodate more than one use during their lifetime through retrofit rather than demolition. The model operates through a new investment partnership; a long-term investor invests in the skin and structure, while a short-term investor rents the chassis to adapt it for a specific use.**	**YY**	**Y+**	**Y**	**(ARUP & Ellen MacArthur Foundation, 2020)**
32	**Flexible Spaces**	**Builds on the trend of co-working spaces to unlock the potential of underutilised space in buildings while balancing the risks normally associated with short tenure space.**	**YY**	**Y+**	**Y**	**(ARUP & Ellen MacArthur Foundation, 2020)**
33	Relocatable buildings	The Relocatable Buildings model sees an operator deploying a portfolio of relocatable buildings on unused sites to create short-term, or meanwhile, spaces. Relocatable Buildings are modular, designed for deconstruction and made of	**YY**	**N**	**N**	(ARUP & Ellen MacArthur Foundation, 2020)

		durable, high-quality materials that create spaces with a permanent feel.				
34	**Performance Procurement**	**Performance Procurement extends the product-as-a- service model, currently seen in individual products such as lighting, to the building level.**	**YY**	**Y**	**Y**	**(ARUP & Ellen MacArthur Foundation, 2020)**
34	Encourage sufficiency	Solutions that actively seek to reduce end-user consumption through principles such as durability, upgradability, service, warranty and reparability and a non-consumerist approach to marketing and sales (e.g. no sales commissions)	**Y**	**Y+**	**YY/ NN**	(Bocken et al., 2016) (Nußholz, 2017)
35	Extending resource value	Exploiting the residual value of resources: collection and sourcing of otherwise "wasted" materials or resources to turn these into new forms of value	**Y**	**Y**	**NN**	(Bocken et al., 2016) (Nußholz, 2017)
36	Industrial Symbiosis	A process-orientated solution, concerned with using residual outputs from one process as feedstock for another process, which benefits from geographical proximity of businesses	**Y**	**Y**	**NN**	(Bocken et al., 2016) (Nußholz, 2017)

*as defined by (Florian Lüdeke-Freund et al., 2019) Slightly extended to include the reuse in its totality.

Note1: The double letters YY/NN mean that this consideration has already been made in the original publication. The letters Y/N are a new consideration.

Note2: the **highlighted CBM** are considered as most feasible for further research in terms of the potential to support long-lifespan of the construction products and systems.

Phase 02: BMs in 7 cases studies of construction product producers

The grounded theory research was performed in order to understand the current state of implementation of the CBMs in the construction sector, as well as if there is any value given to the studied circular characteristics of the construction products and systems: the adaptability, reusability and durability.

The selected case studies and their main categorization is summarised in the following figure (Figure 2).

	Field of action	Size based on employee nr.	Size based on turnover	Maturity	Margin approx.	Selected based on H2020 collab.
P1: Architectural double skins.	international	Micro <10	Micro <2M	Startup (1-3 y)	mainly 20-30%	
P2: Waterproofing, insulation, mortars.	international	Large >250	Large >50M	Maturity (>10 y)	< 10%	
P3: Corrugated & flat boards for envelopes.	international	Large >250	Large >50M	Maturity (>10 y)	mainly 20-30% (+very variable)	
P4: Prefab walls, window frames	international	Medium <250	Medium <50M	Maturity (>10 y)	mainly 20-30%	
P5: Panel sandwich	international	Large >250	Large >50M	Maturity (>10 y)	< 10%	
P6: Façade systems and service	international	Small <50	Medium <50M	Maturity (>10 y)	mainly 20-30%	
P7: Glass and alu envelopes	international	Large >250	Medium <50M	Maturity (>10 y)	mainly 20-30%	

Figure 2. *General characteristics of the analysed cases*

In order to understand the collected data, the following figure (Figure 3) shows the position of each of the 7 producers in the value chain and defines the relevant activities they perform.

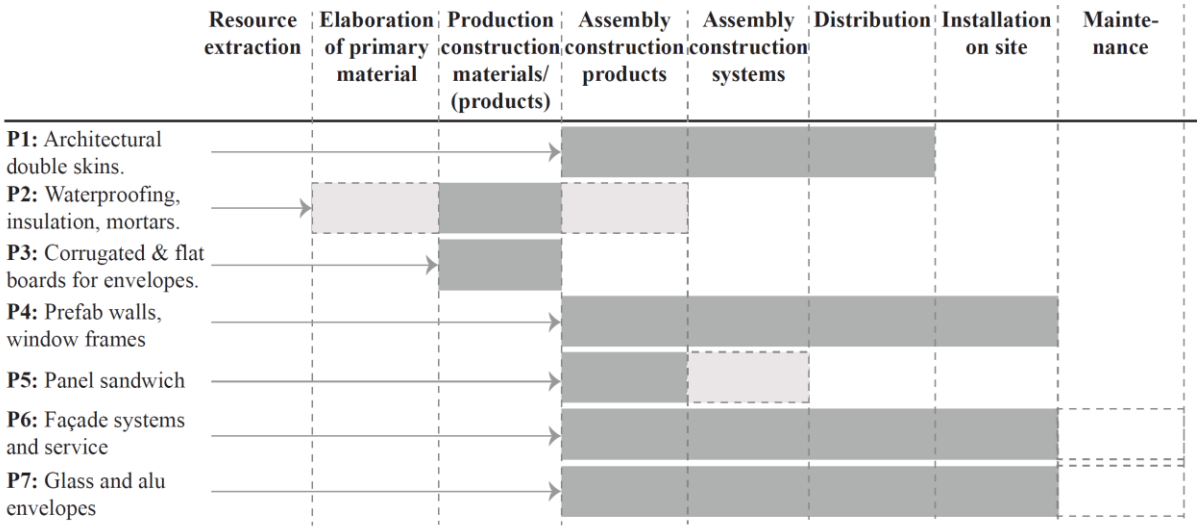

Figure 3. *Positioning of the producers analysed as case studies in the value chain activities.*

The results within the 2 topics of the interview are discussed in the following section.

- **CBMs**

Considering the first proposed BM- **Product as a service**, the producers were asked whether they offer services that are strongly related to the potential of applying this model, the installation and maintenance. While 3/7 producers responded that they were offering installation, and actually would install most of their products, none of the 7 producers normally provides maintenance, and only 2 of them sometimes provide this kind of service. The installation is provided by the producers positioned

higher in the value chain, and are medium size companies in terms of employees (P4, P6, P7). The maintenance is normally not provided because it is not feasible either for the manufacturer or for the client. The reason may be that the company is not located in the same country as the construction site, or that the client normally does not invest the necessary amount into the maintenance, and so it results as more economic not to pay for the maintenance upfront. There has also appeared the argument that the maintenance need depends on the final user, and cannot be controlled by the production company, which therefore cannot be held responsible.

In regard to the current state of implementation of this BM, 2/7 producers have never heard of it, 4/7 have considered applying it or are discussing it at the internal level and only 1 producer has tried to offer such a model but has not been received positively by the client.

The potential benefits identified were mostly the continuous cashflow, the consequent higher stability especially in times of crisis and higher margins. However, difficulties in identifying any benefits have been observed in general, and their actual exploitation is seen as very dependent on the correct set-up and needs long-term planning.

On the other hand, the barriers identified referred to financial, contractual, value chain, technological and legal aspects. To assume the initial investment was seen as a financial problem. The too-long lifecycle of the building and the consequent length of the contract, the contract being related with the owner and not building and owners changing in time are contractual issues. There were doubts on how to resolve if a client stops to pay, especially if the product cannot be removed. The current value chain is questioned given that the final beneficiary is not the one who buys from the producer. The shared ownership is seen as a problem when the owners want to sell the building. The multiple stakeholders were identified as a general complication. The legal constraints are related to safety vs. maintenance, and the difficulty to define who is responsible. The most pessimistic observation was not seeing any value in end-of-life products.

The next BM studied was the **Product life extension** model. The attitude of the producers in regard to extending the product life has been studied. The maintenance topic has been covered already, so the repair would be the next strategy to keep the product in its lifecycle longer. When asked about keeping stock for potential component replacement or repair, 5/7 producers do not keep any stock while the remaining 2/7 producers keep very limited stock. Some of the producers rely on other stakeholders, such as their suppliers who have more standard products (P7) or sell spare parts to the client at the installation phase already (P6). The reasons for not keeping replacement parts are mainly spatial. Also, it is important to comment that many of the producers work mostly with custom-designed products, which makes it difficult to consider keeping the parts (P1, P4, P6, P7).

Another topic related to the life extension of a product is the guarantee. Based on the answers, the minimum guarantee is defined by regulations, however, in most of the cases (6/7) the producers provide

a longer guarantee. The regulatory guarantee is based on country and factory location and it is related to safety issues (P6). The additional guarantee is based on market and client requirements (P1, P2, P3, P6) and on the environmental conditions based on an environmental questionnaire (P5). The guarantee is perceived as an assurance of quality and trust (P1, P3) and as a competitive benefit (P7). There is no additional cost to the longer guarantee (P1, P5, P7). Compliance with the required maintenance is crucial and if not achieved the guarantee can be lost.

The **Reverse logistics** potential has been explored in the next part. At this point, it seemed difficult to separate this model from similar models. If the definition that material flows from customer to manufacturer (Górecki et al., 2019) is restricted to the responsibility of the producer to their own products at their end of life, then there is no such system in place within the studied cases. There is no remanufacturing/ recycling or reuse scheme active in 7/7 cases, although there have been some piloting projects and tests performed (P3, P4, P5). The absence of the recovery schemes could be explained by the lack of relationship with the customer after the product had been installed (P1). However, there are similar approaches that are related to this strategy, such as the recovery of material from other industries (P2) or managing the recycling of the construction systems there are being replaced by the new products provided by the producer (P7) or the production waste sent to third parties (P5). In the first case, the process is driven by the company, in the second case it is a practical necessity and it is beneficial for the client (e.g. at exchanging windows, both actions are done at the same time). In the piloting cases, the drivers were the requests by clients or architects (P3, P6).

Another topic important for the reverse logistics model is the toxic substances. The most important finding was that there is a certain contradiction in requesting very low levels of certain chemical substances in order to reach certifications, and using recycled materials that cannot be fully controlled, in case these come from third parties or different industries (P2). Another fact is that some of the companies do not control the presence of toxic substances in their supplies, as they are confident that there are regulations that do not allow for these to be commercialized (P1) or admit that there are potentially toxic substances when ingested or in contact with fire or in some particular cases (P5, P6, P7).

- **Impact of durability, reusability and adaptability to the value of the product**

In regard to **durability**, only one of the companies (P4) has systemized data tracking the lifespan of their products. 2/7 of the producer have performed surveys (P2, P5) and 2/7 companies have general knowledge and follow the projects with their products installed (P3, P6), but not in a systemic way.

The aspects that most influence the durability of their products are the quality of the used materials, their composition and treatment in relation to the environmental conditions (P1, P2, P4, P5, P6, P7), the correct installation (P2, P3, P5), system integration (P1, P4) and maintenance (P7).

In regard to the value given by the consumers, according to the producers' experience, durability is being valued only in 3/7 cases (P1, P4, P7), partially in one case (P6). Crossing these answers with the definition of the companies' BMs, it results that these are the companies that are contracted directly by the construction companies. The typical customers of the rest of the producers are installers and distributors, who do not have any motivation to make the buildings durable, according to the producers (P2, P3, P5). In one case, it was mentioned that the customer values more aesthetics than durability (P3), which may be also related to the kind of product being sold (façade cladding). Some of the producers from the first group think that their customers are willing to pay more for durable products because they want to avoid excessive maintenance (P1), or in case the price difference is not too high (P4, P6, P7). Only 1 of the companies (P4) actually increases the price of the products that are more durable, because they believe in this value. In other cases, the price of a product is defined based on different criteria, such as aesthetics and market analysis (P3), or the durable products, considered as high-end products, need to be sold with a lower benefit in order to stay on the market (P6).

In regard to the relation between the cost of production and installation and the durability, there is no clear consensus. Some of the producers do not see it directly related (P1, P3, P7), for others, there is a relation as the durable products need materials with higher quality (P5), more additives (P2) or treatments (P4) or higher system complexity. An interesting comment is that the higher durability of materials is usually certified to assure the performance and these certifications are expensive (P5).

Similar questions have been placed in regard to **reusability**. The typical products of all 7/7 producers are not designed for reuse, although 2/7 producers do have a product designed for reuse. These 2 producers (P4, P6) are providers of façade systems and participate in H2020 research projects, which may be related. Additionally, 2/7 producers think that some of their products are inherently reusable (P3, P5), although they need additional treatment to be reused. The difficulty of reusing custom-made systems has been mentioned (P1). It is considered easier to reuse modular, durable and high-end products, and more difficult with products that have many layers or where adhesives and sealants were used. Some producers already use only mechanical fixing (P5, P6) and another has an internal directive in place to minimize the use of adhesives (P3).

According to all the 7/7 producers, no value to reusability is given by the customers. This is considered to be caused by the higher price of this system compared to the competitors (P6), or because the installers prefer the installation methods they are used to apply (P4), as they do not understand the new solution. Considering that, it is logical that none of the producers does increase the benefit of the reusable products. In regard to the relation between reusability and the cost of production and installation, there are again different visions- 1 producer thinks there is no relation (P4), others mention that the reusable products are more expensive because they are not standard (P2) or because they need to be more durable (P6).

Finally, in regard to **adaptability**, just 1 producer states their products are designed for adaptability (P1). However, all the other 6/7 producers think that some of their products are inherently adaptable, mostly related to the potential for disassembly and the modular design of their products.

Considering the value given to the adaptability by their consumers, 2 of the producers state that their consumers do value it because they value the freedom (P1) or in the case when they foresee any future adaptation of the system (P5). Other 4/7 do not think so, as the potential adaptation is too far in the time given the long lifespan (30-50 years for façade) of their products (P6), or because the end-users change and they do not think of the future end-users (P7). None of the 7/7 producers would increase the margin in the case of the adaptable products. The opinions in regard to the relation between the cost of production and installation vs. adaptability mostly coincide with the answers to the same question related to reusability. This is probably because both properties are related to the same or similar design criteria, such as design for disassembly, durability and modularity.

Discussion

The findings of the second phase, dedicated to the case studies, are closely related and confirm some of the findings in the publication by (Hart et al., 2019), that resumes the barriers and enablers of the implementation of CE in construction. As the barriers were much more present in the collected data, the discussion is focused on them.

The cultural barriers related to the value chain seem to be the strongest barrier. “Lack of vertical and horizontal collaboration” and “Lack of interest and engagement throughout the value chain” (Hart et al., 2019) are related to the repeatedly identified problem of the fragmented value chain. Collaboration was identified as a key requirement for progressing the CE (Adams et al., 2017). Value chain management is considered as a powerful tool of value-adding in construction projects (Górecki et al., 2019), but the lack of it is the case. Lack of transparency in the value chain (Carra & Magdani, 2017) is also part of the same problem.

The regulatory barriers were only mentioned marginally, and were especially related to “Obstructing laws and regulations” (Hart et al., 2019), referring to incompatibility of the regulations with the exploratory strategies like recycling or reusing materials.

The financial and sectoral barriers are closely related here. “Short-term blinkers”, “High upfront investment costs” and “Long product lifecycles” were identified as problems by almost all of the producers, stating that the long contractual relations due to the long life of the products are currently not feasible neither for them nor for their clients. The viability of the application of the CBMs has been explored in other sectors, questioning their viability for long-life structures (Tukker, 2015, Lewandowski, 2016). The present research suggests that it is the case in the construction sector.

Additionally, the challenge of the low value of products/materials at their end of life, making recovery schemes uneconomical (Adams et al., 2017), also appeared between the barriers. The uncertainty on material resource prices into the future, particularly for long-lived products, was already mentioned by Morgan in 2014 (Adams et al., 2017).

4. Conclusions

In the first phase of this research, 36 CBMs were evaluated. 17 of them have been identified as suitable for the construction product and system producers, to potentially increase the success of the durable, adaptable and reusable products and systems on the market. It would be worth analysing all these BMs in further research, as well as consider their improvement or development of new CBMs based on some of their beneficial characteristics.

In the second phase, 3 of the identified BMs and the potential of their application have been studied in 7 case studies. A general conclusion is that the companies, except the ones identified based on their participation in European research projects, are still quite far from applying any of the studied CBMs. However, in most of the cases they are performing internal R&D activities and pilot projects which could lead to their implementation.

One of the main reasons for not having implemented these models mentioned was the fragmented value chain, due to which the producers lose the connection with the product, generally, once they have sold, in some cases when installed the product and latest when the guarantee period is over. Another barrier that appeared repeatedly is related to the different location of the production and construction sites, especially when these are located in different countries, and consequent practical, financial, regulatory and communication barriers. This was mentioned in regard to the maintenance but also recovery schemes, influencing all the 3 studied models. Doubts in regard to the contractual issues were also seen as a barrier, especially given the long lifespan of the construction products, during which the end-users can change, they may stop to pay and it is difficult to remove the product, or they do not use and maintain the product properly.

The impact of durability, reusability and adaptability to the value of the product has also been analysed. The general conclusion is that the adaptability and reusability of the products is generally not considered at all, and even in the pilot projects where such characteristics were implemented, the companies' customers (installers, construction companies) did not appreciate them. So, the fragmented value chain is a barrier in this sense too, because it does not allow the potential interest of the end-user in durability, adaptability and reusability of the product to reach the producer, and is lost in the intermediary (installer, distributor, construction) company, who does not have any motivation to support these characteristics. The final beneficiary is not part of the decision process to determine these characteristics. The long lifespan of the products is not considered as a positive value, because the consumers are not used to be

concerned about the far future. Given these current conditions, the producers generally do not consider the value of the potential life time extension, possible due to the circular design characteristics of their products, in the definition of the product prices and so this potential value is lost.

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Complementary Economics

Greater Sustainability by Learning From Nature's Ecosystems

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Abstract

To reach the UN Sustainable Development Goals, fundamental changes in dominating political and economic thinking are needed. This paper demonstrates how complementary economics, a concept that emphasizes the importance of economic systems functioning like ecosystems, can be a necessary extension of the current economic understanding to achieve the SDGs and a sustainable future. The benefits of a complementary economic understanding are illustrated through the example of *Omatt Gjenbruksverksted* in Bodø, Norway, a workshop that repairs and resells waste electric and electronic equipment. The business model of *Omatt* was developed through the interaction between several local actors. Two of the authors of this paper have actively contributed to developing and testing the business model in practice, and from this experience with the project, we are developing some more theoretical perspectives on complementary economics. *Omatt Gjenbruksverksted* arose organically to answer specific, observed local needs that set the direction for how the business model developed, which is a key element of complementary economics. Much like in ecosystems, the project partners all have different needs that must be fulfilled. At the same time, they have resources that can be useful for other actors. By working together, potential or "sleeping" assets are realized and activated, and thus greater value is created, both in economic, environmental, and social terms. A complementary economic approach is well-suited for mapping these needs and resources of the cooperating actors, and the model of analysis has great transfer value to other cases. Economic systems that function like ecosystems, interconnected across levels and sectors, are needed to gain a sustainable future and reach the UN Sustainable Development Goals, and a complementary economic approach is useful to achieve this.

Keywords: sustainability, complementary economics, triple bottom line

1. Introduction

This paper focuses on a workshop for repairing and re-selling electronics in Bodø, Norway, named *Omatt Gjenbruksverksted* . Omatt provides an example of how a business model can concretize the term *sustainability*. The business model was developed through the interaction of local businesses and local government, with a volunteer organization – the local Red Cross – acting as coordinator. The main

goals of the business model are co-creation, reciprocity, considerate use of human and material resources and long-term strong sustainability.

We have chosen to use the term *complementary economics* because we think it successfully encompasses the principles inherent in Omatt's business model.

As a concept, complementary economics is an example of retrovation – a re-finding – of ways to adapt during times when increased capacity for action has not been factored into budgets. Combinations of money-based and non-money-based contributions along with a long tradition for voluntary work have been, and still are, important elements in Norwegian economic context. A complementary economic approach builds on simple principles:

1) *activating* resources, both existing and potential
2) in *cooperation*
3) to achieve *mutual* benefit.

The procedure is to identify needs and available assets in the current situation. In addition, ways in which the individual actor in need can make a positive contribution are identified, and resources are activated. Such a form of economic thinking aims to assemble the individual parts to a greater good, like when one is solving a puzzle. The better the puzzle is planned; the greater the synergies that can be achieved.

Our ontological starting point is as in Jakobsen (2019: 55), that fundamental changes in the dominating economic and political approaches are needed in order to fulfil the UN Sustainable Development Goals (SDGs). The SDGs build on a common core of values that involves both social, ecological and economic considerations, and cooperation to achieve the goals (UN, 2015). This core of values can be called the "triple bottom line", where cultural/societal values, natural values and economic values are considered as equally important (Elkington, 1999; Ingebrigtsen and Jakobsen, 2007). The circular economic approach that is also fully compatible with this kind of understanding includes values that can be of natural, manufactured, human, cultural or economical character. To reach the UN SDGs, a holistic and long-term perspective is also needed, where solidarity with future generations is integrated. Then it is useful to have a broadened economic understanding, based on how ecosystems function. That is where our complementary economic approach can contribute.

Other writers have highlighted similar principles as us, pointing out that (neo)classical competitive economics is not able to create equality and sustainability, and have therefore sought out different, more value-based ways of economic thinking. The triple-bottom-line principle is an example of this. Other examples are a pluralistic economic understanding (Söderbaum, 2014), stating that "Neoclassical economics is more or less blind to equality issues and not enough to deal constructively

with present unsustainable trends" or an inclusive economy based on African traditions and a "worldview that understands reality as inclusive, complementary and relational" (Kanu, 2017).

Mutual benefit is a foundational principle for how ecosystems work, where adaptation happens all the time for the ecosystem's inhabitants to be able to meet their needs. Species adapt to each other in symbiotic interactions. Interaction between levels in a social or economic context is well illustrated in models that were originally developed to describe interactions in nature. Capra and Jakobsen (2017) call it "the systemic principles of life", underpinning that instead of conquering nature, human-made (economic) systems should aim "to develop knowledge that teaches us how we can adapt economy to the principles found in nature" (2017: 833). The *feedback loop* (Holling, 2001: 394) and the *Panarchy model* (Walker & Salt, 2006: 11, 75, 80-81) illustrate how experience and learning are key features in systems operating by the principles of life, and how dynamic processes at different levels affect each other. In general, developmental processes are larger and slower at the overall (global, national) level, and faster at lower (local, regional) levels. This means that early effects, of changed framework conditions or of system errors, will first and best be visible from below. Thus, local solutions to global problems are noteworthy since feedback from below is thus absolutely necessary in order to be at the forefront of developments. Consequences propagate upwards over time and can have much greater ripple effects at later stages. Experiences accumulated from the bottom-up create arenas for sharing and mutual learning from the mistakes that others have made, and the solutions they have found. This paper aims to contribute to creating this kind of accumulated experience-based knowledge base by sharing experience from our pilot project.

Conscious economic planning can be achieved by following the principle of mutual benefit, and hence this becomes a foundational principle in the complementary economic approach. This understanding includes both the triple-bottom-line perspective, and historical experience with many different combinations of sector-transgressing private-public cooperation in Norway (see for example Koren, 2012; Myhre, 2015; Stugu, 2017). Traditions in Norway point towards complementary economic thinking. From the 1800s a rich variety of NGOs, flourishing in the civil and volunteer sector, shaped both common political participation, and laid a foundation for the welfare state, which was established in the 1900s. Echoing a similar theme, the early founding of non-profit organizations created an institutional legacy of civic commitment in Norwegian communities (Marquis and Tilcsik, 2013: 209, referring to Greve and Rao, 2012). Furthermore, Norway has the age-old *dugnad* tradition: networked voluntary work with reciprocity as a key value. In this context, our concept of complementary economics can hence be understood as a retrovation, where old knowledge is reused in new packaging. Practical historical experience from a Norwegian context also shows that if a welfare service of the type that is in focus in this case shall be sustainable over time, it requires involvement and support from both the public, private and voluntary sector, and from households/inhabitants. Figure 1 below illustrates

how interaction between sectors leads to the resources from each sector contributing more greatly to covering each other's needs than in a scenario where there is little or no cross-sector cooperation and where the actors would rather compete for resources than cooperate to utilize them wisely.

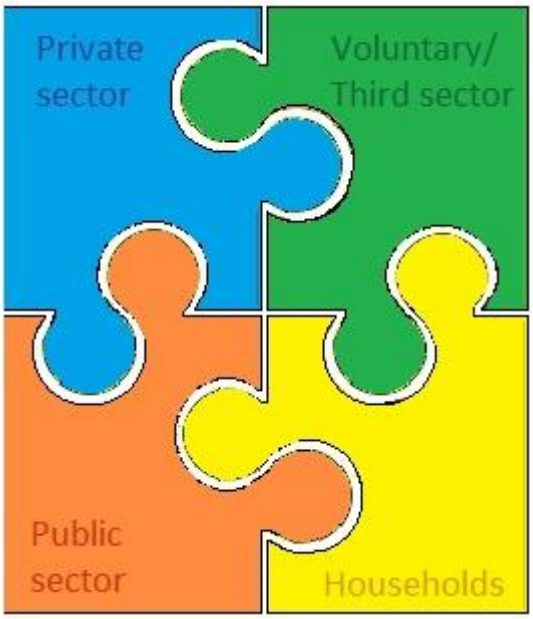

***Figure 1**. Key principle: Mutual benefit through Cross-sector cooperation.*

When thinking of economics in this way, the discussion about growth becomes quite irrelevant. Instead, the discussion centres on the allocation of existing resources in the combinations where they generate the largest benefit. Hence identifying real needs and allocating the resources to meet these becomes a priority, rather than starting out with a supply and then working towards meeting a created demand. As it is expected that the budgets available to Norwegian public bodies will become tighter in the coming years ((St. meld. nr. 29 (2016–2017); St. meld. nr. 5 (2020-2021)), it seems clear that civil society, business and volunteers are forced to solve societal needs in cohesion and with wiser use of resources.

It is necessary to separate between weak and strong sustainability (Zadek, 2001; Ott, 2011). Weak sustainability allows for an "exchange" between natural resources and other types of capital, and is often the basis of neo-classical economics, for example when purchasing carbon emission allowances. With such a mindset, it is irrelevant whether resources are unused natural resources, or if resources are processed. On the other hand, the principle of strong sustainability maintains that one cannot damage or reduce the stock of natural resources. That means that resources in use must be renewable or conditionally renewable. When using resources of the latter kind, the outtake cannot exceed the regrowth (Ingulfsvann, 2013). With a wide understanding of processed resources, both resources that have been intentionally adapted to human needs, and resources that have been contaminated from such use, are included. Then it is clear that the stock of natural resources is diminishing quickly. Seen from this perspective, comprehensive changes are needed to reach the UN SDGs. When the goal is to achieve

long-term strong sustainability, resources that are damaged or blocked from current or future use, must be depreciated as losses.

In recent decades, attention seems to have been focused on economic and environmental sustainability, while societal sustainability has not been a priority (Holand, 2017; 2020). This downgrading also had negative consequences for the voluntary sector/third sector. Still, the voluntary sector is considered essential for the welfare state in Norway (St.meld. nr. 10 (2018-2019)). Also Bodø municipality, where our empirical example is situated, considers contributions from the volunteer sector as key to achieve goals linked to inclusion, public health, and welfare (Bodø kommune, 2017a; 2017b). Statistics also show that the volunteer sector's economic impact in Norway is increasing, especially regarding responsibility for safeguarding social and environmental sustainability (Statistics Norway/SSB, 2019).

2. Methods

This article shows how a complementary economic understanding works in practice, with the help of an empirical example in the form of the project *Omatt Gjenbruksverksted*. Omatt was started as a pilot project by Bodø Red Cross in the fall of 2019 in cooperation with the waste management company Iris Salten IKS and the extended producer responsibility company Norsirk. It aims to repair electrical and electronical equipment for reuse, and at the same time create activity and inclusion for persons with no other opportunities in the working life. The workshop creates values within all three dimensions of sustainability: social, economic, and environmental. The concept's value proposition is that Omatt shall demonstrate sustainability in practice through considerate use of human and material resources (table 1).

Two of the authors have actively contributed to developing and testing the business model in practice, departing from an ontology rooted in industrial ecology and ecological economy thinking. The project came about as a result of an exploratory approach towards solving a number of unmet needs (see table 4). In this perspective, the project becomes active learning, in the form of a research method named *action research,* where the purpose is to solve specific problems, challenges within an organization or society, often with a defined set of values (Johannessen et. Al 2008). In this way, one can develop new perspectives that can help to see reality with new eyes. In this paper, we are developing some more theoretical perspectives based on empirical learning from our experience with the pilot project.

The starting challenges were these: At the immigrant receptions in Bodø there were many people, especially men, who needed work, which would help them find a more meaningful everyday life. Some of them already had valuable skills as workers. At the same time, the local Red Cross second-hand store needed more competence to better take care of the quality of its goods for sale, especially electric/electronic items, a rare competence in our times. Also at the same time, local schools needed

worksites for young trainees learning electric/electronic repair work. The need for jobs with social inclusion and language training is great, the need for skilled workers from perishing professions is great, so is the need for trainee arenas. Combined with the redistribution of financial resources, the Bodø Red Cross saw this as an opportunity to create value in all three dimensions of sustainable development. This was the starting point for *Omatt* both as a business model experiment and as a case for action research.

3. Results and Discussion

Example of complementary economics: Omatt Gjenbruksverksted – Bodø Red CrossA main goal for the Omatt project is to reduce the environmental impact from waste electric and electronic equipment (WEEE) through reuse. WEEE is a growing source of waste**,** and an important focus area in the EU's action plan for circular economy (EU, 2020). Omatt receives WEEE from waste management companies and stores selling new electric and electronical equipment. The products are tested, cleaned, repaired and sold locally in Bodø Red Cross' second-hand store. The store receives income that can be used for socially beneficial purposes.

When the products can be reused rather than recycled, they are lifted in the waste hierarchy (figure 2), which demonstrates what types of waste treatment is preferable from an environmental and resource preservation point of view (Avfall Norge, no date)**.** At the same time this contributes to better local utilization of resources, while avoiding long-distance transportation of waste and energy-intensive recycling processes.

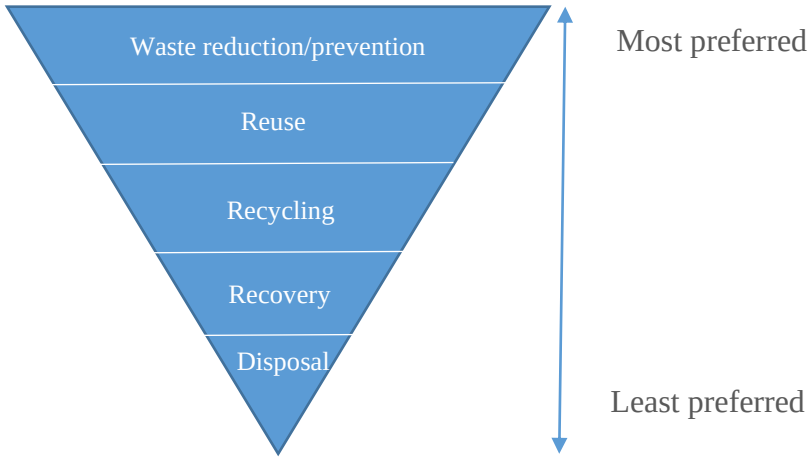

Figure 2*. The waste hierarchy.*

Omatt is officially approved for carrying out the electrical repair work and training apprentices and is hence important for the local society in maintaining the level of expertise in repair work that is important

in a circular economy with more sustainable consumption. Omatt also creates a possibility for the public to have their products repaired.

Components from products that cannot be repaired are taken out with a view to carrying out in-house repairs on other equipment or are sold to private individuals. This is to avoid sending all waste for recycling. As a result, these components are also lifted to a higher level in the waste hierarchy, and greater economic and environmental value is ensured. This part of the job does not require the same level of skill associated with electrical repair work, and therefore an opportunity is provided for the employment of people who do not have professional training in the field of electronics, as well as others who may not have any other possibilities in the job market.

Revenue streams, resources, and core activities

Omatt's revenues today are based on sales of single products. All products made available for sale in the second-hand store have been quickly sold with no form for marketing, and the capacity of the workshop has been the limiting factor for sales. The customer base consists of a wide range of private individuals in the Bodø area, especially immigrants, low-income households, and a considerable share of high-income persons with a strong attachment to environmental issues.

Omatt's most important resource is waste electric and electronical equipment. Crucially, what is considered as waste by others, can become a valuable resource for Omatt. Discarded white goods have been especially important, as well as smaller products like coffee makers and microwave ovens. As the competence and capacity of the workshop increases, also electronic products like mobile phones and computers are also becoming more important resources. The resources consist of products that are well used by households before they are discarded, as well as of products from stores that are damaged in some way and that are often easier to repair and have a longer expected lifetime in the reuse-phase.

While Omatt's customer base is concentrated in the Bodø area in Norway, the concept can easily be replicated elsewhere with local adaptations. The idea is not to extend Omatt's reach beyond Bodø, but rather to establish similar locally based organisations that are willing to cooperate and to share competencies. The concept does not centre on large-scale operations, but rather on decentralized and local solutions. The markets for used goods are limited also in other districts close to Bodø, and similar concepts like Omatt can contribute to covering local demand, creating local employment and encouraging the reuse of WEEE elsewhere.

Omatt's business model in a sustainability perspective

Omatt's business model is a resource driven one based on WEEE as a raw material for the production. Key aims include encouraging the reuse of products, creating meaningful work for those who would

normally have trouble finding a place in the employment market, and generating revenue that can be used for socially beneficial purposes. This is triple-bottom-line thinking in practice. The ambition is that the business model will be an inspiration for other local communities.

The complementary economic element of Omatt is that it is based on cross-sector cooperation. For the project to work, the different actors need to establish effective forms of cooperation. All involved actors need to be equal and co-dependent. At the same time, for the concept to survive in the long term, households must see the value of the service and need to make use of it. This simple formula is the basis for complementary economics, where the main point is seeing the whole picture rather than thinking sectorally. Added value as a consequence of sharing competence is key in a complementary economic approach. Omatt has partners across the value chain, contributing to securing access to waste for reuse, labour, and competence for repairs. Sales of the products are conducted through the second-hand store so that employees in Omatt can focus on developing and maintaining skills in repair work. Altogether, the partners have a good level of competence in terms of people, waste and recycling, and electrical work.

Table 1 sums up the values created for environment, society, and the customer.

Table 1. *Value creation for the environment, society, and customer.*

Value for environment	**Value for society**	**Value for customer**
Lifting waste higher up in the waste hierarchy, and preserves the resources in the waste	Economical profits for humanitarian purposes	Electrical products of good quality, that are considerably cheaper than equivalent new products
Prolonging the lifetime of WEEE, reducing the product's environmental impact	Creating unique apprentice positions that provide competence in repairs	Making it easy for the customer to choose the socially and environmentally best option
Reducing transportation emissions by treating the waste locally.	Employing persons that otherwise would have had no place in the labour market	
	Creating a concept with transfer-value to other districts	

Evaluation of the business model – SWOT analysis

The pilot project has shown that the concept of Omatt works well. There is great demand for the products, and the business has relatively low costs for repairs and production. Levels of cooperation relating raw material inputs, labour and sales is good, and allows Omatt to focus on core activities and

keeping production costs low. Hence, Omatt can encourage positive environmental and social values, while running an economically sustainable business. Omatt's largest costs are salaries, rent and electricity, expenses for collecting waste products for repairs, and consumables like tools, detergents and similar. The costs are relatively predictable and many of them are fixed. Hence the costs per product are reduced through growth in the production levels.

As the capacity of the workshop increases, an important part of the plans for the Omatt project is to secure access to more electrical products of the type that are more easily repaired, through cooperation with a broader range of partners. This will contribute to the widespread use of more WEEE, while helping enhance the efficiency of repairs. Cooperation agreements with public and private actors for Omatt to repair their used electrical products will also be beneficial for these partners, as they will be able to show that they take responsibility for society and the environment by sending their electrical waste to reuse locally, rather than recycling through national or international channels. The SWOT analysis below further sums up the strengths and weaknesses of the business model and key external factors.

Table 2. *SWOT analysis (Strengths, Weaknesses, Opportunities, Threats)*

Strengths	**Weaknesses**
- Great demand for the products - Unique offer and unique competence in the local area - Low production costs - Good cooperation for raw material input, labour and sales - Sustainability and circular economy in practice through local benefits and reduced environmental impact	- Some complaints still - Lack of capacity in the workshop – does not balance with the demand - Sales of single products – no repetitive revenues - Products only available in one physical store today
Opportunities	**Threats**
- Repair and reuse of several types of products, like IT-products or components - Offering services like repairing computers - Reaching a larger customer segment through changes in attitudes towards buying used products, and by marketing the concept more - Getting more cooperation partners for raw	- Legislation is strict – risk of not complying with all relevant demands - Fires or other electrical accidents at customers' homes - Losing key personnel with critical competence - New competitors - Losing cooperation contracts

materials in to increase the production - Implementing a system for documenting repairs and handling complaints, to document the quality and professionality, and be able to charge higher prices - Start selling the products online and starting a delivery service to reach more customers - Apply for grants to invest and develop the concept further	

Locally, Omatt competes for sales with the private market where people sell and buy used electrical products online. Omatt, however, represents a more stable and predictable market with regards to access and prices, and can document the repairs and tests each product has been through, to ensure the customer about the quality of the product.

Evaluation of the triple-bottom-line and contribution to strong sustainability

It is important for both the business and its partners to act in accordance with the UN SDGs. Omatt should not only generate economic profits, but also contribute positively to the environment and the local society. It is also important for them to give consumers the opportunity to make sustainable choices.

Omatt has chosen to focus particularly on those of the UN SDGs that comply the most readily with the company's activities: 12 - responsible production and consumption, 8 – decent work and economic growth and 17 – partnership for the goals. The project creates benefits for the environment through making waste a valuable commodity. By lifting WEEE to a higher level in the waste hierarchy and prolonging the lifetime of products, the consumption of new products is reduced, and environmental impact is reduced. Omatt makes it easy for citizens in the Bodø area to choose environmentally friendly electrical and electronical products – a possibility that has not been easily available for these consumers hitherto. By reusing products locally, the environmentally damaging long-distance transportation of waste to energy-intensive recycling plants elsewhere in the country or abroad is avoided. The business model hence directly contributes to SDG 12.

Omatt will also take social responsibility and create benefits for their local community beyond generating its own economic profit. This happens through offering apprentice positions and generating local employment opportunities for persons in lack of other opportunities in working life. The workshop will focus on making sure that each employee gets customized tasks and good working conditions, and meaningful work. In cooperation with Bodø's high schools they make suitable locally based apprenticeships available and maintain and transfer knowledge about repairs that proves key to

achieving a circular economy. By these means, Omatt's business model also contributes directly to SDG 8.

To ensure a sustainable running of Omatt Gjenbruksverksted, the organisation's strategy is to work by a triple-bottom-line and measure their success by the extent to which they can generate societal gains and contribute positively to the environment while operating with an economic surplus, as illustrated in table 3.

Table 3. *Triple-bottom-line for Omatt Gjenbruksverksted*

Social responsibility	**Environmental impact**	**Economy**
Create apprentice positions and practice for students	Increase the amounts of WEEE for reuse	Sales must cover production costs and create space for further development
Create individually customized employment	Reducing the transport of WEEE for recycling	Non-profit – potential profits are used for development or ideal purposes
Create added value for second-hand stores with ideal purposes	Become certified within an environmental standard	

Both economic capital in the form of direct and indirect financial contributions, waged and volunteer work, infrastructure, and social capital in the form of trust, goodwill and support are key to achieve a sustainable running of Omatt's business. Also, knowledge and competence are key resources. In practice, this works as a formula incorporating various different factors. The case presented here shows that the establishment of Omatt activated potential or "sleeping" resources pertaining to the involved partners, so that these contributions became real resources. The realization of resources that happens during the interaction between the actors also contributes to a perception of reduced demands for profit, because the gains in the other areas are perceived as valuable. As the case shows, these are clearly real gains, although they can hardly be described in monetary terms. As a supplement to the more traditional SWOT-analysis, we have developed a model for complementary economic analysis. This is a useful form for mapping needs and resources among involved actors, and it is especially useful in the case of a resource-driven business model like this. In the case of Omatt, the analysis is shown in table 4.

Table 4. *Complementary economic analysis of Omatt Gjenbruksverksted*

Schools	need	Practice arena
	recourse	Competence and labour
Red Cross	need	Means for operation
	recourse	Connection function between actors
Businesses	need	Getting rid of discarded or damaged products

	recourse	Discarded/damaged products becomes a resource for the reuse workshop
Individuals (customers)	need	Cheap products, sustainable option
	recourse	Purchasing power, demand for sustainable consumption
Individuals (employees)	need	Meaningful activities/work
	recourse	Competence and labour
Municipality	need	Measures for employment and integration
	recourse	Infrastructure
Landlord	need	Activity in empty premises
	recourse	Infrastructure
Workshop Omatt	need	Discarded products for reuse, competence and labour
	recourse	Resales and reuse of products, integration measures, employment opportunities, contribution to sustainable use of resources, being a practice arena

4. Conclusions

Omatt Gjenbruksverksted developed organically when it was started by the actors themselves, the Red Cross in cooperation with the municipality and local business. The ideas behind the concept arose as solutions to concrete, observable local needs that became guidelines for how the resource-driven business model evolved. An interesting feature with complementary economics is that it is driven more commonly by bottom-up processes than top-down ones, something that is especially visible in the case of learning in the Omatt project.

Omatt and other businesses that run similar concepts offer illustrative examples of today's economic reality, where complementary economics are largely put into practice at the micro level. The complementary economic aspect is mainly based on the added value that occurs when "sleeping" assets are realized, and new value creation can take place. The concept shows that the purpose is not maximizing profits, but to solve societal and environmental challenges. In a triple-bottom-line perspective the concept brings gains within both social, environmental, and economic value creation: social human needs are met, environmental impact is reduced, and some financial revenue is generated. A main point is that more values are accounted for than the strictly financial. A complementary economic analysis is well-suited for mapping the needs and resources of cooperating actors, and the model of analysis has great transfer value to other cases.

This article describes an economic order that already exists, that has historical roots, but that so far has not received the recognition it deserves. This is an economic order that consists of many different and complex contributions, in cooperation across sectors, where the goal is interconnected use of resources. Such an approach seems necessary for society's sustainability – or robustness – in meeting future challenges.

What is needed in the future is that economic systems function like ecological systems, interconnected across levels and sectors – from small to large, from locally to globally, where there is no longer a separation between producers and consumers, but where every actor has a role as a contributor to the system. That is how ecosystems function, and how more winners can be created by learning from nature's ecosystems. And the gain? A sustainable future, shaped by local communities. The ability of each individual company, organisation, and local or large community to adapt to reach the UN SDGs will be decisive. That is why a complementary economic approach, with interaction across sectors and between levels, is the way to go.

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8. Social Foundations of Sustainability

8a. Gender, inclusivity and human rights

Abstracts

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To be Included – an Exploration of Visual Strategies at Government Agencies in Sweden

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Abstract

A well-functioning democracy is based on the fact that there is confidence in organizations in the public sector (Gromark & Melin, 2013). Access to information is important for maintaining an organization's legitimacy and can thus be seen as a foundation of democracy. The opposite, that people do not have access to equivalent information, can instead result in inequality and other forms of discrimination. In Sweden, there is a new law to secure that information on public websites must be accessible and possible to perceive (2018: 1937). Legitimacy and trust in the authorities and governmental works is governed, among other things, by norms, rules and principles for what is right and wrong communication (Fredriksson & Pallas, 2011). Public trust is presented as a process and result of publicly generated trust in publicly visible actors (Bentele and Seidenglanz, 2008). On this basis, credibility is related to communication processes in a context of inclusivity. Here, visual strategies are important since it can be used to influence opinion (Wong, 2016), change attitude and behavior (Frascara, 2006) and for transformation and social change (Buchanan, 1998; Bichler and Beier, 2016).

Against this background, the purpose of this study is to explore how communication professionals at government agencies in Sweden plan their visual communication in a digital context from a inclusivity perspective.

In order to answer the purpose, a literature review was done, and interviews were conducted. The sample of this study focuses on *government agencies* in Sweden, i.e. authorities controlled by the Swedish government.

In the results, we first describe how communication professionals at government agencies in Sweden plan their visual communication in a digital context. Second, the result focus on visual strategies as an assessment tool in a communication planning process from a inclusivity perspective.

With this study, we hope to provide a better understanding of visual strategies in the communication planning process, contributing to knowledge about how to create inclusion in visual digital communication. This is in line with global goal number 16; Peaceful and inclusive societies – Promote peaceful and inclusive societies for sustainable development, ensure that everyone has access to justice and build effective and accountable and inclusive institutions at all levels and also 16.10: Ensure public access to information and protect fundamental freedoms – Ensure public access to information and protect fundamental freedoms, in accordance with national law and international agreements.

At times of pandemic and restrictions in society with limited possibilities to visit government agencies in the same way as before the crises, access to digital information is of great importance. This is relevant for an inclusive, democratic and sustainable society, not excluding citizens. COVID-19 has acted as an accelerator for the need of inclusivity included to prevent inequality.

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Exploring new waters for sustainability: gender equality in European seaports

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Abstract

Ports have been working towards becoming more sustainable. Although gender equality (SDG5) is very important within the 17 United Nations Sustainable Development Goals, it is ranked almost at the bottom of port priorities. The aim of this research is to provide insights into how ports have been addressing gender equality in their efforts to contribute to sustainability. Twelve semi-structured interviews were conducted with directors and sustainability managers from six European countries. The responses from interviewees were analysed using Grounded Theory's constant comparative analysis.

The findings show that European ports have engaged in measures aimed at contributing to sustainability through gender equality classified in five stages: (1) Gender segregation, which needs to be overcome, and is, in many cases, the starting point; (2) Compliance with national laws and regulation, e.g. in recruitment and salaries; (3) Gender equity, reducing barriers to entry and compensate for the historical and social disadvantages that women had previously suffered from; (4) Gender equality, guaranteeing the equal treatment of men and women in all processes; and (5) More sustainable ports. Achieving gender equality is a *sine qua non* to make ports more sustainable, i.e. integrating social issues of sustainability with economic and environmental ones. Internal and external forces affect each of the stages, where thrust forces help ports reduce gender segregation and advance towards becoming more sustainability and drag forces slow or block the efforts and may lead to returning to a previous stage. The findings were used to develop a "Gender equality for sustainability in ports" framework.

This research is especially related to SDG5, target 5.1 (End all forms of discrimination against all women and girls everywhere), and 5.5 (Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life).

Ports, and other traditionally male-dominated industries, could capitalise on women's holistic perspective and higher engagement to better contribute to accelerating the progress to make Europe more sustainable, especially in these testing times.

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Accentuation or leveling? Gender implications at higher education institutions in Germany during Covid-19

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Abstract

It is not new that women are struggling to achieve the status of a full professor. Blithe and Elliott's (2019) findings show that "women in academia continue to experience extreme workplace hostilities and stressors, and that these stressors vary by rank". Furthermore, the Covid-19 pandemic highlighted the centrality of care work (childcare, care of relatives, and household activities of all kinds) in managing crises. Germany's extensive shutdown of daycare centers, kindergartens as well as schools in spring 2020 and winter 2020/2021 relocated an increasing amount of such care work to private households. Especially working parents mostly have to arrange care themselves. But managing care work and gainful employment connected with a heavy shift to remote work at the same time poses a major challenge for many families. Unfortunately, women continue to shoulder the greater share of unpaid care work during the pandemic, which seems to be a major roll-back. However, the proportion of men who are more involved in childcare has increased significantly during this period, which in turn appears to be a leveling of gender inequality (Globisch & Osiander, 2020).

Aiming to explore if the corona crisis is affecting gender inequality in German academia, our research is driven by the following questions: *What is the impact of the Covid-19 pandemic on scientific staff at universities? What roles do gender, parenthood, and rank play here?* In order to answer these questions adequately and investigate this contemporary phenomenon, a qualitative approach was chosen. We integrated the qualitative experiment technique of transformation, reduction, and adjection (Kleining, 1986) into interviewing. After transcribing our data were analyzed with MAXQDA using qualitative content analysis through the lens of gendered organizations and neoliberal academia. First findings suggest that there is a significant influence of parenthood and rank but not gender to the impact of the pandemic on scientific staff.

Our empirical study relates to the SDG 5 (gender equality) with its targets 5.4 as well as 5.5. We hence investigate current trends and implications for the social dimension of sustainable development in German academia. The crisis confronts higher education institutions (HEIs) with new challenges, which imply both opportunities and risks. HEIs respond to the new conditions and develop a variety of coping strategies, which can have long-term effects on individuals as well as organizations. However, the longed-for desire to "get back to normal" harbors the risk of reinforcing gendered structures and discarding positive advances. Therefore, HEIs should combine the changes resulting from the pandemic with all SDGs.

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Gender in sustainability transition studies: Theoretical perspectives, blind spots and future orientations

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Abstract

In order to cope with the aggravating global social-ecological crisis of our times, theoretical frameworks are needed that can help to interpret and navigate complex societal transformations towards sustainability. Over the past decade, the field of sustainability transition (ST) studies has rapidly grown in response to this call. Today it forms a widely cited source of concepts and heuristics for understanding path-deviant socio-technical change - including for other fields, policy and practice (cf. Köhler et al., 2019). However, despite their broad inter- and transdisciplinary constitution and explicit concern for re-shaping societal systems, ST studies have so far largely failed to engage theoretically with the crucial role of "gender" in sustainability transitions, relegating it to questions of impact or ethics.

Drawing on the rich legacy of theoretical propositions made by feminist approaches for understanding relations between gender and societal change, our contribution aims to illustrate the remarkable gender blindness of ST studies, but also advocates a conceptual way forward to address this. We do so by first outlining how "gender" essentially structures social interactions as well as societal relations and organizes symbolic orders. Hence, it not only constitutes a vital factor in shaping technologies, but also lies at the core of norms, cultures, institutions and practices, both enabling and impeding socio-technical change. Using these insights we then discuss the results of a systematic literature review focused on the role of "gender" as an analytical category in ST studies (2010-2020). Our findings show only marginal engagement as well as theoretical vagueness, while recognizing weak signs of a recent increase in relevant contributions, especially dealing with the Global South.

Against this backdrop we suggest using a conceptual prism derived from feminist approaches to systematically explore and expose the role of gender in sustainability transitions. Considering the three overarching orientations of ST studies at understanding "regimes", "niches" and/or niche/regime relations and their respective dynamics, it positions "gender" as *identity*, *structure* and *symbolism* in each of these perspectives, thereby anchoring its multidimensional character in the epistemological core of the field.

In conclusion, we reflect on the deep implications this conceptual extension may have for understanding and guiding sustainability transitions, for inter- and transdisciplinary research designs conceived for this purpose, as well as for future (research) policy. Our contribution thus focuses on accelerating progress towards SDG 5, while highlighting its entanglement with all other SDGs, and in particular SDG4 and SDG16 in terms of a broader adoption of the suggested comprehensive gender perspective.

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IMPACTS OF THE COVID-19 PANDEMIA TO COOPERATIVE LIFE CYCLE: CASES OF HOZAT AND OVACIK TOWNSHIPS

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Abstract

Cooperative actıvites usually scrutinized under the normal life cycle—however, current climatical changes and disasters force them to widen analytical perspectives. Disasters have been evaluated under the light of global decisions like Yokohama, Hyogo, Istanbul declarations, and Sendai Framework for Disaster Risk Reduction 2015-2030 to aim holistic disaster risk management at all levels. However, decision-making at the global level sometimes does not work along with local and other global issues. The COVID-19 pandemia creates socially, economically, and politically unexpected processes and completes examining the particular local, national, and international formal and informal social relations and applications. Cooperative activities are not distant from that examination. Disasters are approached as a situation that prevails underlying inequalities during their occurrences and related processes. This study takes grants this approach and evaluates the life cycle of cooperative activities from December 2019 and to the current time.

Moreover, it aims to reveal changes following a pandemic and the impacts of COVID-19. The study consists of four sections—introduction, methodology, findings, and conclusion. The introduction section evaluates the importance of assessing cooperatives and gender presence and changes at the time of disaster and in the case of Pandemia. This section will be discussed in the light of the conceptual and theoretical frame. The methodological section will be revealing the focus of the study. The fieldwork carried on 2019 and observations of the developments following year in Turkish two townships are the study's main base. The methodological frame will be evaluating worldwide findings on gender income generating activity changes at the time of crisis and disasters. Then, it focuses on Hozat and Ovacık cooperative experiences in the province of Tunceli during COVID 19 Pandemia. These evaluations will be under the light of SDG's, especially with Goal 11b.

The findings reveal that cooperatives' life cycle in two townships differs concerning social, economic, and management conditions and activity types. The agricultural production and usage of digital platforms support the requirements of the Ovacık cooperative. But there are increasing race between other newly established agricultural cooperative and the formal support changes. However, the movement of one of the cooperative activator of Hozat Hobe baby production Cooperative and the shift in the approach of the new local governor to support agricultural production puts stress on the continuity of the cooperative. Hobe dolls' organic doll production is losing formal importance, and transfer support of the newly emerged agricultural activities and cooperatives in Hozat township develops. But possible production of dolls at homes easies formal stresses. It survives through local close-knitted relations, supports the cooperative's continuity, and activates new local leaders to gain a formal recognition process. So women's income-generating activities in both townships have been going through some similar and some different difficulties. However, their strategies to overcome these difficulties differ as well. The final section covers a conclusive evaluation of the global and local findings.

Keywords: Gender, Turkey, Cooperative, Tunceli, COVID-19

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The effects of street hawking on adolescent girls in Ogbomoso North, Oyo State Nigeria

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Abstract

This paper work focused on the causes and effects of street hawking on adolescent girls of Ogbomoso North in Oyo State. The study identified the causes of street hawking; examined the effects of street hawking on adolescent girls in Ogbomoso. The descriptive design was chosen, both quantitative and qualitative data were collected.

The instrument used for collecting data was questionnaire as a primary source, the internet, journals, books etc were visited as secondary sources of data collection. Software Package for the Social Sciences (SPSS) was used to analyze responses gotten from the questionnaire. Findings revealed that those who hawk on the street or by the road side do not always think of the dangers they are exposing their lives to, most especially, those of adolescent age. Suggested recommendations include: parents should be encouraged to reduce the number of children they give birth to, so they would be able to give birth to the ones they can take care of. Free education should be made compulsory for children especially girls of school age. Incentives like being fed at least twice before leaving school daily should be added to the free education, this would make children to be willing to go to school and stay in school.

This research work is related to the following SDGs: SDG 2 - Zero Hunger, SDG 3 - Good Health and Wellbeing, SDG 4 - Quality Education, SDG 5 - Gender Equality, SDG 8 - Decent Work and Economic Growth, SDG 9 - Industry, Innovation, and Infrastructure, SDG 10 - Reduced Inequalities, SDG 11 - Sustainable Cities and Communities, SDG 16 - Peace and strong Institutions and finally, SDG 17 - Partnerships for the Goals.

This work relates with the topic of the Conference “ACCELERATING PROGRESS TOWARDS SDGs IN TIMES OF CRISIS” as it is one of the critical issues that need germane consideration even before the time of crisis. Adopting the recommendations made would on one hand, help one know how to curb street hawking, while on the other hand, speed-up the progress in achieving the Sustainable Development Goals in due time, thereby making a given environment more safe and conducive to live in giving regards to the wellbeing of its inhabitants. Summarily, reducing street hawking among adolescents would help prevent or reduce crisis that might result from such menace in any given community in Africa and the whole world at large.

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Women Participation in Tourism Development in Nigeria: An X-Ray of the Place of Women in an Emerging Industry

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Abstract

The tourism experience was perceived traditionally, in terms of products, destinations and consumption patterns. Women have contributed greatly to tourism development, promoting transport development and encouraging hotel progress, which help in reducing or eliminating poverty. This study sheds light on the extent of women participation in tourism development. The specific objective of the study is to examine the factors affecting women participation in tourism development and how tourism industry benefits women.

This study collected qualitative and quantitative data from respondents. Primary and secondary sources of data collection were used. Data was collected by using two methods: oral interview and administration of structured questionnaires, which were randomly administered at the various study area sites. The data were analyzed by using descriptive statistic, simple percentages, bar-chart, pie-chart and chi-square respectively. Results obtained revealed that 90.8% of the factor affecting women participation in tourism development, include: lack of financial capital, poverty, illiteracy, traditional perception, religious factor, child bearing and career development issues.

The findings also indicated that 88% of the respondents are of the opinion that policies such as tourism education, trainings, internet marketing, and formation of business network for self-support and municipality support can be employed to improve women participation in tourism development.

Keywords: Women participation, employment status, economic benefits, traditional perception, equal benefits, Tourism Development

Full papers

BREAKING THE BARRIERS OF INEQUALITY: A ROAD MAP TO ADVANCING GENDER EQUALITY IN SUSTAINABLE DEVELOPMENT GOAL

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Abstract

Gender equality has been a global menace ravaging almost every country of the world. Though unresolved, yet human right concern and a key to advancing human progress in the United Nations Sustainable Development Goal (5) (SDG 5). Gender equality is a state where one's gender does not determine one's opportunities, freedom or importance rooted in gender parity and gender equity. However, despite existing international and local frameworks to curb gender inequality, still it remains a global challenge to sustainable development. The aim of the research is to examine the barriers to gender equality and how to break these barriers in other to achieve peace, stability, and prosperity. In doing so, recent literatures on the subject matter sourced from Web of Science, Scopus and google scholar were analysed alongside commentaries, repositories, reports, etc. It was discovered that culture, social norms, religion, law, and the state constitute the barriers to achieving equality between the two sexes. These barriers have kept women in abject poverty which has continued in cycles from generations hampering economic development. And to achieve a healthy society, reduce poverty and promote health, education, protection, and well-being of human beings irrespective of gender, advancing gender equality is key. Thus, the suggestion for the need for an action plan and/or policy by all at the international and national level towards equal opportunity, equal responsibility, equal expectations, equal commitment, equal rights and equal relevance between girls and boys to advance gender equality in the sustainable development goal by 2030.

Keywords: Gender Equality, Sustainable Development Goal, Education, Barrier, Empowerment

1. Introduction

> *"I thought education was everything. Because just like my brother, they let me go to school. Now I have dreams, I aspire, I want to excel, I want to progress, but I am stuck with a heavy chain, pulling me backward. Oh! what should I do? My life is in a box. What if I give up? Will I be free? What if I am free? How will they survive? Who will give them food, clothing, shelter, comfort, and*

> *"that" education? My heart is tearing apart, I cannot escape my fate. Who will safe me from my present situation?"*

This is the fate of most if not all educated women in our society today. The reality of their lives especially those that have found themselves in offices as employees but mostly those in government employment. A woman from birth goes through a lot of challenges, from the believe ghat a girl child at 3 months old is strong enough to start sitting, to the fact that at age 5 she is expected to know how to do chores and from 9 years old some undergo forced marriage. The journey continues to motherhood and care and the cycle continues to generations. She struggles with identity, she is caged by culture, religion, social norms, local legislations, and government policies that are unfavourable. Although there seems to have been some hope with local and international legislations against discrimination seeking gender equality like International Labour Organization (ILO), Convention on the Elimination of Domestic Violence against Women (CEDAW) and Declaration on the Elimination of Violence against Women (DEVAW) at the international level. Yet, the closer a woman gets to achieving her highest potential, the farther it becomes due to her marginalized position. And the fact that when the issue of gender inequality is raised, attention is mainly geared towards women empowerment as the solution.

Unfortunately, the idea behind empowerment is towards micro-credit for women to start up business which is usually a meagre resource available mostly to those in rural areas and the uneducated in urban areas forgetting the working-class women. With the hope that such empowerment will address gender inequality. But a recent report reveals that gender equality as of 2020 remained unreached (UN, 2020). Hence, this study in examining barriers to inequality focuses on the plight of working-class women whose situation is unknown and as such not addressed. And this research is important to the SDGs 2030 because it will serve as an eye opener to the deeper realities of women in working environments. Which will propel measures to address the discrimination within a supposed "equality ". This we hope will help in achieving success in SDG 5 on gender equality and in turn bring about a peaceful and stable society come 2030.

LITERATURE REVIEW

Sustainable development goals

The 2030 agenda for sustainable development is universal, holistic, and indivisible, with a special imperative not to leave anyone behind (UN, 2016). The sustainable development goals (SDGs) were adopted by the United Nations in 2015 to replace the Millennium development goals (MDGs) (International council of Nurses, 2017). The United Nations (UN) set up 17 global development goals for sustainable development by 2030 in its 2030 agenda. Which include amongst others gender equality, no poverty, zero hunger, quality education, good health and wellbeing and the likes as summarized in table 1 below.

Table 1. *Sustainable Development Goals in 2030.*

UN_SDGs	*Definitions*	*Descriptions*
UN_SDG 1	No poverty	Ending poverty in all its forms everywhere
UN_SDG 2	Zero hunger	Ending hunger, achieve food security, and improved nutrition and promote sustainable agriculture
UN_SDG 3	Good health and well-being	Ensuring healthy lives, and promote well-being for all at all ages
UN_SDG 4	Quality education	Ensuring inclusive and equitable quality education and promote lifelong learning opportunities for all
UN_SDG 5	Gender equality	Achieving gender equality and empower all women and girls
UN_SDG 6	Clean water and sanitation	Ensuring availability and sustainable management of water and sanitation for all
UN_SDG 7	Affordable and clean energy	Ensuring access to affordable, reliable, sustainable, and modern energy for all
UN_SDG 8	Decent work and economic growth	Promoting sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all
UN_SDG 9	Industry, innovation, and infrastructure	Building resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
UN_SDG 10	Reduced inequalities	Reduce inequality within and among countries
UN_SDG 11	Sustainable cities and communities	Make cities and human settlements inclusive, safe, resilient, and sustainable
UN_SDG 12	Responsible consumption and production	Ensure sustainable consumption and production patterns
UN_SDG 13	Climate action	Take urgent action to combat climate change and its impacts
UN_SDG 14	Life below water	Conserve and sustainably use the oceans, seas, and marine resources for sustainable development
UN_SDG 15	Life on land	Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reserve land degradation and halt biodiversity loss
UN_SDG 16	Peace, justice, and strong institutions	institutions Promote peaceful and inclusive societies for sustainable development; provide access to justice for all and build effective, accountable, and inclusive institutions at all levels
UN_SDG 17	Partnership for the goals	Strengthen the means of implementation and revitalize

		the global partnership for sustainable development
	SOURCE Tsalis et al. (2020)	

The essence of SDG (5) on gender equality is: to achieve gender equality and empower all women and girls. To achieve gender equality, the following SGDs must be addressed. Such as the need to end poverty at all levels and in all its forms (SDG 1), zero hunger: ending hunger, achieving food security and improving nutrition (SDG 2), good health and well-being by ensuring healthy lives for women and girls and promoting well-being for them at all ages (SDG3), quality education (SDG 4) by ensuring inclusive and quality education and promoting lifelong learning opportunities for women and girls, reduce inequality within and among countries (SDG 10), promote peaceful and inclusive societies for sustainable development; provide access to justice for all and build effective, accountable, and inclusive institutions at all levels (SDG 16) and strengthen the means of implementation and revitalizing the global partnership for sustainable development (SDG 17). These goals must work hand in hand for SDG (5) to be achieved to ensure peace, stability, and prosperity of a nation.

The UN has adopted substantive equality for all (LISO, 2014; Le, 2015, Do, 2015, Do, 2017 (a) & Do, 2017 (b)) by resolving long-existing conflicts in equality laws and still focusing on human rights at the same time for vulnerable groups. Prior to 2015, the focus of development has been implementing Millennium development goals (MDG) (Hawkings, 2010; Langford, 2010; Sachs, 2012) but recently, the focus has shifted to sustainable development goals (SDG) (Benavot, 2016; Winkler, 2017)

Gender equality (SDG 5)

Gender equality is a fundamental human right issue. Yet the menace persists and women and children in most parts of the world are not treated equally despite existing international and national legislations. Many are vulnerable to all manner of diseases such as HIV and STIs (UNAIDS, 2016) because they are not permitted to make decisions regarding their bodies and their healthcare. Which is most common in Africa and some parts of Asia. It has been observed in these regions that women and girls cannot choose who to marry, at what age to marry, when to have sex (European Commission, 2016) and how to protect themselves from communicable diseases and how many children they will have. They are subjected to physical and sexual violence at an alarming rate.

The impacts of gender inequality are far reaching and pervasive in most societies of the world. Gender equality is very important because it affects people's abilities to make decisions regarding their rights as human beings. Gender equality have been found to affect the health of millions of women and girls (International council of girls, 2017). Which occur due to discrimination, feeding pattern, domestic violence against women, lack of access to resources and opportunities, lack of decisions making power, gender bias in power, entitlements, norms, and values and in the organization of available services. UN report (2019) revealed that of the 70% of detected victims of human trafficking are women and girls,

mostly for sexual exploitation. And that women constitute 64% of homicide victims of intimate partner violence and family – related homicide victims.

Gender parity have been seen in situations where men in developing world have control over funds and tend to leave women and children at the disadvantage. This is because they are less likely to invest in their families and communities as their women counterparts (Women's Economic Empowerment, 2011). That is why it is not uncommon to see men in parts of Africa, Latin America, India, some parts of Asia spend their monies on alcohol while the women spend their meagre resources on the family and even spend their life on the farm just to feed and care for the home (Mirembe, 1995, Kimberly, 2013). A recent survey has shown that about 60% of hungry people in the world are women (Food Security and Land Rights, 2012). It was argued that, biologically, females produce the next generation of workers, gestation, and birthing, that is why they have a deep connection to children than the fathers. This probably explains why the female will invest more in her family and community than male. (Kimberly, 2013)

And when it comes to empowerment programs, it is mostly discriminatory in nature because, resources or loans are provided for women only in petty trading's and small businesses that do not have long term gains while when it comes to men, there is available resources for long term business plans such as agriculture, establishing companies and the likes. Although there is no existing legislation limiting or forbidding women's right to hold key positions in government, yet women are not only underrepresented but also disadvantaged in terms of economic power to make impact in politics and due to cultural underpinnings (Kimberly, 2013).

A research in 2010 (UKDID, 2010) shows that women are responsible for 38% of small businesses around the world as such they keep money in circulation, contributes to local economies by creating jobs, providing goods and services which leads to economic growth. Inequality is a barrier to achieving most if not all sustainable development goals such as ending hunger, poverty, gender equality and empowerment of women and girls, good health and wellbeing, peace, justice, and strong institutions and ensuring inclusive and equitable quality education, sanitation facilities, decent work and economic growth, sustainable cities, and communities. That is why women ought to be given equal opportunity to boost economic development by revisiting the concept of empowerment with a bigger outlook than what it has been.

The research is divided into 5 sections, a literature review, short life experiences of women, barriers to inequality, keys to gender equality, and conclusion and recommendations.

2. Methods

In achieving the aim of the research, the researchers employed the doctrinal library-based research methodology to examine existing literatures, reports, commentaries on gender equality and sustainable development. And shared a few life experiences, one is the life of one of the researchers and others from close observation and association with some women to further buttress the reality of these experiences. The research is restricted to life experience of married working-class women in government employment in Sub-Sahara Africa, Nigeria.

3. Results and Discussion

Experiences of working-class women

"I am a female lecturer in Nigeria. We are 4 female lecturers among 33 male lecturers. I got employed a year after I secured admission for my master's degree. All lecturers are eligible for Tertiary Institution scholarship for masters and PhD. So, I applied for the scholarship, but given one-year internal scholarship in the valued at $1, 500 as against the Federal scholarship worth $20, 000. I signed a bond and served a term of 2yeras for one year of scholarship alongside male co-lecturers who enjoyed federal scholarship. I enrolled for PhD and applied again for sponsorship, followed due process, gave the institution ample time to process and forward to federal government by deferring a semester. But soon after I left the country for further studies, spent my savings on tuition, I was sent denial of sponsorship for late submission. I then applied for study leave and loan to complete the studies. The loan was refused without reasons. The study leave is approved subject to returning to Nigeria to sign a bond form. Because the institution wrote that to me that my scanned signature is unacceptable. I have 4 children to Carter for, aged parents' dependent on me being the only surviving child. We have no female principal officer in the institution. My 10years sacrifice in the institution waiting for male colleagues on scholarship to finish their studies and come back is in vain. They do not care how I will get the money to fly back to Nigeria, neither do they care if I contact covid-19 in the process. All they care about is come back and sign the same bond with those on scholarship. What do I do? Who do I go to? Who should I complain to? Who will stand for me? I am helpless and hopeless who will help me?"

Janet

"Being a female lawyer has been difficult because I am being taunted every day and asked if I can survive the men's world and the men's profession. Because I chose to join male colleagues by opening a law firm and practicing the profession which is seen as abnormal in the Northern part of the country since it is believed, I should choose a quieter job and remain silent." Zara

Another experience is the story of *Prof. Hadiza* in one of the Universities in Nigeria, she was employed as a PhD holder and pioneered the setting up of the institution. Now that the Institution has been fully established and running effectively, she was relegated to the background to head an intermediate yearly program the Institution runs, which enables successful students secure admissions for undergraduate

studies. As such, she is excluded from University Management and cannot influence any decision be it minor in the Institution. Those who got employed a few years ago and just got their PhD's, but male colleagues now head the institution and decides what happen in the institution. Ensuring that there is no female representation in the institution's management.

Barriers to inequality

Religion

Religion is the opium of the mases. It is both a shield and a weapon. While the vulnerable consider it a shield, the powerful use it as a weapon of oppression. Religion has been used by many to cage women and keep them in subservient positions with men. It has led to disparity amongst the sexes. Uplifting men, giving them superior positions above women and women being treated as mere objects, toys or even properties (Ying et Al., 2017; Ramakishaan, Hashim & Yusof, 2018; Teefah, 2019). In fact, many have used religion to keep women in abject poverty by either refusing them education and marrying them off at a tender age to men old enough to be their grandparents or allowing them to be educated but denying them the right to paid work.

Culture

Culture has been a problem in every society. Culture has been so magnified that reason is thrown to the bin. Many cultures believe women's role is in the kitchen and nothing more (Egwurube 2016), so they try everything in their power to ensure that tradition is not broken (Haylock et al., 2016). Research have shown that some go to the extent of stultifying meaningful government policies to a better life once their culture is involved (Sawe, 2018). Culture says a woman has no right but what she is offered by her husband. This continually cages her.

Local legislations

There is existing local legislation in various states that despite international legislations on the issues of discriminatory, those local legislations still work side by side. For instance, in Nigeria, Section 55(1)(d) of the Penal Code allows a man to discipline his wife by beating her. In Malaysia, the proviso to Section 374 of the Penal Code Act 574 indirectly supports wife rape. A recent World Bank's Women's report (2018), based on the data from 189 counties reveals several legal barriers affecting women's life.18 countries where found to prohibit from getting a job or pursuing a trade or profession same as men, 4 countries restrict women from registering a business in the same way as men, 104 countries restrict the kinds of jobs women can hold, 18 countries require women to get husband's permission to take on a paid employment outside the home and 96 countries have not adopted an antidiscrimination commission to fight discrimination.

State policies

Some state government policies give rise to inequalities. Such as specifying a particular percentage of women representation in government and government organizations. Usually, this percentage is always low as compared to men representation. Some governments advocate for 20% or 25% representation which is a clear indication of inequality. Representation of women in politics and managerial positions is still low, 25% internationally and 36% locally (UN, 2020). In Nigeria, a recent research show that women constitute half of the population of work force ages 15 and above. However, the type of work, condition under which women work and access opportunities for improvements differs from men (Nairametrics, 2020). A statistic of 45.5% of women constitute Nigeria's labour force (World Bank, 2019). But 73.15% of that population are farmers and only 26.65% are in non-farming jobs (IDS, 2019). Women are often disadvantaged in access to employment opportunities, access to finance, and condition of work (Nairametrics, 2020). Female unemployment has risen to 35.2% from 26.6% in 2018 as against 22.9% from 20.3% for male within the same period. Only 6% of women in Nigeria hold seat in Parliament as against 24% of women in Sub-Sahara Africa (World Bank SCD, 2018).

Poverty

Poverty is another strong barrier to equality. Women's lack of economic power has put them in a marginalized position till date. As such, some women have been forced to resort to sex for survival (Njoku & Akintayo, 2021), while yet others willingly gave into trafficking and sexual exploitation (Kook, 2018). In the process these women become illegal immigrants with uncertain fate. It was argued that in developed countries, the risk of poverty and deprivation also tends to be higher among immigrant families, single-parent families, as well as families living in urban areas; those where the educational levels of parents are low, low work intensity and cases of large families (Richardson & Bradshaw, 2012, UNICEF, 2018). That the wage gap between men and women remain wide everywhere. And exists, to the detriment of women, in all countries irrespective of economic development. A study shows that due to the hungry and improvised life of females, poverty can only be alleviated through gender studies that will project the main needs of women (Food Security and Land Rights, 2012, UN, 2019). Although Kimberly (2013) had argued that there is need for promulgation of anti-prostitution laws which will help mitigate occurrences of prostitution and in turn curb the spread of STDs & HIV/AIDs as part of MDG. But we think women's empowerment and improving their standard of living, giving them equal opportunity with men will help curb prostitution in all its facet. This is because, most women who venture into this trade do it unwillingly. It is either they want to feed, or take care of their family, or run away from their harsh government policies that have not allowed them to thrive or simply because they want to upgrade their status. Seeing that the men who earn the most fine it difficult to carter for the home. A report on SDG in 2019 revealed that 736 Million people accounting for 56% of world's population live in abject poverty in 2015 and 413 Million are from Sub-Sahara Africa (UN, 2019). One would no doubt agree that women and children constitute the larger population of that statistic. And women are more at the receiving end as African men tend to careless about family and responsibility.

And in 2017, Sub-Sahara Africa and Southern Asia accounted for the world's undernourished population of 237 Million and 277 Million respectively (UN, 2019).

Gender pay-gaps

Women are most times victims of gender pay gaps like the few experiences of women discussed earlier, the story of Janet in particular whose gender fettered her from benefiting scholarship like her male colleagues. Gender pay gaps are due to factors like education, training, care responsibilities, work experience, expertise and the likes, other factors could include discrimination, implicit biases, and social norms (ILO, 2019). Which gaps leads to lifetime disparities of earnings which continually keeps women stuck in one place without progression and accounts for their unequal position in the workplace.

Women Empowerment

The main barrier is in the 'perceived' concept of women empowerment applicable in most countries of the world in addressing gender inequality. Although it has been opined that equality among sexes around the world have seen considerable improvement with stalled progress in closing gender gaps and progress (Commission on status of women, 2020). Which is mostly witnessed in the labour market participation, pay of equal value, women representation in high-paying jobs, management, and distribution of unpaid care work (UN Women, 2020). Hence posited that to achieve gender equality in the workplace, there must be existing legal framework, government must take proactive steps with transformative policies in place (UN Women, 2020).

Everyone talks about micro-credit for women as the relevant financial support and business services (ICLEI, 2015) then the issue of maternity and childcare benefits as the issues surrounding women (ICLEI, 2015). When the issue of gender equality in the workplace is mentioned, legislations and policies alongside literatures have only been tailored towards requirement for equal pay for value at work, maternity leave, discrimination, violence, and sexual harassment (UN Women, 2020). But no one looks deeper into the reality of the work environment whether it is suitable to allow for women's growth into high positions or not. Whether women can rise into management and become key officers in decision making in the organization they work. Just like Janet and Hadiza who are struggling to be relevant and be able to help fellow female colleagues yet pulled down and forced to stagnate. It has been argued that a male-dominated and hierarchical workplace culture poses risk (IKEA, 2019). This is evident from the lives of Janet, Zara and Hadiza. Women constitute only 27% internationally of managerial position (UN, 2019) and of course, this statistic cannot be envisaged in Sub-Sahara Africa. As such, women should not be given stereotypical roles and viewed as subservient (WE EMPOWER, 2019).

That is why UN Women (2020) argued that international and local legislations alone are not sufficient to curb inequality in the workplace and women's economic empowerment. This is because, without meaningful and proactive actions from social partners, progressive legislation alone cannot suffice.

Hence, one would no doubt conclude that had women with workplace experience been part of policy makers, they would have offered better suggestions on gender equality in the workplace alongside empowerment programs that will reduce poverty among women by at least 60% which will in turn meet sustainable development goals 2030 and bring about peace and stability in the world – the cycle of poverty haven been broken. As addressing gender inequalities is not only an end but a means of achieving economic growth and social justice for all. And as part of Goal 16 of the SDG, peace, justice and strong institutions, there is need for equal access to government services and an avenue to exercise one's rights and freedoms.

Breaking inequality

Quality Education

Education is key, a right and the basis of human dignity. Education provides the means to transmit knowledge, values, and skills across generation, enabling societies to set up foundations for future advancement (Review of SDG, 2019). Although much progress has been made towards universal primary education under the MDG, the SGD (4) seeks to raise the bar and make education a catalyst for a wider change in sustainable development of a nation. (Review of SDG, 2019) It has been argued that ensuing inclusive and equitable quality education and promoting lifelong opportunities for all, plays an integral part and key in building sustainable, inclusive, and resilient societies (Review of SDG, 2019). However, the context of quality education is changing with new technologies and skill demands. And considering the importance of quality education, if there must be gender equality, then there is need for education to be included in national development plans and strategies for achieving all the SDGs. As such educating women will improve their economic prospects and in turn improve a country's economy. McKinsey & Company (2018), in their latest analysis reaffirmed the global relevance of the link between greater proportion of women in company's leadership and company's financial outperformance. Arguing that women improve a government's GDP by 23%.

A 2015 statistics show that although there has been a considerable effort in universal primary education, an estimate of 617 Million – more than 50% - of children and adolescents worldwide have not achieved minimum proficiency levels in reading and mathematics. About 750 Million adults – two thirds of which are women – remained illiterate in 2016. Half in Southern Asia and a quarter in sub-Sahara Africa. Many developing countries still lack basic infrastructures and facilities to provide effective learning environments (UNESCO, 2018). Sub-Sahara Africa faces the biggest challenges at all levels of education, primary, secondary, and tertiary levels, only a handful of the schools have access to electricity, the internet, computers, health facilities and basic drinking water.

Scholars have argued that there is need for a gendered approach to education for accelerated progress to SDG 4. These incudes, financial and logistical support for women and girls, employment of females in all sectors of workforce, the inclusion of reproductive and sexual rights education in curricula, and

increased encouragement of girls and women to study sciences, engineering, and technology (Review SDG, 2019). Efforts should be made also to ensure that all women and girls can equitably attend schools and learning facilities by ensuring safe, gender separated, and accessible sanitation facilities (e.g. school toilets) are usable, including measures for safe and dignified menstrual hygiene management. Also, education has the responsibility to ensure new technologies do not result in a division, including gender divides by including digital skills from the onset (UNESCO, 2018). In this rapidly changing world of technologies, for the acquired skills not to be obsolete, there is need for a shift in the learning system to match with changing world, so that today's skills will match the jobs of tomorrow (Review SDG, 2019).

Education will help in reducing poverty amongst women, supporting women's economic growth, and increasing women's access to decent work, advancing knowledge and innovation around health care, climate change and peaceful institutions. Thus, need for finances to be challenged towards achieving this goal. This is because in Sub-Sahara Africa (UNESCO, 2018), it was found that Tertiary education is the least affordable where it exceeds 60% of average national income in most of those countries.

Improve Healthcare

From the SGDs adopted by 2030, health has a central part in SGD3 – ensuring healthy lives and promote well-being for all ages. Which both health practitioners, psychologist and the judiciary have a part to play. While medical practitioners are responsible for the physical aspect of the health of people, psychologist will consider the psychological well-being of women and girls who have been traumatized because of discrimination, gender inequality, denial of equal opportunity and domestic violence and the judiciary will provide favorable environment for access to justice for victims of domestic violence so as the heal their emotional and psychological pain.

It was argued that the MDGs did much towards improving the lives of millions of people around the world, but the gap between the rich and poor, healthy and unhealthy, educated and uneducated is still on the increase. (International council of nurses, 2017). Hence the need to tackle inequality within and between nations (SDG 10). And that life expectancy is associated with income level. The higher the GDP per capita, the higher the life expectancy rate above 70years and the lower the GDP per capita, the lower the live expectancy rate below 70years. (Gapminder, 2016) Life expectancy rate is determined by the quality of life and social determinants. Poor health is associated with inequality in the conditions of birth, growth, livelihood, work, and age. Which arise due to the inequities of power, money, education, and resources that give rise to daily life inequities. (WHO, 2016; Marmot, 2016). And some of the most important identified social determinants of health include poverty, economic inequality, social status, stress, education and care in early life, social exclusion and job security, social support, domestic violence and abuse, and food security (International council of Nurses, 2017). No wonder women's health is associated to their emotional and psychological fitness (El-Serag & Thurston, 2020).

A study found that, the circumstance of birth dramatically affects one's development and growth. And it is not how one starts but how one ends based on the accumulated advantages and disadvantages of life. (International council of Nurses, 2017). Another study proved that people who have had four or more different types of adverse childhood experiences had nearly five times more risk of having weeks in depressive mood, and 12 times the risk of suicide (Marmot, 2015; Taylor, 2016). Social disadvantage is linked to higher rates of suicide, alcohol and drug abuse, mental health problems, heart disease, lung diseases, obesity, diabetes and many other types of diseases and risk factors. While those least disadvantaged with better social status have a better health condition. (International council of Nurses, 2017). This inequality exists within and between countries and gender - a known fact that remains unchallenged. Research have also shown that non-health or poor health care system have led to a rise in non-communicable disease such as cancer (WHO, 2015; Center for Disease Control, 2016) and hepatitis C (Andrews, 2011) which has caused not only premature deaths mostly in women because of their improvised position but also a great cost to a nation's economy (Chan, 2015). Thereby affecting the economic development of a country haven spent so much money to save the lives of its people.

Although a recent research has shown that the four leading causes of death annually in the world are: cardiovascular diseases (15.5 Million); cancer (8.5 Million), respiratory diseases (4 Million) and diabetes (1.5 Million) (WHO, 2015). Yet, the rate of suicide which is quite alarming, and a public health concern is found to rank third leading cause of death among ages 10 – 19years in the United States with more teenagers and young adults dying from suicide than cancer, heart disease, AIDS, birth complications and lung disease (WHO, 2016, UNICEF, 2018). Which are mostly connected to inequality.

Women and development

With more women participation in politics, there will be an associated increase in justice and equality among the sexes. And there will be a more efficient and effective use of available resources because women support development, health programs and basic needs programs and do not consider it as government waiting funds on frivolities (Aulette et al., 2009; Kimberly, 2013).

Although it has been opined that, since the word empowerment is vague and controversial, the best way to empower women is by finding the "power within" (Townsend et al., 1999). And that barrier to these empowerments are culture and exploitation from women themselves since they are not a homogenous group (Kimberly, 2013). Even though micro-loans have succeeded in Bangladesh and FIDA in Uganda to fight for women's right. Nevertheless, we believe going a step further than just thinking about the poor rural women in terms of empowerment to a bigger picture of the educated working among their male counterparts who themselves want to improve their status due to the "power within" but are suppressed because they lack the resources and enabling environment to do so, also end in poverty just like their uneducated female out there. A good example is Nigeria, while gender equality is encouraged

and laws against discrimination are in place, yet there is no provision for funds to implement the policies. That is why, in a place like University, one would find a situation where all the principal officers from the department to the faculty and the university body are all male without a single female. And a female lecturer who desires to progress in the system by obtaining a PhD through a scholarship scheme by the government meant for all staff irrespective of gender, struggles without any success, because the process her application for scholarship will follow are not favourable as they are all being blocked by the men to the point where her application is rejected, and her male counterpart's application succeed (Janet's life). These female lecturers often do not have anywhere to run to or anyone within or outside the system to stand for them. And at the end of the day most are frustrated and remain where they are without progressing in the system, while still others leave the system because of frustration or 'inefficiency' in the eye of the system. Only a few breaks all barriers to make progress with their meagre resources only to come back and serve the system in the same manner as their male counterparts who enjoyed scholarships. Here, while the men are empowered to progress, the women are discriminated upon and expected to progress like their male counterparts.

These women, the working-class, also need empowerment to maintain their working-class status and remain relevant, efficient, and effective. As such, the SDGs 2030, should consider the plight of working-class women in its empowerment programs to end poverty. This is because, if the woman is unable to progress in her place of work like the male counterparts, they outlive their relevance or become not only inefficient and unproductive but continue in the circle of poverty as they were unable to break the chain to take up important positions to help their fellow women upgrade. These women do not need loan for petty trading or business. They need to hold key positions in their organizations and have a say in decision making. These women do not have other means of income except their monthly take-home pay which in Nigeria is less than $500 per month. She has children and aged parents to carter for. Yet, denied access to government services beneficial to all.

The plight of these women is seldom considered because gender equality has been narrowed to equal opportunity, equal participation in terms of education and nothing more. Therefore, the believe that once a woman is educated, she has been given equal opportunity as such no longer regarded as poor. That is why most if not all empowerment programs are towards micro-loans for businesses, internship programs for different vocation and trade. The few that consider scholarship for women to study are only in the sciences. Those in the Arts, social sciences and humanities are considered irrelevant fields of study that are not eligible for these scholarships. One would have thought that these government scholarships university lecturers should give special preference to women to benefit since they are few in the system. But that is not the case and so, where the institution has only male in administration, then women do not get the chance to gain the scholarships. The cycle of discrimination, gender inequality and poverty will continue to thrive in the system, if women are not empowered to rise to administrative

positions or managerial positions and become decision makers to pilot the cause of their female gender when issues of this nature come up.

4. Conclusions

Breaking the barriers of inequalities should go deeper than what it is today. Although culture is seen as a barrier, yet government policies in place, workplace policies, bureaucracy in government organizations, male 'superiority' syndrome, and unavailability of opportunities for obtaining resources for all irrespective of being a working class, housewife or trader and women's weak will are barriers to inequality.

As such, for SDGs to be achieved in terms of gender equality, poverty among women in all its facet must be addressed. Starting from the working class, the educated whom when empowered will take up positions of authority where they can themselves become decision makers. And will make favourable decisions that will positively impact the women folks. This is because they are themselves women, they know the plight of women, they know the needs of women, they know the programs if put in place for these women will help salvage the issue of poverty and help raise women status to achieve equality. For as long as women are left out of decision making on behalf of their fellow women, very little will be achieved. Although, some may argue that it is the women that are exploiting their fellow women. Because they are the once coming up with the ideas of micro-loans and petty trading's. Accepted, yet when the lives of these exploiters is considered deeply, it is not surprising to find out that some of them are either mere politicians who are not educated but business women who rose to those positions with their business skills, or some had to lobby their ways by parting with cash and kind just to acquire those positions, and so feel cheated and used and would not want other women to upgrade to a better status on a platter. As such, only a few get into high positions of authorities on merit and when their activities and input are considered, they tend to do better because they encourage merit and fight for the right cause.

Hence, we recommend that there is need for women empowerment to be viewed in the words of Egwurube (2016:138), as "the relative ease with which women have access to decision making roles and can mobilize available legal, economic, social and political to make and take decisions that affects their lives and those of others around them". This is because among the elite and public sphere, women trail behind men which gap ought to be bridged.

ILO regulations should be ratified by governments in Sub-Sahara Africa and Nigeria to reduce the gender pay gap and gender disparity in labour market. Also, policies should be made and enforced to ensure women's full participation in politics, government agencies and private sectors to improve national development.

Government should introduce a more realistic and feasible empowerment programme for women that will fit their various skills as against the notion of loan for petty readings or artisan programmes alone because these women have their peculiarities. In doing so, poverty in women will be addressed and that will promote economic growth. And SDG 2, 3, 4, 5, 10 & 17 will be fully achieved simultaneously. Women should also be given equal opportunities, equal responsibilities, equal expectations like their men counterpart will have a positive effect on the issue of gender equality among sexes.

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Effect Of Village Seed Entreprises (VSEs) Project On Women Empowerment And Social Capital In Abia and Akwa Ibom States, Nigeria.

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Globally, women empowerment and entrepreneurship issues have been a key factor in the development process and poverty alleviation. Empowerment has different meanings in different socio-cultural and political contexts. In its broadest sense, empowerment is the expansion of freedom of choices and action. Women involvement in agriculture contributes positively to the growth and development of a country. Efforts at empowering women have encountered setbacks both at the theoretical and empirical levels due particularly to the seeming vagueness in the definition and analysis of the word empowerment (Swain & Wallentin, 2008). In Nigeria, a significant deficit in food production causes food insecurity and malnutrition, particularly for poor and vulnerable households. A nation-wide shortage of certified high-quality seeds is one of the main obstacles keeping farmers from increasing their production. To address the huge gap between the demand and supply of certified seeds, scientists have introduced Village Seed Enterprises (VSEs). The Building an Economically Sustainable Integrated Cassava Seed System (BASICS) aims at contributing to empower and sustain seed system in Nigeria. Its major target is to strengthen all components of the cassava value chain. It seeks to empower village farmers to increase productivity, income, and consequently supply them with high quality planting materials of new, improved and/ or existing varieties produced from certified basics seeds. Hence, empowerment and social structure of the VSE is meant to initiate improved production and empower more women. The aim of the study is first to

determine the level of women empowerment in Abia and Akwa Ibom states of Nigeria, measure the level of social capital among women and to analyse the effect of VSE on women empowerment and social capital. The research employs both quantitative and qualitative methods, data presented in the study are obtained primarily which was collected directly from the respondents using questionnaires and interviews and focus group discussion with about 250 respondents. It is hoped that this study will inform farmers and mostly women about the importance of empowerment through agriculture. Preliminary results reveal that VSEs has positive effects on women empowerment and social capital in the study areas.

This topic relates to SDGs 5 which is to achieve gender equality and empower all women and girls. And target 5:5 states that, to ensure women's full participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life.

Women empowerment is a crucial factor for achieving sustainable development, because to achieve a sustainable developed country there is need to have a fair representation of women across different levels of decision making.

Hence, women's contribution in accelerating progress towards Sustainable Development Goals (SDGs) in times of crisis is through empowerment in agriculture thereby contributing positively to the growth and development of a country.

Keywords: Women empowerment, Cassava, Productivity.

1. Introduction

The BASICS which is an acronym for 'Building an Economically Sustainable Integrated Cassava Seed System' project aims at contributing to empower and sustain seed system in Nigeria. Its major target is to strengthen all components of the cassava value chain. BASICS is structured into four components which include the Village Seed Entrepreneurs (VSEs) Model, Breeder Seed Component, Processor Led Model, Quality Seed Component. The Village Seed Entrepreneurs is a model that seeks to empower village level farmers to increase productivity and income. (CGIAR Annual Report, 2017). Village Seed Entrepreneurs are commercial firms supplying farmers with high-quality planting materials of new, improved and/or existing varieties produced from certified basics seeds (Osunde, 2017). Cassava is a major crop in Nigeria, with over 7 million ha under cultivation, production around 55 million tons of cassava roots. (FAOSTAT, 2014). Nigeria is the highest producer (consumer) of cassava in Africa. (Ogbeh, 2016).

The concept of VSEs envisages village self-sufficiency in production of quality seed by distribution to farmers. VSEs operate under peer supervision with utmost transparency, mutual trust and social responsibility toward fellow farmers. Though this is not an entirely new concept to villagers, it is being promoted to reduce their dependence on external non-reliable sources, including government-subsidized seed distribution. The VSEs as a micro seed enterprise at the village level can be efficient. Some will have the potential to expand into specialized, small or medium-sized local seed enterprises. (Timilehin, 2017).

Women involvement in agriculture contributes positively to the growth and development of a country. Hence, empowerment and social structure of the Village Seed Entrepreneurs will increase production and empower more women, and this will, in turn, make more women independent and help to improve general living conditions through increase in income generated from VSEs as well as sustainability of the business model.

Women's empowerment therefore has a direct positive outcome on agricultural productivity and household food security (Harper et al, 2013), and this has made it stands at the core of agricultural research and outreach practices in developing countries (Gates, 2014). Women has been the major focus of Donor agencies, NGOs, and Government as the dependents and strengthening their investments to reduce gender inequality and empower women. (World Bank, 2012). This opinion has been reflected through the Sustainable Development Goals (SDGs) established during the United Nations Conference on Sustainable Development held

in Rio de Janeiro in 2012 one of the 17 SDGs is “Achieve gender equality and empower all women and girls” (SDGs5) (United Nations, 2015).

Efforts at empowering women have encountered setbacks both theoretical and empirical levels particularly due to the seeming vagueness in the definition and analysis of the word ‘empowerment’ (Swain & Wallentin, 2008). Many scholars have asserted that because power relations operate at different levels, so does empowerment (Mayoux 2001; Bisnath and Elson 1999). Agriculture has proved to be an important engine of growth and poverty reduction in many countries of the world (Ashimolowo & Otufale, 2012; Olokoyo, Efobi, Osabuolhien, and Beecroft 2015). Women, who operate at the subsistence, small farm holder level, constitute the major food producers in many of these countries. Rural women participation, more than men, take the lead in agricultural activities, consisting of about 60-80 per cent of the labour force (Sahel, 2014). The prevailing gender inequality that dominates in the sector places rural women farmers at a point of disadvantage, which limits their productivity (Ogunlela and Mukhtar, 2009). In pursuance of empowering women, policies and programs have been initiated globally both by multilateral bodies and national agencies over the years, especially in the last three decades. The paucity of data regarding rural women farmers constitutes a major problem to the empowerment of rural women farmers (Olaleye, et al, 2009). Literature is replete with the fact that closing the gender gap in agriculture would generate significant gains not just in the agricultural sector, but also in the larger society as a whole (Iruonagbe, 2010)

The notion of clearing the cobwebs of gender bias in culture frees women for genuine empowerment programs and processes. Empowerment of women in history by several organisations and programs had been questioned and challenged as programs that claim public acclaim without making any impact on the lives of the targeted group of women. This claim is buttressed mostly by the expression that evolves from government houses where, the governments pose as champions of women empowerment. They create a huge expenditure profile which is supposedly meant to empower women but, in fact, end up inside the private pockets of Africa’s First Ladies (wives of the Heads of Government).

This paper shows the effects of Village Seed Enterprises (VSEs) on Women Livelihood, the changes in income-generating activities and women economic status and evaluation of the effect of household, characteristics on empowerment and social capital among the VSEs in Abia and Akwa Ibom States in Nigeria.

This information is important as a baseline confirm the effect of VSEs models on women empowerment and social capital development.

2. Materials and Methods

2.1 Study Area

The study was conducted in Abia and Akwa Ibom States in Nigeria. Abia and Akwa Ibom States are preferred case studies because just like some other states in the country they are locations for the project village seed enterprise, thus it was obviously easy to get sufficient and reliable data. Also, these regions form part of the southern part of Nigeria, characterized by pleasant climate and high rainfall.

Abia is a State in the south eastern part of Nigeria. The capital is Umuahia and the major commercial city is Aba, which was formerly a British colonial government outpost in the region. It is one of the constituent states of the Niger Delta region. Abia State, which occupies about 6,320 square kilometers, is bounded on the north and northeast by the states of Anambra, Enugu, and Ebonyi. To the west of Abia is Imo State, to the east and southeast are Cross River State and Akwa Ibom State respectively and to the south is Rivers State. The southern part of the State lies within the riverine part of Nigeria, it is a low-lying tropical rainforest with some oil-palm brush, and the southern portion gets heavy rainfall of about 2,400 millimeters (94 in) per year and is especially intense between the months of April through October. The rest of the State is moderately high plain and wooded savanna. The most important rivers in Abia State are the Imo and Aba Rivers which flow into the Atlantic Ocean through Akwa Ibom State.

Akwa Ibom is a State in Nigeria. It is located in the coastal southern part of the country called the Niger Delta, lying between latitudes 4°32′N and 5°33′N, and longitudes 7°25′E and 8°25′E. The state is located in the South-South geopolitical zone and is bordered on the east by Cross River State, on the west by Rivers State and Abia State, and on the south by the Atlantic Ocean and the southernmost tip of Cross River State. Akwa Ibom is one of Nigeria's 36 states, with a population of over five million people. The state was created in 1987 from the former Cross River State and is currently the highest oil- and gas-producing state in the country. The state's capital is Uyo.

2.2 Method of Data Collection

The research employed both quantitative and qualitative methods to define concepts, characteristics, descriptions, counts and measures to demonstrate implications of the issue under question. Data presented in the study were obtained through primary data and was

collected directly from respondents using questionnaires and interviews and group discussion with focus groups. Sampling frame were mainly women involved in farming, trading, and civil servants. The total number of beneficiaries in Abia is 105 which consist of VSEs and non-VSEs. The total number in Akwa Ibom is 109 which consists of VSEs and non-VSEs. The above summing up to 214 in sample size.

Types of data collected include socio-economic data, women empowerment, and information on the village seed entrepreneurs (VSEs). Both secondary and primary data were used in this study. The primary data were collected through the use of well-structured questionnaires and administered by well-trained enumerators in the study area. Secondary data were obtained from the records made available by the IITA through relevant reviews and publications, textbooks and publications of BASICS teams. Stratified sampling method was adopted each stratum was sampled as an independent sub-population.

The quantitative research relies on field data collected using structured questionnaire that included questions on different issues in practice and the role of women in agriculture. Basic information was collected on demographic and socio-economic situation of survey respondents.

The qualitative research mainly focused on the role of women in agriculture in the study area. Information is attained through interviews and focus group discussions by using interview and discussion guides. The discussion was undertaken to collect information from relevant bodies involved on actual implementation of the role of women in agricultural practice by using open and close-ended questions. Focus group discussion was conducted with women in the study area. The focus group discussion was unstructured, thereby allowing participants to be precise and discuss freely. Useful information was gathered as several issues were raised from participants. The focus group discussion offered in agricultural practice by using open and close-ended questions. Focus group discussion was conducted with rural women in the study area. The focus group discussion was unstructured, thus allowing participants to pen up and discuss freely. Useful information was gathered as several issues were raised from participants. The focus group discussion offered opportunity to capture case stories and to direct observations.

2.3 Analytical Procedure

Qualitative data from FGDs and key informants were transcribed and analysed using content analysis to draw out themes relating to specific questions. In this study, content analysis was carried out manually. Quantitative data were analysed using Statistical Software for Social Sciences (IBM SPSS) Version 21. Percentages and bar graphs were generated from SPSS to depict women's empowerment. Statistical analysis was carried out using a chi-square test to test the relationship between household characteristics and empowerment to achieve the objectives of the study mentioned in chapter one. Due to the nature of the study the researcher deems these analytical methods appropriate.

The formula for the chi-square statistic used in the chi square test is:

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

The subscript "c" is the degrees of freedom. "O" is our observed value and E is our expected value. A chi-square statistic is one way to show a relationship between two categorical variables. The chi-squared statistic is a single number that tells us how much difference exists between our observed counts and the counts we would expect if there were no relationship at all in the population. For the purpose of accuracy and conveniences, this study employed the use of chi-square statistical test in SPSS.

The study also adapted the Women's Empowerment in Agriculture Index (WEAI) Alkire (2013), to measure empowerment levels of Village Seed entrepreneurs in the study area and to measure elements of empowerment as stated in the WEAI to compare levels of empowerment between both VSEs and non VSEs women. The Indicators have therefore been adapted as shown below.

3. Results and Discussion

3.1 Effect of Village Seed Enterprises (VSEs) on Women Empowerment

Table 1 presents empowerment indices as pertaining to women empowerment and entrepreneurship. It could be observed from table 1, that after the village seed enterprises, there exist some percentage improvements in the empowerment indices. For instance, access to credit by VSEs increased from 22% to 79.9% and decision on entrepreneurship increased from 39.7% to 83.6%, also access to land from 82.7% to 90.2%, thereby given the women equal rights to economic resources. Many other indices as could be seen from the table experienced some percentage improvement. All these point to the fact that VSEs has had positive impacts on the empowerment level of the women seed entrepreneurs thereby promoting gender equality.

Table 1: **Empowerment Level of Women**

Parameters	Before VSEs Initiatives (%)	After VSEs Initiatives (%)	(%) Improvement	Ranking
Access to credit	22.0	79.9	57.94	1st
Decision on Entrepreneurship	39.7	83.6	43.93	2nd
Making Decisions on Credit	21.8	44.4	22.59	3rd
Personally, Owned Business Premises	47.7	68.7	21.03	4th
Personally, Owned House	68.7	82.4	13.71	5th

Access to Land	82.7	90.2	7.48	6th
Average	47.1	74.87	27.78	

3.2 Changes in income-generating activities and women economic status

Table 2 indicates that a total of total of 158 representing 73.83% of women respondents experienced a direct increased in their economic status as a result of VSEs initiative. This translates to the fact that about more than half of the women are economically empowered. The women also agreed that VSEs initiative has also helped them to generate more income through the sale of cassava seed and thereby enabling them to support their family and make decision on their business, also having equal opportunities to make decisions on economic resources since they now generate more income.

Table 2: Proportion of women whose economic status and sources of income have changed as a result of VSEs initiative

STATE	YES	NO	TOTAL (%)
ABIA	91 86.7%	14 13.3%	105 100%
AKWA IBOM	67 61.5%	42 38.5%	109 100%
AVERAGE	158 73.83%	56 26.1%	214 100%

Table 3: Difference on average in number of customers' service/ week and gross income/ month as a result of VSEs initiative

Table 3 presents the average number of customer service per week and gross income per month after the VSEs initiative, also the percentage difference before and after the VSEs initiative on the two variables. As it could be observed, before VSEs, the minimum and maximum number of customers' service per week is one and fifteen, respectively. On average, an individual services about three customers in a week before the VSEs initiative. This, however, witness a change after the VSEs initiative as the average number of customers serviced in a week increased to about five customers. This implies about 42.7% difference in the average number of customer service per week. On the other hand, the gross income per month also witnessed some percentage difference on the mean. Before the VSEs initiative, the average income was ₦28,252.32 with minimum and maximum being ₦2,000 and ₦100,000 respectively. However, after the VSEs initiative, the average income increased to ₦45,112.77, with minimum and maximum to ₦2900 and ₦200,000. This implies about 59.7% increase in the gross income of VSEs per month. All these point to the fact that VSEs has had positive impacts on the livelihoods of women seed entrepreneurs in their respective communities.

Difference on average in number of customers' service/week and gross income/month as a result of VSEs initiative

ITEM	N	MEAN	MEDIAN	MODE	STD. DEVIATION	MINIMUM	MAXIMUM	%DIFFERENCE ON AVERAGE
BEFORE VSEs	143	3.33	2.00	1	3.372	1	15	
AVERAGE N0 OF CUSTOMERS SERVICE/WEEK								42.69
AFTER VSEs	177	4.75	3.00	2	4.526	1	20	
BEFORE VSEs	141	28252.32	23500.00	20000	21701.963	2000	100000	
GROSS INCOME/MONTH								59.68
AFTER VSEs	193	45112.77	32000.00	25000	40156.970	2900	200000	

4. Conclusion

It is quite safe therefore, to conclude from the study, that women involvement in agriculture contributes positively to the growth and development of a country. Hence, empowerment and social structure of the Village Seed Entrepreneurs should be encouraged as it also seeks to make more women financially independent as discussed in the results of this study which is in line with the SDGs 5: to achieve gender equality and empower all women and girls. It could be said with certainty that Village Seed Entrepreneurs has sustainably empowered women in the study areas,

Village Seed Entrepreneurs is an important factor in advocating for gender equality especially in the agricultural sector because it promotes women empowerment, thereby reducing poverty rates and generating more income for the women which in turn contributes positively to the growth of the economy, also allowing women to participate fully and effectively in levels of decisions making especially in agricultural sector and economy sector.

The VSEs initiative has also contributed positively to gender equality in the study area, through increase in girl's child education because the women can now afford quality education for their children, especially the girls.

From the study, it is accurate to say that VSEs enables village self-sufficiency in production of quality seed and distribution to farmers, since it operates under peer supervision with utmost transparency, mutual trust, and social responsibility towards fellow farmers. The VSEs as a micro seed enterprise at the village level can be efficient as some will have the potential to expand into specialized, small or medium-size local seed enterprises.

Thus, VSEs initiative has effectively bridged the gap in gender equality through the women empowerment in agriculture by ensuring full participation of women in agriculture, given the women equal opportunities to economic resources, also rights to access of land and control over their business.

5. Recommendations

Based on the findings of this research, the following recommendations are made:

Based on the challenges such as lack of farm inputs and finances encountered by the VSEs on buying and selling of stems, it is recommended that state governments and NGOs (IITA, NRCRI) subsidize prices of inputs to enable farmers purchase the required inputs.

Since Village Seed Entrepreneurs is a model that seeks to empower village level farmers (women) to increase productivity and income, the government has a significant role to play in creating an institutional environment that is conducive for this initiative to thrive because it will help in empowering women and girls especially within the rural areas as required by the SDGs.

Also, there is a need for government and development partners to promote and boost public-private partnerships that will ensure better access to inputs for production of certified seed, provide better access to credit and financial services for VSEs, and increase revenues from certified seed production and village seed enterprises. The government should provide an enabling policy environment and incentives to scale up Village Seed Enterprises. Government, however, should help the farmers acquire land as some of the women still do not have access to land in their community. This will encourage women to expand their farms for increased productivity.

The study also recommends that a good means of transportation is essential for VSEs to carry their stems to other farmers at lower cost as buying and selling of stems is difficult due to the distance of the seller to buyers. Instability in the quantity of cassava seed and prices should also be addressed as there is no uniform price of selling stems and this can constitute major challenges to the VSEs in the community. Finally, farmers should be encouraged to plant improved varieties of cassava seed to ensure increased productivity since improved seeds are disease-free. Doing so will make them patronize the Village Seed Entrepreneurs and thereby improve their income as well.

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NECROPOLITICS IN THE BRAZILIAN MINING SECTOR

a critical analysis of a corporate environmental crime in a mining-dependent community

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Abstract

Our paper analyzes the dynamics of exploration, domination, death, and commercialization of bodies that take place in the Brazilian mineral sector. For this purpose, two territories marked by economic dependence, as well as psychic and social mining, Itabira and Brumadinho, in the State of Minas Gerais, constitute the locus of research. These are realities marked by the death and impracticability of certain ways of life in their relationship with mining, not only when crime tragedies happen as in Brumadinho, but along the historical trajectory of these territories. The research is based on engagement, reflexivity, thinking-reason, and dialogic. The results indicate that in territories marked by Mining-Dependence, the Necropolitics intensifies, perpetuating realities favorable to impunity and continuity of corporate crimes in the Brazilian mineral sector.

Keywords: Necropolitics, Mining, Environmental Conflicts, Mining-Dependence, Corporate Crimes.

1. Introduction

Global mining chains make up the contemporary capitalist context, often marked by corporate crimes, corporate social irresponsibility, and criminal tragedies, which incur systematic human rights violations in different territories around the world (Icasuriaga; Bernardo, 2020; Pastran; Mallett, 2020; Zhouri; 2019; Dias; Oliveira, 2018; Zhouri *et al*.; 2016). Even when seeking to develop socio-environmental interventions derived from government regulation and/or pressure from ecological and social movements, to compensate for environmental, economic, social, cultural, and political damage generated, the mining industry and an entire ecosystem of consultancies, technical advisors, civil society organizations specialized in tragedy and professionals from different areas end up reproducing logics, rationales and ways of being and living in territories that condemn hundreds of communities and people to have their life projects made impossible by progress and development and by the side effects that this quest for development incur (Chowdhury; 2021; Banerjee, 2018; Dias; Oliveira, 2018. The Brazilian mineral sector does not escape this dynamic of operation, unfortunately building a recent history that records some of the most serious corporate crimes in the tragedies of Mariana and

Brumadinho, both in Minas Gerais (Fontoura; Naves; Teodósio; Gomes, 2019). This historical trajectory, marked by these two episodes, which concentrated a high number of deaths of people, animals, and plants in a short period, may lead those who analyze this sector and its main corporations more lightly and superficially to imagine that treating isolated situations, non - recurring and fruit-off and unusual phenomena failures, unexpected and fatalities (Milanez; Losekann, 2016; Milanez, Magno, Pinto, 2019).

However, a careful analysis of this sector reveals systematic deaths, happening little by little within the mines and productive units of the mineral sector, either in the communities around it, sometimes due to precarious working conditions, sometimes due to the pain and suffering that an activity that destroys the landscape and dramatically changes the life and daily life of communities, some of them living traditionally for hundreds of years, it brings to the territories (Dias; Oliveira, 2018). Even before tragedies lead to the loss of hundreds of human lives, in the territories marked by mining there is a high rate of attempts at self-extermination, as seen in Brumadinho / MG (Bechler; Ribeiro, 2019; Oliveira; Oliveira, 2019). The bodies in territories marked by mining, live a death reality, dropper or not, suffering and physical and mental illness (Heller, 2019; Noal; Rabelo; Chachamovich, 2019).

In the Brazilian context, more specifically in the state of Minas Gerais, the history of mining is associated with slavery and, even after the abolition of slavery, with the oppression of traditional peoples such as quilombolas, indigenous, riverine and small farmers. (Souza; Paula; Cunha, 2009; Souza; Reis, 2006). Studying mining, under critical analysis lenses and taking into account its historical trajectory , requires understanding mineral extraction as an economic activity in which some bodies are more valuable than others, generate more value than others, quickly lose more value than others and, when they disappear for submission to lethal productive logic of this activity, they are the object of controversy surrounding the payment or monetization by the absence, the pain, the grief generated and the impracticability of life projects (Chowdhury, 2021; Banerjee, 2018; Dias; Oliveira, 2018).

Since its foundation in Itabira, Minas Gerais, in 1942, Vale has accounted in its predatory operations for various work accidents and deaths, such as that of indigenous people during the construction of the Vitória-Minas railroad. In addition to these very serious impacts, a fundamental characteristic of mining remains: the monopoly in the explored cities and the imposition of unique histories and modes of existence in the territories, which we can call “Minerodependência”, harm, prevent and eliminate the development of other activities such as family farming, sustainable tourism and other ways to exist / resist economic, cultural, social and environmental (Alvarenga, Dias, Furiati, Solsona, 2018; Araóz, 2020; Svampa, 2019).

Even in contexts in which the large-scale loss of human life arouses anger, revolt, generates mourning and helps to give life to mining resistance and containment movements, a logic of dependency and true “love and hate” from mining intensify (Gasparo; 2019). Markets, economic activities and labor relations do not constitute social spaces in which only a self-interested rationality and action driven by

the search for maximizing satisfaction are manifested. Markets are social spaces in which affections, various rationalities, distinct interests, different degrees of solidarity and cooperation and multiple meanings of existing, producing and consuming to reproduce life manifest themselves and intersect with economic and self-interested rationality (Fontoura; Naves; Teodósio; Gomes, 2019; Gasparo; 2019).

Therefore, in this research, we do not consider the so-called Mining-Dependence, that is, the great difficulty of territories and their communities in freeing themselves from the mining activity due to the economic strength and power that these enterprises and sector concentrate (Coelho, 2017; Szwako; Lavalle; Dowbor, 2019), only as an economic dynamic. Ore-Dependence is understood in this investigation as an economic activity that leads to a psychic and social dependence on workers, communities, territories and different social groups and individuals regarding mining, making it difficult and even unfeasible that new realities of Well Living and developing the territories, outside the context of mining, may flourish (Acosta, 2016) . Ultimately, bodies that suffer from the pains of a productive activity that kills, destroys and makes landscapes and ways of life, despite suffering on the skin and in the spirit, continuing to shed dependence based on bonds of affection with their executioner, in a tragic plot.

Based on the different knowledge mobilized by the field of organizational studies, critical analyzes of corporate crimes, although still initial in the country, present rich contributions capable of problematizing business action and its implications for human and non-human life and society and the environment. environment (Alcadipani; Medeiros, 2019; Medeiros; Alcadipani, 2019; Saraiva, 2018; Souza; Valadão Júnior; Medeiros; Gallego, 2017; Medeiros, 2015; Borges; Medeiros, 2014). We assume in the present investigation the starting point that the deaths that mark the history of the Brazilian mineral sector are a history of corporate crimes, which incurred very low accountability and punishment, perpetuating in the present day even when new post-tragedy governance strategies and judicialization are put into action.

In addition, we assume research positions that go beyond the mere observation and analysis of the phenomena that lead to suffering, illness and death of bodies as a social dynamic in which we, as researchers, should remain distant to guarantee a supposed methodological consistency of the research. We take the engagement as a central element in the investigation (Pozzebon, 2018), which deepens the methodological quality (Pozzebon; Petrini, 2013) from the search based interactions on empathy (Freire, 1997, 2009), in which we put as sensitive and reflective researchers (Cunliffe, 2020; Fals Borda, 1987, 1994) to individuals, social groups or communities of the territories marked by Mining-dependence, always seeking dialogicity this interaction (Pozzebon; Rodriguez; Petrini, 2014). This investigative stance is very dear to us, especially when we see that in the real Aid Industry that settles in the territories after crime tragedies, paternalistic, welfare and authoritarian relations are manifested (Chowdhury, 2021; Banerjee, 2018).

In organizational studies, it is necessary to unveil those beings, those bodies that deserve life, visibility and the benefits of economic activity and those that are forgotten, made invisible and for which the benefits of market and/or capitalist dynamics never go beyond a project future and utopia (Amaral; Paes, 2016). We emphatically place ourselves next to those who suffer from the loss of loved ones and the tragic realization that some bodies are worth more than others in the fate of "severine lives" working in the Brazilian mineral sector.

To investigate the similarities between the necropoder and colonial necropolitic of Mbembe in modern times and in Brazil, this article will resort to a mining case study from the practices of the company Vale S.A. The inquiry that guides the investigation is based on the generation of value that the necropolitics perpetrated by a large mining organization can generate, or better, a devaluation for workers, communities, governments and society in general. Hence, the question arises: Necropolitics is it worth!?, Necropolitics is worth it?! What is it worth? Who is it for?

The implications of colonialism can be explored through the eyes of Cameroonian philosopher Achiles Mbembe (2015). Using a reinterpretation of the concept of biopower and conservation of life proposed by Foucault, Mbembe proposes to appropriate a phenomenon experienced by countries that were colonized by Europeans: that of the conscious and systematic extermination of the original or enslaved peoples by the colonizer.

Therefore, “making you die” is inaugurated, the basic epistemology of what Mbembe calls Necropolitics and Necropoder. This ability to decide on the limits of life or death is the key factor in exercising sovereignty and greater verticalization in relations to power and domination. To better discuss the implications of death policies, Mbembe (2015) analyzes this process in war practices.

The *“*state of exception*”* is a nodal point for initially understanding the modes of subordination of bodies. As an example, the Nazi concentration and extermination camps are presented. In addition to bodily death, the extermination camps and the state of exception force the occupant to have his subjectivity and political right extracted, reducing them to his real body only. Mbembe (2015) also points out that these states are particular cuts in an existing legal structure, where the dominator makes the law itself according to his criteria and interests.

Another key question posed by the author to explain forms of necropolitics is the use of terror. For the author, this tool was used systematically during the French revolution. However, Mbembe (2015) refers to colonization and slavery as one of the first instances of biopolitical manifestation, with its consequences paradoxically very similar to the state of exception:

> Paradoxical for two reasons. First, in the context of colonization, the human nature of the slave is depicted as a personified shadow.The condition of slave results from a triple loss: loss of a “home”, loss of rights over his body and loss of political status. This triple loss is tantamount to absolute domination, alienation at birth and social death (expulsion of humanity in general). To be sure, as a political-legal structure, a farm is the space where the slave belongs to a master. It is not a community because, by definition, it would imply the exercise of the power of expression and thought. [...] As a work tool, the slave has a price. As a property, it has a value. Your work is needed and used. The slave, therefore, is

> kept alive, but in a "state of injury", in a spectral world of intense horrors, cruelty and profanity. (MBEMBE, 2015, p. 10)

However, despite this relationship of domination and reification of the slave, he is still able to elaborate representations of the material environment in which he lives, in addition to being able to reframe these abstractions. The slave then uses his corporeality and music to become a person again. An example of this manifestation can be seen in the development of capoeira by Brazilian slaves as a way of existence and resistance.

The author points out that these experiences are not exclusive to the colonial period and that their implication brings unfolding physical, psychological, social and cultural orders over time. In addition to this violence aimed at the individual, the geographic space of these populations is also altered in their demarcations and resource extraction. An example cited by Mbembe (2015) is that of the racial districts implanted during *Apartheid* in South Africa and the deprivation of rights to black citizens. Again, manifests the sovereignty, which is to show and demonstrate " the ability to define who matters and who does not matter who is disposable and who is not." (Mbembe, 2015, p. 14).

Another contemporary example explained by the author - with greater detail on the ways of killing and applying necro power - is the occupation in Palestine. The colonial state claims its cultural and religious legitimacy in space, expelling people from their homes and creating refugee camps. The exercise of sovereignty does not refer only to the field in the physical field, but also in what can be called the "verticality policy" (Mbembe, 2015) and the domination of the airspace with airplanes, bombs, in addition to the use of hills and valleys that protect dominators give them privileged vision and vigilance, as well as a monopoly on water sources. Thus, it is possible to observe that:

> As the Palestinian case illustrates, the contemporary colonial occupation is a concatenation of various powers: disciplinary, biopolitical and necropolitical. The combination of the three allows the colonial power absolute domination over the inhabitants of the occupied territory. The "state of siege" itself is a military institution. It allows for a type of crime that makes no distinction between the internal and the external enemy. Whole populations are the target of the sovereign. The besieged towns and cities are surrounded and isolated from the world (MBEMBE, 2015, p. 16).

After the colonial approach, Mbembe (2015) also proposes to make an analysis based on contemporary wars, emphasizing that they have greater mobility and surprise effect and argues that the actions today are no longer of conquests and permanence in the place, but rather than adopt lightning-fast approaches. In addition, the author reinforces that the strategies are not immediate to implement, but to curtail basic infrastructure needs, such as water limitation, power cuts and road destruction, among others, significantly affecting the target population, causing "bankruptcy of the enemy's survival system". (Mbembe, 2015, p. 18)

Another particularity of contemporary wars concerns war machines. Mbembe (2015) makes use of this concept of Deleuze and Guatarri (1980) to say of armed groups that organize themselves in a polymorphic and circumstantial way. They may even adopt commercial practices at the same time or not in which they are embedded in the state power in which they are inserted.

> A war machine combines a plurality of functions. It has the characteristics of a political organization and a commercial enterprise. It operates through catches and depredations, and can even mint its own money. To finance the extraction and export of natural resources located in the territory they control, the war machines forge direct links with transnational networks. War machines emerged in Africa during the last quarter of the 20th century in direct relation to the erosion of the postcolonial state's ability to build the economic foundations of political order and authority. This capacity involves increasing revenue, commanding and regulating access to natural resources within a well-defined territory. In the mid-1970s, with the erosion of the State's ability to maintain this capacity, a clearly defined line emerges between monetary instability and spatial fragmentation. (Mbembe, 2015, p. 19)

The author points out that this monetary circulation has crossed state / society relations in two ways. The first concerns the concentration of liquidity in a few channels. This brings the reification of people to the fore, measuring people by their worth and usefulness. The second refers to the poor distribution of capital originated from the exploitation of natural resources in certain territories, which created gaps and inequalities, also changing the relationship between "people and things".

Here lies the danger of a state hostage to the war machine, where weak regulation allows these devices to act in a predatory manner according to the law itself and demobilize and incapacitate the affected population. This set of repressions, whether in the topological field, of access to water and light, exploitation of labor, widespread deaths and social demobilization of the affected territories incrusted the person-victim of modern occupation in a state of lethargy and suffering (Mbembe, 2015). Still according to the philosopher, there is the possibility of freedom, but this is a condition that has not yet arrived and still reflects suffering in the present.

This relationship of socio-environmental conflicts arising from the economic interest in modernity can also be found in Acserald's (2002) writings on environmental and social justice. This perspective is worked to the detriment of the risk management of public and private undertakings. The scenario is that they absorb the positive fruits of the initiatives in Minas Gerais, the high profit and positions of power in the miners, leaving the population affected by the burden of risks, such as unemployment, precarious work conditions, disruption and terrorism of dams, land expropriation and air pollution, in addition to water scarcity. In the words of the author:

> From this perspective, there would be no way to separate environmental problems from the unequal distribution of power over political, material and symbolic resources. Simultaneous forms of oppression would be responsible for environmental injustices arising from the inseparable nature of oppression of class, race and gender. (Acserald, 2002, p. 3)

One of the first forms of insurgency on the part of the population affected in favor of environmental justice can be registered in the mid-1960s in the United States, where the community at that time was positioned against the disposal of toxic waste, contamination of their place of residence, improvements in sanitation and an end to unhealthy working conditions (Acserald, 2002). However, resistance practices in the face of social and environmental aggression can be identified from the beginning of colonial practices.

The process of struggle in modern societies managed, from 1987 onwards, to elaborate with technical and scientific evaluations, arguments that justified that the environmental impacts of large enterprises caused side effects mainly in the vulnerable classes, such as blacks, poor, workers. It is important to stress that this whole process was only possible from the co-construction with the affected public, since only they know about their processes and are part of the relevant knowledge for the balance in the inequality of risks (Acserald, 2002).

This demand for representativeness caused the movement for environmental justice to become institutionalized in two ways. Those of a regional/objective character that guided collective reparations with a geographic, territorial focus and those of a discursive/subjective character, which understood the prevailing correlation of inequality with the dominated races and ethnicities. This possibility made the fight for environmental justice a broader scope and guided other associated social vulnerabilities.

Thus, Acserald (2002) proposes to organize that each environmental justice movement had two characteristics, respectively: Objectivist 1 and 2. Subjectivist 1 and 2. The particularities of each are exemplified below.

Chart 1. *Characteristic of movements for environmental justice*.

Objectivist 1	Subjectivist 1	Objectivist 2	Subjectivist 2
It was born from a practical confrontation of a population that defended the non-contamination of its territory by third parties with greater decision-making power	When identifying that the disposal of toxic waste was strongly correlated to the territories of the black population, environmental justice was disseminated in the debate of civil and social causes.	It reconciles the Objectivist 1 and Subjectivist 1 propositions, understanding environmental inequality with a racial relationship and that the disposal of toxic waste in places favors places with low social mobilization and decision-making power.	The possibility of approximations with other vulnerabilities increases the integration of collectives and social movements. This made possible a greater branching for regions without articulation, helping them in the resistance.

Source: Elaborated by the authors (2020)

In summary, social and environmental vulnerability already existed, with social movements considering the importance of building an understanding of the aggressions they suffered, identifying patterns of occurrence, strategies used to perpetuate inequalities and expanding the scope of the

debate to provide technical resources. and discursive other similar communities to preserve their lives. This power of interlocution is called mobility, a strong resource of financial capital used to weaken and submit vulnerable groups and which, thanks to the environmental justice movement, was used in favor of those affected.

However, according to Acserald (2018), capital has not been paralyzed in the face of social mobilization and had its profitable activity as a threat and risk. The way found by the market to deal with social movements was through geographic and historical mapping, in addition to anticipating agendas. This form of work refers to strategic reason seeking a d control and its employees, the environment in which the company operates, and now on the socio-political conditions of the territory from which they extract their resources (Acserald, 2018).

On the other hand, the company's attempt to minimize risks arising from conflicts, makes it approach the exploited territory trying to establish bonds of trust, which refers to social management practices, even though this approach is guided by an attempt by the company to minimize or avoid financial losses (Acserald, 2018). It is important to add to this perspective of the author, the fact that extractive companies need to comply with social and environmental conditions provided for by law so that they can exercise their activities. (Acserald, 2018)

Territorial conflicts arising from economic interests can be observed in Brazil and Minas Gerais, demonstrating that the ways of life of the populations regarding large enterprises were seen as obstacles and dichotomous industrial and urban policies (Zhouri & Laschefski, 2010). For these authors, in Minas Gerais, ethnic conflicts are always present, mainly in export-oriented market practices. Thus, for the major economic projects are executed, the condition seems to be inevitable environmental injustice, excluding the victims of decision-making, silencing their demands and bequeathing to them the side effects of the projects.

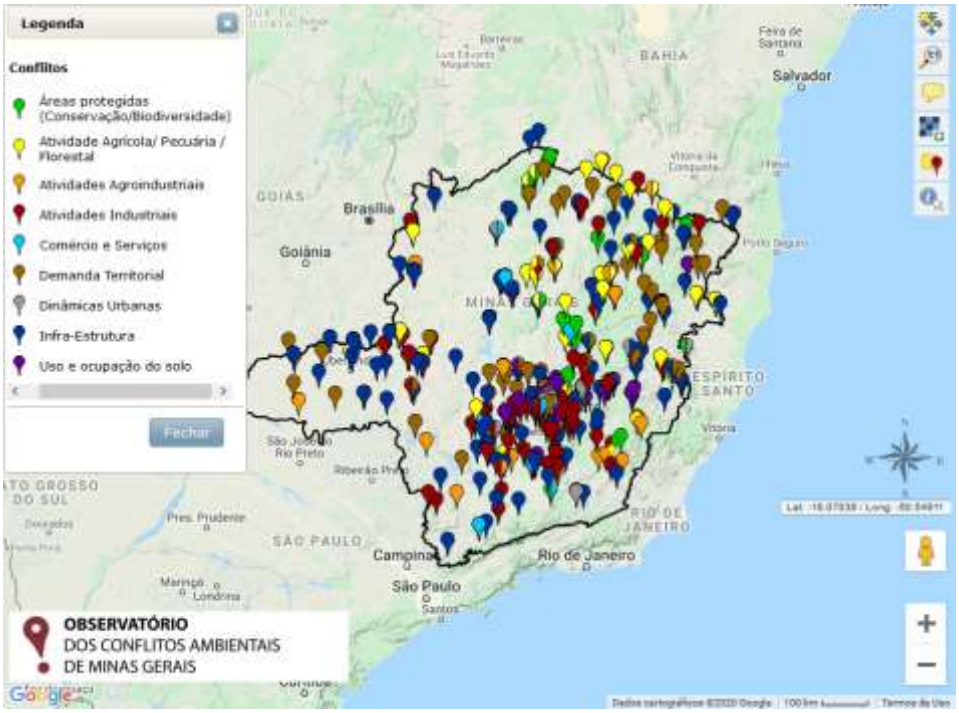

Figure 1. *Map of Minas Gerais's environmental conflicts.* Source: Minas Gerais Conflict Observatory (2014), Extraction on: 28 May 2021 at 17h 30min

As noted in the map above, the number and content of conflicts is diverse. As an example, one can mention the São Francisco riverside residents suffering from heavy metal contamination from mining activities, diversions and drainage of water that affect plantations and subsistence supply. Another case is the experience of quilombola communities that are threatened in favor of eucalyptus monoculture, incurring the displacement and removal of these communities.

According to the authors, these territorial conflicts can also be observed in an urban context, such as the residents of the Camargos neighborhood in Belo Horizonte who mobilized to remove a hospital waste incineration plant in their residential area. It is necessary to take into account the particularities of conflict in each territory and in each enterprise (Zhouri & Laschefski, 2010).

In a long fieldwork carried out for four years in the region of Conceição do Mato Dentro, Dom Joaquim and Alvorada de Minas, the UFMG Poles of Citizenship Program team described and analyzed innumerable violence practiced by the AngloAmerican mining company and by Governments, especially the State of Minas Gerais and the municipalities affected by the mega Minas-Rio project (Dias et. al, 2018th.; Dias et al, 2018b.).

Among the violence practiced by the mining company and by governments, the silencing and invisibility of the narratives and places of speech of the local populations stand out; the constant disrespect for the centrality, autonomy and protagonism of the people and families affected; the intensification of intra and inter-family and community conflicts; the systematic elimination of

the weakening and modes of existence/resistance to Mining-Dependence, among others (Dias et. al, 2018th;. Dias et. al, 2018b.).

2. Methods

This article is derived from research that takes on the characteristics of a case study to understand Vale S's forms of action. An on the actors in risk areas of the territories in which it operates, based on the practices of necropolitics and necro power as proposed by the philosopher Achilles Mbembe (2015). To this end, data collections were carried out on electronic sites and documents available on the Internet, such as reports on the daily life of mining territories, water grants and statistics on mining accidents in Minas Gerais.

Finally, the participation in meetings and groups of people affected by mining created in response to socio-environmental conflicts in Itabira and Brumadinho, allowed us to identify some representations of the violence practiced by the mining company. The insertion in the field is because the authors of the article come from these two cities, with whom they maintain strong bonds of coexistence until today, being present in the social life of these territories for years.

The choice of different sources of information is based on the importance of triangulation (Fusch & Ness, 2015) of data in qualitative studies, which increases the reliability and validity of the findings, while allowing greater analytical generalization. In addition to this variety of information sources, historical redemptions of the company's foundation were also sought, as well as its construction until privatization, to better understand its past and current forms of operation. The collected data were compared with those of war and death policies presented by Achilles Mbembe (2015). Some concepts - key used by the author were listed as analytical categories for the following research, including: The right to kill; sovereignty; State of siege; Surprise effect; State of exception; Use of terror; Reification; Class-based racism; Murder technologies; Territorial fragmentation; War machines; Scorched earth; Verticality policy; New combat fields and Resistance techniques.

3. Results and Discussion

The history of mining in Itabira dates back to 1871. The fact is due to the use of enslaved labor to extract gold and iron in the city. Slavery, in addition to suppression in the bodies of blacks, produced reflections in their culture, silencing cultural representations and treating blacks as mere cogs in mining. Even with the abolition in 1888, you can find slavery records still in 1930 and perverse manifestations of racismo and structural present to the present day (Almeida, 2019; Ferreira, 2015).

With the arrival of Itabira Iron, which was later to be called Companhia Vale do Rio Doce (CVRD) in 1942, blacks reification practices and workers is maintained, which is the structural axis that made the first extractions iron ore to be made from pickaxe, in the cold and at the cost of your

health. “They are illiterate people. All he had was just illiterate. He had a terrible blackout. Black and illiterate. I didn't know how to do anything, I just knew how to work.” (Minayo, 2004, p.89).

As much as CVRD was an institution focused on the market, the organization had in essence, since its foundation, the state character. In addition, it should be noted that the organization was formed in a partnership with the British and Americans to provide raw materials for the manufacture of weapons for war. This armament and military perspective were also visible in the workers' demonstrations for better working conditions, in which the state company sent an apparatus of 60 military personnel to increase the repression (Minayo, 2004).

In this section, it is possible to identify how the concepts of necropolitics and war machines, supported by colonialism, are intertwined with the praxis of mining company Vale. The latter takes on a polymorphic character typical of war machines from the intertwining with the state, commodification and the use of power and sovereignty, subduing colonized peoples to fulfill their financial objectives.

Some of the reflexes of these practices in the body of its employees are initially pointed out by the precarious accommodation provided by the company, to which the conditions triggered diseases such as “tuberculosis, malaria, typhus and alcoholism” (Ferreira, 2015, p. 71).

As a way of not harming its productivity, the mining company provided for the construction of new residential centers (Ferreira, 2015 apud Oliveira, C. 1992). It is important to highlight that these nuclei would become areas of risk, making explicit the necropolitical practices of the territorial arrangements of the colonized population for areas of death (Mbembe, 2015).

> In Itabira, as well as in Brazil and the world, the social imaginary was constituted conditioned by Eurocentric discourses, fed by the coloniality of knowledge and power. The circumscribed horizon was, and is, the ideal of development. And the predatory appropriation of nature to reach such a horizon is legitimized in the name of the greater good, in the name of development. Once predatory appropriation is legalized, the subjects are conditioned by it, they are also muted before the great asymmetries of power (Ferreira, 2015, p.92)

Even with the privatization of Vale, entanglements with the State did not cease to occur, since it is responsible for the inspection of Vale's socio-environmental actions in the territories. On the other hand, it is possible to note that this relationship is somewhat homogeneous and the State is, in most cases, complacent and negligent with the violence practiced systematically by mining companies.

In Itabira, since the mining company was installed in the city, only two governments have not been supported by it (Ferreira, 2015). In addition, this univocity allows Vale to be flexible in complying with environmental legislation, which leads to a shortage of water in the city, a high rate of atmospheric pollution and the creation of tailings pump dams without any punishment by Organs competent bodies (Ferreira, 2015).

> The Economic power that confused with public power in the three spheres, even after privatization, since the imperial period the Brazilian government has legislated and managed in favor of the mineral extractive economy to serve the foreign market, interfering

> in the autonomy of the local instance. Kidnapping the municipality's autonomy to manage space and public administration, both by overlapping federal and state decisions over municipal ones, and by disregarding environmental legislation, social and political rights, and subjects' interests (Ferreira, 2015, p. 99)

If daily work at Vale is marked by necropolitics, the occurrences of tragedies-crimes resulting from the company's activities, in Mariana, through Samarco, a company controlled by Vale and also mining company BHP Billiton, and in Brumadinho, brought concentrated intensity in a short period for a trajectory of domination, expropriation and death. Phenomena of the necropolitics that in other territories, such as Itabira, were often not visible because they manifest themselves through small recurring episodes over the years.

3.1 The rupture of the dam and its effects

Since the rupture of Vale's dam in Brumadinho, which collapsed on January 25, at least 1,100 people had to flee their homes in a hurry because they lived in risky places. Since then, 1 dam has been breached and 7 are on alert. Of this total, 954 people are in temporary residences. (Cristini, Flávia, 2019). In addition, it should be noted that the crime also caused the death of 2 7 2 people and 1 0 are still missing.

There was a direct impact on the Paraopeba River, which compromised the water supply of Belo Horizonte and the metropolitan region, leaving these only eighteen months of autonomy before it enters rationing, according to the CPI established in the city council of the capital of Minas Gerais (Research data, 2021). In addition, Paraopeba is a tributary of the São Francisco River, responsible for most of the country's water supply.

As for Social Assistance in Brumadinho, public calamity and financial emergency were decreed, in addition to weakness in employment ties, bureaucracy and state inefficiency and weakened social mobilization. Emergency work involves welcoming victims' relatives, initial recording of immediate needs, organization and participation in receiving donations, and articulating the network of public policies and social networks. The post-emergency requires data systematization, medium / long-term strategic planning and support in the organization in the distribution of donations. (Christiano, 2019)

Still, on the consequences, there is a massive lack of confidence in the public authorities and the private sector; great questioning about the future of the family and the city; greater illness in mental health; health problems of patients already followed up; weakening of the health team; rupture, disorganization, redesign and weakening of family bonds (Research data, 2021).

The same author also highlights the possible actions of the post-tragedy social worker; Socio-family orientation; Actions to promote citizenship; Network strengthening; Health promotion for affected patients and families; Integrated actions that provide autonomy, confidence and perspective to the population (Research data, 2021).

Another place hit by the tailings dam burst was the Bento Rodrigues district in 2015, located in the city of Mariana. Account 19 direct deaths, and the complete burial of the district, still unpunished crimes by the courts of our country and that refer to the domineering behavior in the colony: "The sovereign right to kill is not subject to any rules in the colonies. There, the sovereign can kill at any time or in any way. Colonial warfare is not subject to legal and institutional norms." (MBEMBE, 2015, p. 13).

Dam crimes have embedded in the population a state that has been called by those affected as "dam terrorism". In Brumadinho, some mental health professionals pointed out in the interviews that it is extremely delicate to deal with the affected population since they are fragile and in an extremely shaken emotional state.

This makes mourning and trauma elaboration more difficult, as places are revisited during the dialogue and memories are triggered that reorganize the therapeutic process. In addition, the lack of support with caregivers and the fragility in the relationship between public health professionals is also pointed out as an important issue to be faced. Recalling that historically M drug addiction has also provided a weakening of local public policies in health, social assistance, education, as described and analyzed by Dias et al. (2018a).

The syndrome of small powers was also highlighted as a barrier to be overcome. In addition, the difficulty in preparing for mourning is crossed by the "race for compensation and emergency wages", since the victims' relatives are approached by relatives and acquaintances who charge their share of the compensation or make bad jokes about the enrichment by cause of death. The struggle is permeated with revolt and anger. You can also find r vulnerability and human rights violations in employees of Vale, those who returned to work at the site of the tragedy, aiding in the rescue of the bodies of their colleagues.

In addition to the traumatic experience recorded in the subjectivity of those who suffered from the rupture as in Mariana and Brumadinho or those who were rushed from their homes, the other cities that have Vale S / A dams live in a constant state of alert under the risk imminent of being buried. Itabira, Vale's birthplace, is surrounded by 400 million cubic meters of tailings, threatening the direct integrity of 15,000 people. Since the installation of sirens for evacuation in the event of a breach, the sound signals have been triggered numerous times by Vale's "technical error", increasing the tension and anxiety in the population in facing their death, where they sometimes had to leave their homes. in the middle of the night, suddenly, causing fear, anguish and the feeling of imminent death (Desembargador, 2020).

The fact is that this evacuation device does not save people from death, as experienced by residents at the training event promoted by the mining company. Residents were able to experience that even leaving the house in a hurry, they would not have time to reach the safe area or would head towards the mud (Na Real, 2020). It is noteworthy here that these communities are located will at least fifteen meters from a dam and are mostly composed of elderly and retired workers of

Vale. Employees and retirees of the "highest-ranking" of the company live in neighborhoods outside the risk area (Ferreira, 2015). Here we can identify the suitability of racial necropolitics for classes as well.

> Class-based racism, which, in translating the social conflicts of the industrial world into racial terms, ended up comparing the working classes and the "helpless by the state" in the industrial world with the "savages" in the colonial world. (Mbembe ,2015, p.8)

Vale has neglected the risk of these residents in Itabira since the 2000s, when it signed a commitment with the community, public authorities and the judiciary to resettle residents who were in areas at risk. This term appears in condition number 46 that has not been fulfilled until today (Research data, 2021).

It is important to highlight that these domination strategies in the territories have long been observed in Itabira, a period in which the city's elite sought to build houses, churches and agricultural, while the Portuguese crown was only concerned with exporting wealth. On the other hand, the blacks and "mestizos" who represented the poor of the city were not given the right to develop projects for the territory in which they lived (Ferreira, 2015).

Dam breaks produce a massive number of direct victims, instantaneous brutal impact, environmental devastation of rivers, with social reverberations that are difficult to measure, as mentioned by Mbembe (2015) when analyzing new ways of killing.

> Innovations in murder technologies aim not only to "civilize" the ways of death, but also to eliminate a large number of victims in a relatively short period. At the same time, a new cultural sensitivity emerges, in which killing the enemy of the State is an extension of gambling. More intimate, sinister and tranquil forms of cruelty appear. (Mbembe, 2015, p.8)

These new ways of killing are also intertwined with new conceptions of space and battlefield, as well as new domination strategies exercised. In Itabira, the population does not have representation or deliberation in the dialogues between the Public Ministry, Vale and City Hall. In Brumadinho and Mariana, those affected are not directly heard, being imposed the need for "Technical Advisory Services" to represent them or to mediate their dialogue with the State and Federal Public Ministries, as well as with the Public Defender's Office of the Union and the State of São Paulo. Minas Gerais.

In the spectacle of disaster and socio-environmental crime staged and represented in these territories, Vale works to delegitimize the need for technical assistance in Brumadinho, to negotiate individually with those affected, to fragment and weaken the struggles. Again, taking up Mbembe's text:

> The assertion of supreme authority in a given political space does not come easily. Instead, a mosaic of incomplete and overlapping, disguised and entangled rights to govern emerges, in which there are many different *de facto* legal instances geographically intertwined, and in

> which plural allegiances, asymmetric suzerainty and enclaves abound. In this heteronomous organization of territorial rights and claims, it makes little sense to insist on the distinction between the "internal" and "external" political fields, separated by clearly demarcated boundaries ... More and more, war does not occur between armies of two Sovereign states. It is fought by armed groups that act behind the mask of the State against armed groups that do not have a State, but which control very different territories; both sides have as their main targets unarmed civilian populations or organized as militias. (Mbembe, 2015, p. 18; 20)

4. Conclusions

As demonstrated, Vale was founded in a context of colonial heritage and slave labor, implying the exploitation of labor for profit, in addition to the use of armed and police repression to exercise its sovereignty and domination over blacks and workers.

This pattern of behavior towards its employees continued with the modernization and privatization of the mining company, causing it to resort to camouflaged forms of domination such as moral harassment, based on threats of unemployment, death or expropriation while continuing to place the biological body of its employees at risk, either in exposure to COVID-19 or in dam crimes.

The death policies go beyond the company's guardhouse, since it interferes in the infrastructure of the city in which it operates, whether in the expropriation of families from their homes, the creation of new neighborhoods with quality of housing according to the company's hierarchy and burial of urban and rural areas with their dam crimes.

In addition to these “scorched earth” practices, Vale also operates in the verticality policy, with sirens and bomb dams on the houses of the popular classes. Mbembe (2015) highlights that modernity has brought “new fields” of combat, which is explained by the constant struggle of the mining company to delegitimize the movements of those affected and unions, thus also weakening and breaking the social fabric in which, it impacts.

The infrastructure war can also be explained by the atmospheric pollution of the affected cities, such as Itabira and Brumadinho, which register dense dust storms with levels beyond those acceptable, which creates respiratory problems for the population. Mining also shows predatory in the water aspect, taking shortage to Itabiranas houses, besides d the Mariana dam crimes and Brumadinho eliminate the water supply and ecosystem of fauna and flora do Rio Doce and Rio Paraopeba, as well as pollution and direct contamination and indirect in the territories.

Fear of job loss, risk of being buried by toxic waste, living with false dam alerts, being expropriated from their homes, living with contaminated air, drinking water polluted with heavy material, hearing rock detonation noise, cracks in the rocks houses due to explosions and rail traffic, in addition to the accelerated expansion of contamination of the new coronavirus, establishes in the population affected by mining a state of siege proper to the war. If nothing else, the competition for narratives in support of those affected and " Tragedy Industry" and "Show Disaster-Crime" promote

workers and citizens with a state of emergency, where they are constantly and systematically denied participation in the decision-making processes of their own lives.

It is possible to find a pattern of reification, whether in employees or affected. To the workers, they are just cogs in a machine made to exploit the colony's natural wealth for the benefit of the dominant foreigner. The population, on the other hand, board pieces disputed by "outsiders" who, without social ties to the territory, claim compensation and narratives of an experience they have not lived. This field is disputed by technical advisory institutions, Public Prosecutors, entities and companies created by Vale, which constantly deny the voice and participation of people, families and communities affected and massacred by all the violence in the territories.

Death policies aimed at extracting mineral resources to generate even greater profits, with close intertwining and connivance of the State and Governments, are characteristic practices of the war machines explained by Mbembe (2015).

Faced with so many attacks, those affected manifest at all times the need for resistance, confrontation and the elaboration of effective techniques to combat this predatory force. The solutions developed by them are reconciled with the proposals of Mbembe (2015) to overcome these death policies and manifest the right to live.

The communities affected by mineral exploration and Mining-Dependence emphasize that the resistance actions take place in the identification of the strategies used by the big undertakings to demobilize the territory; in the unification of those affected; in negotiating collective; expanding the network of affected people; the greater dissemination of successful experiences in negotiations; intersectoral action and awareness of other territories.

The highlight the similarity between these practices of resistance to the Greek myth of Circe. This was a sorceress who used potions, spells and banquets to bewitch people. In this case, represented by the mining company and its offers in cash or power to silence the claims. In the aforementioned myth, the form of resistance to these enchantments came from Hermes and Ulysses, with an attempt to understand and alert about the risks, which, unfortunately, were not heard. As a way to help Ulysses, Hermes provided him with an antidote and taught him how to use it. When necessary, Odysseus used the antidote and managed to free his fellows who were under his spell.

We hope that this research can serve for future debates and reflections on the practices of necropolitics developed in territories and communities, whether in the mineral sector or other contexts historically marked by the phenomena of labor exploitation, disrespect to the diverse and multiple modes of existence/resistance .

The rescue, visibility and dialogue with other ways of thinking about organizations, organizing, producing, living and accessing markets are, in our view, essential for more consistent training in the field of Administration. Researches also based on the perspective of those who are made invisible, labeled anti-progress and anti-development and stuck to a way of being and existing that

should not resist "Mining Dependence" and the necropolitics of large mining corporations, are urgent and necessary.

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Women With Mental Illness

Stigma and Career

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Abstract

Estimates by the World Health Organization (WHO) show that depression and anxiety have a global economic impact of one billion dollars a year and that around 450 million people worldwide meet the criteria for the diagnosis of some type of mental disorder, of which 80% live in low and middle-income countries. This study aims to investigate how the stigma of mental illness impacts the insertion in the labor market and the development of women's careers. For this, the Sustainable Development Goals (SDGs) was taken into consideration, especially SDGs 5.1 and 5.5 (by 2030, achieve gender equality and empower all women and girls); 8.5 (achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value); and 10.2 (empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or another status), when seeking to contribute with accelerating progress towards the SDGs in times of crisis. The context of the Covid-19 pandemic and its social isolation measures are considered, as this directly affects the health and well-being of the people involved, their families, and society in general. A systematic review of the recent literature was carried out, analyzing the articles indexed in the Scopus and Web of Science databases, following the recommendations of the Prisma method. The results revealed low academic production on the theme, with the discussion being circumscribed in the Health field and the countries and institutions of the Global North. Results from the corpus of the analysis indicate that the consequences for women who suffer from stigma related to mental illness are serious and their discrimination causes innumerable damages, such as low self-esteem, low self-confidence, and low quality of life. We know how impactful these damages are, as they usually end up reflecting on an entire family, often headed by this woman. It is thus needed that society changes its outlook and practice, aiming at the acceptance of diversity and social inclusion through work. Based on the identified gaps, a research agenda on the topic in the field of Administration is proposed, especially focused on the area of Human Resources Management and Labor Relations.

Keywords: Mental Illness, Stigma, Career, SGDs, Women

1. Introduction

Estimates by the World Health Organization (WHO, 2017) show that depression and anxiety have a global economic impact of one billion dollars a year, and that around 450 million people worldwide meet the criteria for the diagnosis of some type of mental disorder, of which 80% live in low and middle-income countries (Giraldi, 2021). It is indisputable that mental health is an inseparable part of health as a whole and that themes related to mental health have been attracting the attention of the population and institutions, whether public or private, especially at this time of the Covid-19 pandemic. In an official statement on May 14, 2021, Devora Kestel, director of the mental health department of the World Health Organization (WHO) stated that "isolation, fear, uncertainty, economic chaos - they all cause or can cause psychological distress" and that "the mental health and well-being of entire societies have been seriously impacted by this crisis and are a priority to be urgently addressed" (UN, 2021c).

The global guidelines have become daily in the pandemic and, through them, people have managed to act more cautiously and safely. Similarly, in a global pact to tackle poverty, fight inequality and injustice, there is the Sustainable Development Goals (SDGs), also known as Global Goals, which address 17 interconnected goals, which address the main challenges of development faced by people around the world (UN, 2021a). With the Covid-19 pandemic, these inequalities are also becoming even more pronounced, especially in developing countries, which points to an urgent review of this global agenda, of the SDGs and its 169 goals so that sustainable balance is achieved in all areas.

This study covers the ODS 5.1 e 5.5 (by 2030, achieve gender equality and empower all women and girls), 8.5 (achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value), e 10.2 (empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status), by aiming to contribute to accelerating progress towards the SDGs in times of crisis (UN, 2021a).

Considering the exposed scenario, this study aims to investigate how the stigma of mental illnesses impacts the insertion in the job market and the development of women's careers. In particular, the Covid-19 pandemic context and its social isolation measures are considered, as this directly affects the health and well-being of the people involved, their families, and society in general. To this end, a systematic review of the recent literature was carried out, analyzing the articles indexed in the Scopus and Web of Science (WoS) databases.

This study is structured in four sections, in addition to this introduction. The theoretical section discusses women's mental health and professional careers and stigma. The third section presents the methodology, detailing the procedures used for the collection and analysis of the research *corpus*. The fourth section presents the qualitative and quantitative analyzes of the data collected and their

discussions. In the end, in the fifth section, discussions are exposed and suggestions for future research in the field are pointed out.

2. Theoretical Framework

For the World Health Organization (WHO, 2004), mental health refers to well-being in which the individual develops his personal skills, manages to deal with the stresses of life, works productively, and is able to give his contribution to his/her community. In this sense, Almeida-Filho, Coelho, and Peres (1999) explain that mental health means a healthy *socius*, implying in employment, job satisfaction, significant daily life, social participation, leisure, quality of social networks, equity, and, consequently, quality of life. For the authors, mental health is also linked to an emancipatory agenda of the subject, which is unavoidably political in nature.

In turn, Safra (2004) discuss that the phenomenon of globalization and the consequent changes in social relations has resulted in new forms of psychological suffering that are not restricted to only a restlessness, but points to processes of fragmentation of the being and the fragility of one's own psychic constitution. For the author, the current world presents situations that lead the human being to become ill in his/her possibility of being: he/she lives today fragmented, decentralized from himself/herself, unable to find, in culture, the elements and the necessary support to achieve the overcoming of their psychic difficulties (Safra, 2005).

Debord (1997) explains that we live in a society of the spectacle, which understands suffering as a synonym for shame or as something that needs to be medicated and covered up immediately. There is a demand for happiness that is part of the goals of the consumer society (Bauman, 2008), which culminates in the spread of antidepressants and anxiolytics, resulting in the hyper-medicalization of malaise (Coutinho, O'dwyer, and Frossard, 2018). Thus, those who suffer from some psychic “malaise” tend to be held responsible and stigmatized for their failures (Tavares, 2010). In a culture that does not respect mental illness, comparing it to human failure, it is common for these people to suffer discrimination, whether from employers, coworkers, friends, and/or family members (Zanonato, Costa and Aosani, 2021). Furthermore, there is the information from the WHO (2017) that the lack of support for people with mental disorders and the fear of stigma makes it difficult for these individuals to access the necessary treatment to have healthy and productive lives.

Psychiatric epidemiological data show that, in general, women are the majority in mental health service statistics (Busfield, 1996). The diagnoses also list which symptoms and disorders are more common for women, such as anxiety, depression, and eating disorders (Zanello, 2014). The formulation and execution of public mental health policies also focus on women (Maluf, 2010), as well as the actions of the pharmaceutical industries (Zanello 2014). The career woman, in addition to the already known wage inequality concerning men and their precarious, informal, and unstable jobs is also burdened with several overlapping roles, which involve unpaid and socially unrecognized activities, such as caring for

family members, and household chores (ECLAC, 2009). The overload can favor or aggravate dissatisfaction and psychological suffering, opening spaces for the emergence of mental illnesses. The consequent impossibility of continuing to exercise their professional and family activities due to illness, leads to discrimination at work and in social life, stigmatizing women.

From Greek, the word "stigma" means sting, made with a red-hot iron on the arm of slaves, marginal, and criminals, representing social disgrace. It was not related to mental disorders, but associated with shame, humiliation, and devaluation, at which point stereotypes emerged, patterns established by common sense, based on the lack of knowledge on the subject (Rocha, Hara and Paprocki, 2015).

For Goffman (1980), the acquired stigma refers to a physical, psychic, or character attribute, which makes the subjects different or even inferior to the eyes of others considered "normal". After analyzing how victims of stigmatization feel about themselves, the author states that this attribute, considered "abnormal" by the defined "normal" society, is reproduced by an oppressive capitalist system that, indirectly, imposes the rules and conduct that individuals must follow. Upon defining stigma not only as a personal attribute, but also as a form of social designation, Goffman clarifies that its manifestation is extremely harmful to people with mental disorders, since people without mental disorders usually use specific terms of stigma in the speech daily (as, for example, retarded, crazy) as a source of exclusion, without thinking about its original meaning (Goffman, 1980).

In the same way, Fernandes (2006) argues that stigma is related to insufficient or inadequate knowledge, which leads to prejudice, discrimination, and social distance from the stigmatized person. For the author, stigma represents an obstacle both to social inclusion and to the strengthening and construction of identity, because, in addition to the prejudice inculcated in society, there is the prejudice of the person with a mental disorder to himself. Recalling that work, a place where the stigmatized subject is also seen as undesirable, is equally seen as an edifier of the individual identities (Molinier, 2004; Dejours, 2008, 2012).

This view has complex historical and cultural roots, which greatly hamper the efforts of governments and civil society in the process of social inclusion and identity re-signification of people with mental disorders (Volz et al., 2015). Thus, women who suffer from mental disorders end up being triple neglected in the labor market: firstly, due to the stigma of the disease (Goffman, 1980) and, secondly, due to the lack of training (Martins, 2009) and, third, simply for being a woman (Fraga and Rocha-de-Oliveira, 2020).

In this process of exclusion and stigmatization of women with mental disorders, the stigmatized persons tend to show that they apply on themselves the same beliefs supplied by the self-appointed "normal" society; that is, as they are labelled and discriminated, they feel the inner marks and shame of these stereotypes (Goffman, 1980). Fear, shame and the feeling of devaluation make the carriers of mental disorders feel incapable of being productive, both in the cultural and the economic points of view.

Martins (2009) points out that, if before the relevance of work in the scope of mental health denoted a moral norm, entertainment, or therapeutic component, nowadays it has acquired a new meaning: those who were previously seen simply as patients in treatment, begin to be seen as workers (Martins, 2009). Often, the fear of being rejected and discriminated against causes a woman who has or has had a mental illness to hide behind a cover. This is because, when assuming her moral career as a person with a mental disorder, she ceases to be "normal" and becomes a "diminished" one, devalued, and identified by stigma (Volz et al., 2015).

It is worth mentioning the still little explored concept of ableism. These social standards that define who will be stigmatized or who will be part of normality, with people with disabilities being part of the group of stigmatized people, characterize the so-called ableist vision, which designates them as not capable of effectively participating in society (Mik-Meyer, 2016; Brown and Leigh, 2018; Giese and Ruin, 2018). Thus, ableism is always associated with stigma, prejudice concerning the abilities of people with disabilities.

About ableism, Campbell (2001, p. 44) conceptualizes the term as "a network of beliefs, processes, and practices that produce a certain type of self and body (the body pattern) that is designed as the perfect (...)". According to the author, from a ableist perspective, disability is understood as a diminished state of human beings. Shortly, one can define ableism as a discriminatory attitude that sees people with disabilities unfit for work and unable to take care of their own lives. It alludes to a prejudiced posture that hierarchizes people according to the adequacy of their bodies. Due to the phenomenon of ableism, people with disabilities are generally treated as incapable - to produce, to work, to learn, to love, to care, to feel desire, to have sex - bringing the demands of the movements of people with disabilities closer to other social discrimination such as sexism, racism, and homophobia (Campbell, 2019).

The mental illness is debilitating, temporarily or permanently, for work, relationships, and social life in general. Thus, the concept of ableism becomes relevant for the discussion, since the stigmatization of the mentally ill makes him seen as incapable of carrying out daily and productive activities. Since ableism is an a priori judgment of a subject's abilities or disabilities, there is no room for him/her to prove the opposite (Campbell, 2019). The stigma is constructed and reproduced socially and serves as a cage for the protection of beliefs, or as a deposit of characteristics and ways of being that we do not understand and prefer to keep away from our existence. Stigma and ableism are surely driven by many different reasons, but the mechanism always seems to be the same: the exclusion.

The discussion on the insertion of women with mental suffering in the labor market needs to be carried out through broad and interconnected concepts, such as diversity, inclusion, capacities/ableism, stigma, and respect, which refer to the readiness of societies to welcome. The labor market and the organizations are an active part of society's discussions and demands. In the last decades, movements for the identity

struggle have potentiated debates and actions aimed at the inclusion of diversities. The plural is important given another basic concept: that of intersectionality.

Created by Crenshaw (1989), the term intersectionality came up to designate the interdependence of power relations of race, sex, and class, referring to the movement of the late 1970s known as Black Feminism, whose collective criticism turned from radical way against white, middle-class, heteronormative feminism. Bilge (2009), defines intersectionality as a transdisciplinary theory that aims to apprehend the complexity of identities and social inequalities through an integrated approach. It refutes the confinement and hierarchy of the main axes of social differentiation, which are the categories of sex/gender, class, race, ethnicity, age, disability, and sexual orientation. For the author, the intersectional approach goes beyond simply recognizing the multiplicity of systems of oppression that operate from these categories and postulates their interaction in the production and reproduction of social inequalities (Bilge, 2009).

3. Methods

The systematic literature review is employed in several areas of knowledge as a scientific method to bring general information on a given theme (Moher et al., 2009). It aims to identify, select, and critically evaluate relevant research that helps to understand how the stigma of mental illness impacts the insertion in the labor market and the development of the career of women.

The *corpus* of this study consists of articles indexed in the Scopus and Web of Science (WoS), both the largest international bibliographic databases with peer review and with strict indexing criteria. The data collection on these databases was carried out in May 2021.

As a search strategy, a combination of terms was used based on the following keywords: “Career”, “Mental Illness”, and “Woman/Women”. For the crossing of keywords, we used the search by topic terms (TS: title, summary, keywords) with the support of the Boolean operator AND, who located the articles that specifically mention the terms searched, restricting, from this way, the amplitude of the search.

The following research refinements were made, seeking to increase the reliability of the collected data: only records identified as articles and published in the last ten years were considered (time frame: 2011-2020). In this collection stage, 32 articles were found, being: 18 articles in Scopus; and 14 articles on WoS. Regarding the results, it is noticed that the Scopus database showed greater participation with articles aligned with the themes of interest in the present study. It is mentioned that indexing documents in databases usually takes some time. As a result of this process, articles may have been indexed in the searched databases after the date of collection, especially articles approved in the year 2020.

In order to present the systematic review and meta-analysis, the Prisma (Moher et al., 2009) recommendation was followed, which consists of a checklist with 27 items and a four-step flowchart.

Through the flowchart (Figure 1), the numbers of articles screened, evaluated for eligibility, and included in the qualitative and quantitative syntheses are presented. The main reasons for the exclusion of articles in the review stages were non-adherence to the theme and the research corpus.

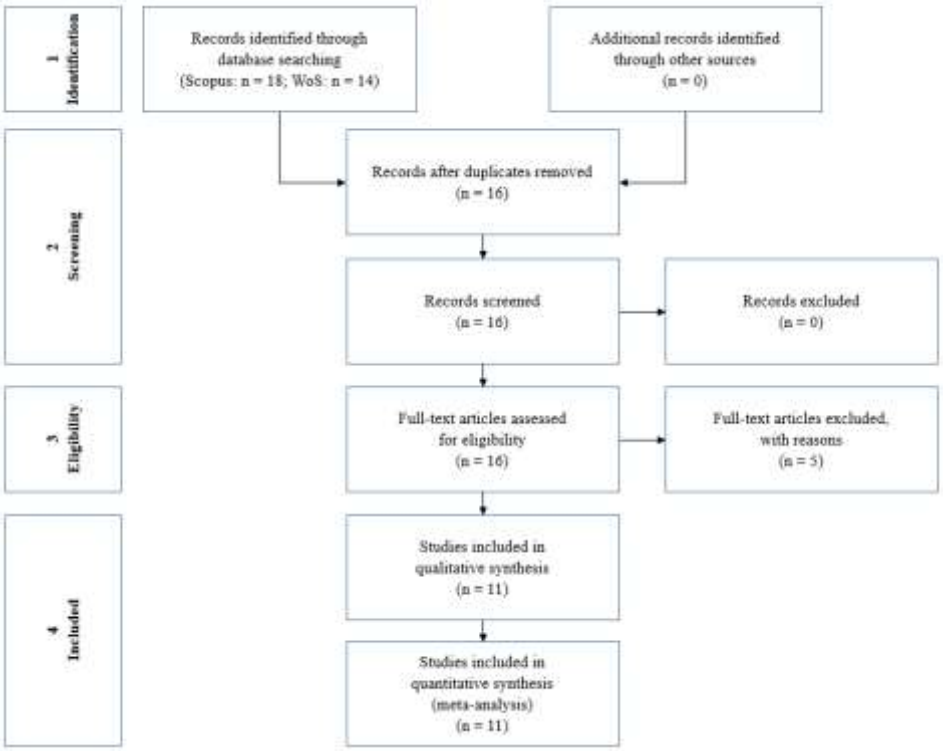

Figure 1. *Flowchart with the steps of the systematic literature review*

Source: Prepared by the authors according to the model provided by Moher et al. (2009).

The analyzes of the articles were performed with the aid of the Mendeley software (data grouping, checking of duplicate documents), Microsoft Excel (graphs, tables, statistics), and NVivo (word frequency query). The articles selected for eligibility were cataloged on a spreadsheet in the Excel software according to the following variables of interest: temporal distribution; keywords; the number of authorships; distribution of articles by country and related institutions; distribution of articles by journals and scopes/study area. The following section presents the analyzes and discussions of the collected data.

4. Results and Discussion

Following the recommendation by Prisma (Moher et al., 2009), this section presents the qualitative and quantitative synthesis of the research corpus, discussing the contributions of articles on the themes and describing their bibliometric characteristics, according to variables of interest.

Figure 2 shows an oscillating behavior in the number of published articles that address the themes of the present study, with an average of almost 2 articles per year. The peak of publications is in the years 2012 and 2018, with 3 articles each, which indicates the lack of research in the area.

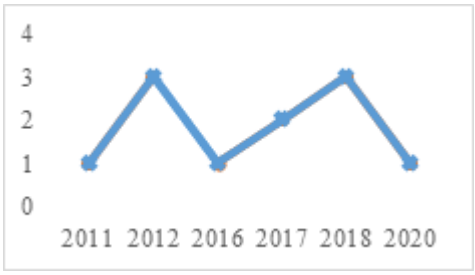

***Figure 2**. Temporal distribution of articles*

Source: Prepared by the authors according to research data.

We found out that most of the papers were written in co-authorship, by two (27,3%) or more authors (45,5%). It was noted that the authorships did not repeat themselves, this may prove that those studies stemmed from a punctual and specific interest that did not have a follow-up. Taking into consideration a ten-year-time period, the studies can be characterized as punctual and restricted to specific realities, we can extrapolate that they were conducted in known environments with facilitated access to data. These characteristics do not necessarily mean that there were limitations, they can be useful to explore different situations and contexts where mental health is relevant to investigate the labour conditions. They can also provide models for similar studies in the future, once the problems of mental health will be well diversified and inspiring. However, we can affirm, after analyzing the papers, that the studies are in scattered order and restricted to specific realities. Nevertheless, the present study may hold an ample vision regarding what has been researched on the theme and what should complement it.

Seeking to know where the articles were produced, the distribution of publications by country and linked institutions was verified. This information was extracted from the articles based on the mini curricula informed by the authors. The countries highlighted by the number of mentions are: United States (37.5%), Spain (11.3%), South Korea (7.5%), Australia, Netherlands, and New Zealand (5% each). In turn, the featured institutions are: “Harvard Medical School” (7.5%), “University of Alabama at Birmingham” (6.3%) and “University of Washington” (6.3%), located in United States, and also “Konkuk University” (6.3%), located in South Korea. It was also observed that there are authors who have links with more than one university (2.9%), and others who have ties to private companies and/or hospitals (18.6%). In particular, what explains a large number of countries and institutions is the article by Auerbach et al. (2016), which has thirty-six authorships.

Table 1 shows the ranking of journals and their scopes where the articles were published. Note the presence of journals from the United States (36.4%) and England (27.3%), which comprise more than half of the published articles. In a certain way, this result indicates a relationship between the authors' country of origin and the journals. It is observed that the articles, for the most part, were published in journals in the areas of Medicine and Psychology, but some of them in the area of Social Sciences. This concentration in the areas can be explained by the predominance of empirical articles carried out with people as subjects of research.

Table 1. *Distribution of articles by journals and scopes/study area*

Source: Prepared by the authors according to research data.

Journal	Country	Scope/Study area
British Journal of Guidance & Counselling	England	Psychology: Applied Psychology
Canadian Bulletin of Medical History	Canada	Medicine: General Medicine
Criminal Justice and Behavior	United States	Social Sciences: Law; Psychology: General Psychology; Medicine: Pathology and Forensic Medicine
Fundación Educación Médica	Spain	Social Sciences: Education
Gynecologic Oncology	United States	Medicine: Obstetrics, Gynecology and Oncology
Indian Journal of Psychiatry	India	Medicine: Psychiatry and Mental Health
Journal of Australian Studies	Australia	Arts and Humanities: History and Literature and Literary Theory; Social Sciences: Cultural Studies, Sociology, Political Science and International Relations
Journal of Southern African Studies	England	Social Sciences: Sociology, Political Science, Geography, Planning and Development; Arts and Humanities: Miscellaneous
Medical Education	United States	Education for health care professional
Psychological Medicine	England	Medicine: Psychiatry and Mental Health; Psychology: Applied Psychology
Social Science & Medicine	United States	Social science research on health

Regarding the approaches of the articles, a predominance of studies in the area of Health (Phillips and Clarke, 2012; Turner et al., 2017) was observed, especially those focused on the incidence of health problems, including mental, resulting from stress and the consequent reduction in the production of these professionals, focused on people management practices. Another highlight was some studies on the situation of incarcerated people (DeHart, 2018; Piper and Nagy, 2018), which discuss the motivation for crimes committed and the possible influence of previous mental illnesses on these transgressive attitudes.

The study by Turner et al. (2017) aimed to assess the impact of depletion on the productivity of gynecological oncologists during the first half of their careers. The data obtained were used to estimate the probability of burnout for male and female gynecological oncologists, the occurrence of depression, alcohol abuse, and early retirement. The authors report that burnout rates were significantly higher among women, 41% in comparison to 27% among men. They also experience sexual and moral harassment, wage inequality, decreased academic promotion, and stress-related to society's expectations for them to play their multiple roles. For the authors, this is a serious problem, given that the estimate is that, in a few years, 80% of professionals in this specialty are women.

As for the studies on the situation of incarcerated people, mention is made, for example, of the research, carried out by Piper and Nagy (2018), which investigates the criminal careers and paths to the prison of 6,042 convicted women in Victoria between 1860 and 1920, and the risk factors associated with subsequent recurrence. His criminological studies found that the paths to prison differ between men and

women, given factors such as drug abuse, mental illness, family networks, migration, geographic mobility, urban location, socioeconomic circumstances, and past victimization more strongly associated with inmates. The results suggest that, although many of today's risk factors have historically been present, there have been considerable changes over time.

It was noted the presence of articles (Gilaberte et al., 2012; Southern and Miller, 2012; Eisenberg-Guyot et al., 2020) that deal with the inferior position of women, with or without mental illness, in relation to men. This inferiority is also seen in labor relations, as discussed in several of the analyzed texts. In two of them (Brookes, 2011; Davis, 2018), professional women were only recognized for their great contribution to the area where they worked years after their death, and one of the justifications pointed out for this was their "madness".

As an illustration, the studies by Brookes (2011) and Davis (2018) are cited. In his study, Brookes (2011) explores Maude Abbott's internationally significant career in medicine and her parallel commitment to caring for her sister with mental illness. The research reveals the difficulties faced by an ambitious Canadian in the medical career from 1890 to 1920 and suggests that it was much more difficult for a female doctor to separate public and private life than for male doctors. Finally, Brookes points out that, although sometimes less qualified, men were recognized with promotions and financially much more than women with better qualifications.

In turn, Davis (2018) study examines the turbulent relationships of South African writer Bessie Head with her editors in London and New York, during the process of publishing the work "A Question of Power" in 1973. The author traces the trade negotiations held in Serowe, Botswana, and the difficulties that Bessie Head faced in getting the manuscript accepted, maintaining her literary career, and her barriers to obtaining royalties or remuneration. According to the author, Bessie Head's biographers attributed her battles to her volatile nature and mental illness, but she also weighed the fact that she was an African woman. In the end, her work became one of the most acclaimed novels. In 1981, the work was classified by Black Scholar magazine as the eighth of the "15 most influential books of the decade", and was listed as one of the "100 best books in Africa" in 2002, being translated into French and Spanish and entered several new pocket editions. For Bessie Head, however, the publishing process was one of frustration and disappointment that persisted until her death. The conflicts that have occurred between Bessie Head and her editors provide insight into the hidden power structures and inequalities endemic in the Anglo-American "writing world", which is repeated in so many other "worlds".

The concern with the development or worsening of mental illnesses during the university and professional training years is brought up by Auerbach et al. (2016). The authors divided the research participants into two groups: university students with mental illnesses developed before and after enrollment at the university and the results were also stratified by gender. The comparison between pre and post-matriculation served to detect and prevent possible aggravations during the courses, as well as

to establish how many students received treatment for their problems. The previous presence of mental illnesses increases the concern about possible aggravations after entering university, marked by new demands and resulting attrition. The analyzes carried out on samples of men and women, found important differences between the groups, such as, for example, depression was the most frequent mental illness among women. Avoiding the potentiation of mental illness at the beginning of the university trajectory, can affect the permanence of university students in the courses and in the prevention of compromises that may interfere in the future professional career. The consequences for life at work can be innumerable: low qualification and remuneration, maladjustment, aggravations, absenteeism, etc. These are conditions that can lead to career dissatisfaction, stigma, and exclusion from the job market.

Other studies deal with the influence of prejudice in the performance of professional activities. Jung et al. (2017) examine the perception, through an inventory, about mental illness among employees of health institutions. The hypothesis is that the professionals' conceptions and perceptions about mental illness interfere in the care and recovery of patients. This study was based on the stratification of data on prejudices by gender, age and brings an interesting discussion on stigma. In the same vein, Phillips and Clarke (2012) deal with the perception of medical students towards teachers who express respect or disrespect for differences, whether in classes or in patient care. Teachers are role models in the training of students and the way they position themselves can make them change their own attitudes and, with this, influence their professional future.

The mentally ill women themselves are the focus of the study by Southern and Miller (2012), which collected life stories and, mainly, the career trajectories of fifteen New Zealand indigenous women. It is a study that brings contributions to cultural diversity and the centrality of work to the identity of women with mental illness.

Guiding the final reflection of the qualitative discussion, a cloud of keywords was elaborated, extracted from the articles, and analyzed by their frequency, seeking to know which terms are most cited. Figure 3 shows that the terms most cited by the articles are in the center of the map and that, the longer the term, the more mentioned it was, highlighting: “Mental Illness” and “Stigma”. Interestingly, there were no articles that dealt with the Covid-19 pandemic effects on mental health. This is believed to have occurred due to the aforementioned time required for the publication of new research.

Other central terms for the debate are also highlighted in Figure 3, such as “Education” and “Violence”. It can even be inferred that education and violence are proportionally inverse terms: the more education a society has, the less violence and discrimination it causes/suffers. Education, therefore, is related to the aforementioned readiness to accept differences, which depends on how, for example, mental health is discussed and included in different countries and contexts. In addition, at least three articles (Phillips and Clarke, 2012; Auerbach et al., 2016; Turner et al. 2017) brought the relevance of discriminatory

behaviors or not of mental health, in situations of university education or the beginning of a professional career.

"Identity" and "Print Culture" are also connected, as accepting the identities of individuals includes accepting their differences. The study carried out by Southern and Miller (2012) on indigenous women from New Zealand is an example of how much culture and identity have an important position in labor relations. "Botswana" and "South Africa", mentioned in the article by Davis (2018), refer us to intersectionalities since the discriminations and stigmas add up, therefore, a woman from peripheral countries has her difficulties amplified. It is noted that the debate on the themes of this study has particularities, since it is addressed in several studies and from multiple perspectives.

***Figure 3**. Keywords frequency cloud*

Source: Prepared by the authors according to research data.

Finally, there was a lack of studies in Social Sciences and especially in Administration that addresses the theme of stigma linked to women with mental illnesses and the consequent barrier that this causes for their insertion and permanence in the labor market. There were also no articles that addressed the impacts caused by the Covid-19 pandemic, which made it even more difficult for these women to enter the labor market and their living conditions as a whole.

Although men represent between 60% and 80% of victims by Covid-19, women are more severely affected by this disease, as pointed out in the report "Women at the heart of the fight against the Covid-19 crisis", released at the end of March 2021 by UN Women, an entity of the United Nations Organization for gender equality and empowerment (UN, 2021b). They are more exposed to the risk of contamination and to the social vulnerabilities resulting from the pandemic, such as unemployment, violence, lack of access to health services, and increased poverty, which most directly affects women with mental illnesses - particularly in peripheral countries, being Brazil an example.

In addition, the lack of discussions on ways to prevent and end this prejudice was confirmed by reading the articles. This makes it difficult to reach the ODS 5.1 e 5.5 (by 2030, achieve gender equality and

empower all women and girls), 8.5 (achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value), e 10.2 (empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status), especially in this pandemic period (UN, 2021a).

5. Conclusions

The proposed revisionary research made a survey of publications on the stigmatization of women with mental illnesses in the labor market, without being limited to the synthesis of the results found in the ten-year time frame. The study also sought to reflect on the contexts and themes related to those proposed, from the qualified reading of the articles, in order to expand and contribute to the theoretical debate on the theme.

The data collection and analysis are distinguished by their attention to relevant academic and social topics, without disregarding the importance of qualitative and quantitative analyzes, carried out with methodological rigor. The methodological procedures followed criteria for the selection and reading of the texts, developed in defined stages, for the treatment of the results.

It was evident that the authors of the selected papers explore themes in research in which the data are specific and, therefore, not generalizable. In addition, they published only once on the topic, configuring sparse studies on specific realities. Thus, the present survey provides not only the panorama of what was already researched in the period, but also possible gaps that can be addressed in future studies.

From the studies selected and analyzed, the concern with the training of sensitive professionals to work with the differences, especially those resulting from psychological suffering, in the articles that deal with the training of university students, doctors, and other helping professions. Other articles address the point of view of people with mental illness or their caregivers, trying to reveal from the inside how much this suffering has echoes in social reality, which contributes to their relief or aggravation. Incarcerated people receive attention when the topic is mental health, and research in this context has provided insights into the previous psychological distress-causing suffering, as well as the suffering resulting from prolonged confinement. The latter case can be associated with the current experience of social isolation due to the pandemic.

Social inclusion through work, our focus, plays an extremely important role in the process of reducing social stigma through mental health. In addition, it is an essential condition for guaranteeing the human rights of these women, as well as accelerating towards progress and the achievement of the aforementioned Sustainable Development Goals, foreseen by the Global Agenda. According to the UN document itself (UN, 2021b), "the pandemic has had and will continue to have a major impact on the health and well-being of many vulnerable groups", and "women are among the most affected".

The results show that the consequences for women who suffer from the stigma related to mental illness are serious and their discrimination causes innumerable damages, such as low self-esteem, low self-confidence, and low quality of life. It is known how much these damages are impactful, since, in general, they end up reflecting on an entire family, often provided by this woman. Society must change its outlook and practice, aiming at the acceptance of diversity and social inclusion through work.

Finally, given this complex and integrated scope, this study also sought to identify research gaps that can be considered in future works in the area, bringing them to the academic debate, such as the impacts of the pandemic on the insertion of women as mental illnesses; analysis of the other social markers of difference - such as class, race, and sexuality - intersected with the theme of mental illness; changes related to inclusive school and university education and their impact on the labor market; and, the role of Human Resources managers in the inclusion and maintenance of women with mental illnesses in the organizational environment.

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Gender path in Italian universities: evidence from University of Salerno

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Abstract

The aim of this contribution is to analyse the issue of gender equality in Italian universities in the light of the initiatives undertaken in recent decades and the changes that have taken place following the spread of the Covid-19 pandemic in the management of daily life times with reference to family commitments and to professional responsibilities. In particular, the efforts made at the University of Salerno see welfare devices as a fundamental element for the affirmation of an innovative model for the management of human resources, culture and business processes, with a view to equal opportunities. In fact, although we are aware of the need for work-life balance policies to go beyond the narrow channel of the female universe, we cannot overlook the powerful contribution they can offer to resolve the gender gap.

The University of Salerno recently adopted a plan for gender equality that outlines a series of concrete actions aimed at ensuring full participation of men and women in scientific research and in the organizational life of the university. An initiative that ensures equal opportunities improves people's well-being and, finally yet importantly, makes the University of Salerno a model of "best practice" on a national and European level.

Keywords: Gender equality, Organizational well-being, diversity management

Background

The pathway towards equal opportunities in the Italian national system shows a gradual progress that reflects the legislator's attempt to respond to the profound changes in the economic, social, cultural and political fields that have affected citizens of both sexes to varying degrees. It was started at the end of the nineteenth century, for historical and cultural reasons, with considerable delay compared to other European countries.

It was started at the end of the nineteenth century, for historical and cultural reasons, with considerable delay compared to other European countries and has continued over the years through numerous regulatory interventions aimed at removing obstacles to the full political, economic and social participation of women and other subjects vulnerable to forms of discrimination.

Despite the efforts made to affirm and implement the principle of gender equality, in Italy, the inequality between men and women continues to persist and to some extent to increase, also due to an increase in economic competition worldwide (Marcucci and Vangelisti, 2013). The latter, requiring an increasingly flexible workforce, creates a disadvantage especially for women, who are often forced to choose between family and career, due to the persistence of serious imbalances in family loads and the scarce flexibility of working hours and services for childhood (Gatti and Iannotta, 2014).

The same principle of gender mainstreaming, as a value to be pursued in all sectors of intervention, as codified in article 1, paragraph 4, of the Code of equal opportunities (legislative decree 11 April 2006, n.198), has not found so far an adequate level of application and, therefore, an exhaustive transversal recognition in the choices of economic and social policy (Directorate of Human Rights, 1998).

It remains limited to formal statements and there is no systematic approach to the matter.

Certainly, a highly critical aspect is attributable to a reduced degree of effectiveness of the rules, which reflects the degree of affirmation of the gender issue in the system of dominant values in society. Unfortunately, there is still a marked gap between the quality of the rules and their concrete application, between the principles affirmed in the regulatory texts and their impact on concrete situations, also due to a little diffused knowledge of the existing instruments.

The laws on reconciliation between life and work times, for example, addressing women above all, seem to assume that it is the woman who must try to reconcile childcare and work (Lombardo and Del Giorgio, 2013).

On the other hand, the same male worker is appreciated precisely in relation to his flexibility and therefore to the more time he can devote to work than the woman (Directorate General Internal Policies, 2014).

In essence, the conciliation did not produce significant results precisely because it concerned only the female gender, without questioning the distribution of tasks between genders.

Important factors such as raising women's educational levels have helped promote their participation in the job market and feed their expectations of personal fulfilment and professional success. Nevertheless, in Italy more than in other democracies, women find it difficult to translate the success achieved in education into the workplace.

The third annual report on the labor market in Italy states that "gender gaps remain high: half of women of working age do not work and almost one in five would like to work but cannot find a job" (Ministry of Labor and Policies social, Istat, Inps, Inail and Anpal, 2020).

A more accurate and significant estimate of gender inequalities is identified by the EU gender equality index (EIGE, 2019). This index, expressed through a score ranging from 1 (total disparity) to 100 (total parity), expresses the overall gap between women and men with reference to six areas: work, money, knowledge, time, power and health.

The estimated index for Italy is 63 points compared to the 67 points found among the 28 states of the European Union. More in detail, it is noted that the gender gap in Italy is 4.4 points lower than the EU-28 score.

The distinction according to the domains of analysis shows that Italy's scores are lower than those of the EU in all sectors, except for the health sector (88.1 points compared to 88.7 points in the EU- 28).

Gender inequalities are most pronounced in the areas of power (47.6 points versus 51.9 points in the EU-28), time (59.3 points versus 65.7 points in the EU-28) and work (63, 1 against 72 points in the EU-28). Less distant and in any case lower are the scores relating to money (78.8 compared to 80.4 points for the EU-28) and knowledge (62.2 compared to 63.5 points for the EU-28).

In particular, female employment in Italy is growing much slower than the growth recorded in other countries.

In fact, Italy is very far from the employment levels for women in countries such as Sweden (75.4%), Denmark (71.5%), Germany (71.5%).

It should also be emphasized that not only is the female employment rate in Italy particularly low, but women also perform part-time jobs and occasional jobs more frequently than men, work fewer hours and earn less (women earn 18% less. compared to men and 20% are at risk of poverty; in couples with children the earnings of women are 30% lower than that of men, and in couples without children it is 26% less) (Eurostat, 2020).

Furthermore, the gender gap is still accentuated in the distribution of time dedicated to care work and domestic activities, considered obvious, which make them visibly invisible and conspicuously represented in the so-called reproductive economy. Women who dedicate themselves daily for at least one hour a day are 81% while men represent only 20%. In addition, women to a greater extent than men take on the daily responsibilities of care and assistance for at least one hour for children, the elderly or the disabled (34% and 24% respectively).

There are also phenomena of occupational segregation (concentration of women in some sectors, lower wages, low qualifications and limited career prospects) which translate into significant factors of direct and indirect discrimination.

Even in the scientific and academic context, conceived as one of the most gender neutral fields, there are processes of segregation and gender bias. Within Italian universities, the female component is still significantly under-represented: compared to 12,303 full professors, there are 2,952 full professors. There are 19,676 associate professors while 7,575 colleagues (Ubbiali, 2021).

Looking at the most important positions, there is a lack of women at the head of universities not only in Italy but also at a European level.

Data from the European University Association show that in 2020, among 28 EU member states, only 15% are rulers (ranging from 9.5% in 2010 to 13% in 2013 and 14.3% in 2019). On a national level, there are directors in only six Italian universities.

Women also tend to abandon their academic and scientific careers more frequently before reaching a stable position.

There are also some areas in which the gap is very wide: this is the case, for example, of some scientific departments where women - professors and researchers - are less than a third of the total.

The processes of exclusion in the academic world are not found in a single barrier that manifests itself in the upper phase, but by multiple barriers and impediments arranged along the academic trajectories. Scientific research highlights new segregation phenomena precisely in correspondence with academic recruitment, new forms of asymmetries that risk marking the university (Ubbiali, 2021). These criticalities do not seem to be spontaneously absorbed in the short term. The scientific literature includes, among the factors contributing to gender imbalance, not only ideological beliefs and persistent stereotypes about the attitudes of the two sexes, but also unconscious biases, practiced by people of both sexes. Consolidated research also underlines that evaluation mechanisms, calibrated on people of only one sex, can contain implicit biases that prevent the advancement of the other sex (Pettit, 2021; Prandini, 2012; Solera and Bettio, 2013 ; Supino, 2016).

This situation is not sustainable, both for reasons of fairness towards scholars and above all for reasons of efficiency: the important female contribution in the production of knowledge is renounced.

Furthermore, the gender difference is a cross-cutting issue that involves both the methods of research and its contents, and which therefore requires adequate recognition in the definition of the scientific disciplinary sectors.

As the policies indicated by the European Commission also suggest, it is necessary to intervene with concrete actions for gender equity, including with a discussion aimed at correcting the gender biases that act in academic evaluation practices by creating a sort of gender filter, invisible, in access and academic progression (EU, 1996). Furthermore, in times of crisis, as the recent Istat data have sadly shown, above all female employment and labour are sacrificed (Istat, 2020; EU, 2020).

The current health emergency from COVID-19, by reshaping the times of life and work and the same urban geography, has further aggravated the situation of women and tragically highlighted the weaknesses of the Italian family welfare system.

The measures adopted by the Italian government to deal with the health emergency, the serious economic crisis that ensued, have resulted in an extra-ordinary remodelling of the instruments and legal regulations in use. Together with social distancing and housing constraint within the perimeter of the home, ways of organizing work (smart working) and forms of teaching management (smart schooling) have been imposed, united by the requirement of "distance" from the places where traditionally work and education are carried out. In this scenario, working mothers suddenly found themselves forced to extricate themselves, in the home environment, between the sudden increase in the care, education and education of children and a new way of organizing work, defined as "agile" in compliance to the legislative discipline from which it was borrowed (law no. 81/2017). However, in the deregulated form introduced by the emergency legislation, it has in fact ended up betraying the original rationale of agile work, aimed at favouring the reconciliation of life times with those of work.

In reality, the smart working introduced during the pandemic was characterized by an evident "rigidity" on the times and places of performance, functional to ensure the continuity of work performance. This was all the more true for working mothers, struck by the "overload" of a continuous run-up between being worthy of career advancement and being good mothers, frustrated by having to guarantee high standards of individual performance, despite the increased children's care, assistance and education needs (CGIL, 2020)

The aim of this work is to analyse, in the light of the changes that have occurred during the pandemic, the innovations and solutions undertaken by the University of Salerno (UNISA), aimed at overcoming gender inequalities.

1. The UNISA approach to gender equality

The University of Salerno has always promoted policies in support of equality and equal opportunities, from the establishment of the Equal Opportunities Committee (in 1999) to the appointment of the first Delegate of the Rector for equal opportunities (in 2000), to the establishment of a Interdepartmental Observatory for Gender Studies and Equal Opportunities (OGEPO) in 2011, whose Board created in the University the basis for the establishment, in 2014, of the CUG (Single Guarantee Committee).

In recent years, the University has implemented and planned multiple positive actions aimed at involving all social actors in order to direct the attention of the latter to the "value" generated by diversity. Among these, it is enough to mention the establishment of a territorial network with the aim of spreading a culture of equality and equality, which, while respecting differences, includes their specificities. Particularly active in recent years has been, in fact, the design of educational paths for the

affirmation of a gender culture that gives full citizenship to differences and eliminates all forms of violence and discrimination.

The strategic path undertaken by the University is aimed not only at highlighting the cultural changes taking place, but is aimed, above all, at attenuating the differences between men and women as regards needs, conditions, paths, life opportunities, work and participation in decision-making processes, as well as demonstrating that policies are not gender neutral but, on the contrary, have a differentiated impact on men and women. In this context, an important role is played by the Gender Report, which the University of Salerno has endowed with, which represents an important tool for promoting and disseminating gender culture. It is a very important reporting tool for the gender mainstreaming of an organization because it is based on the need to be transparent with respect to study, research and work opportunities within university life as well as the desire to promote an ever wider awareness of inequalities that still exist, in order to overcome them through the assumption of specific responsibilities (Unisa, 2016).

The UNISA BdG highlighted a series of critical issues, largely common to other universities. In fact, the gap between the adequate female presence in the low levels and the lack of presence in the high levels persists. In particular, the scarce presence of women in the disciplinary sectors of S.T.E.M.

To reduce the disparities highlighted by the budget and overcome the criticalities present, the University of Salerno has adopted, since 2018, a plan for gender equality (GEP) which outlines a series of concrete actions aimed at ensuring full participation of men and women to scientific research and to the organizational life of the university.

GEPs have become the European Commission's main tool for addressing gender inequality in research organizations, where horizontal and vertical gender segregation is limiting the full participation of women in both research and leadership positions.

In fact, the effectiveness of the GEP is widely recognized as a strategic and operational tool to facilitate the identification of the most suitable legal, organizational, economic and social framework for implementing gender mainstreaming in practice.

UNISA's GEP was developed as part of the Horizon 2020 Project "R&I Peers - Pilot experiences for improving gender equality in research organizations" of which the University, supported by OGEPO, is the lead partner of a Consortium made up of 10 research organizations (EU-Cordis, 2019).

A critical step in the implementation of the GEP is the definition and selection of tailor-made measurable indicators. For this reason, within the R&I PEERS project, indicators are considered a key tool for the transformative potential of planned actions. Monitoring and evaluation tools can support effective actions and create accountability.

The GEP aims to address the challenges still present in achieving gender equality, in particular the obstacles and lasting limitations to the recruitment, advancement and mobility of women, especially in the STEM area, where women receive fewer opportunities, as students, researchers and leaders. It also takes into account the low presence of women in top positions and the limited integration of the gender dimension in research programs, which hampers research excellence and full innovation potential. The GEP is structured in five target areas and provides for a set of strategic actions whose actual implementation, within a specific period, is monitored in progress by appropriate indicators.

These areas include:

- the affirmation of the gender perspective in research and teaching, through a series of strategic actions, including the promotion of free choice courses for students relating to gender studies in various disciplinary sectors; the creation of workshops for students, doctoral students and researchers on how to include the gender perspective in their research projects or through tailor-made mentoring actions for doctoral students, postdocs, researchers;

- the strengthening of work-family reconciliation measures, essential for the real affirmation of equal opportunities and the pursuit of well-being in the workplace. This area provides for a series of measures aimed at ensuring a better balance between work commitments and family responsibilities such as, among other things, the identification of spaces suitable for the creation of a playroom or study rooms for the sons and daughters of employees and students or the identification of agile working methods, more congenial to the conciliation of times (ie teleworking, smart working, flexible working);

- the introduction of the correct use of gender language through a screening of UNISA institutional communication and internal documents in order to gradually introduce in UNISA official communication, from online forms to website contents, the correct use of gender language to be part of the Administration;

- the dissemination of gender culture in the University of Salerno through, among other things, the strengthening of initiatives and seminars on equal opportunities and the fight against gender-based violence and the creation of the second Gender Report;

- the reduction of the gender gap in decision-making bodies through awareness-raising activities on the importance of the presence of women in executive positions on the boards (CDA and Academic Senate) and support activities for female candidates in the decision-making bodies of the University, also with possible introduction of a quota system.

The feasibility of the GEP in terms of the proposed timing and economic sustainability of UNISA's GEP actions has been approved within the two most important decision-making bodies of the University: the Academic Senate and the Board of Directors, in order to strengthen the relevance of gender issues. UNISA, through the implementation and implementation of the GEP, therefore, aims to

integrate teaching and research from the perspective of gender studies and gender equality. Therefore, it is not a project for women but a project for everyone in order to ensure equal opportunities, improve the well-being of people and, finally yet importantly, make the University of Salerno a model of best practices in terms of national and European.

2. Methodological approach

The objective of the paper was achieved through the combined use of different data collection methods as suggested by Eisenhardt's (1989) "triangulation made possible by multiple data collection methods", not only in hypothesis testing but also in theory. building research (Glaser and Strauss, 1967; Yin, 2003).

Primary qualitative and quantitative data or secondary data collected directly, as taken from the published literature, from the UNISA database and from tertiary data, were used.

Primary data were collected through:

- the administration of a questionnaire, at the end of Phase 1 of the Covid-19 emergency - born from the collaboration between all the members of CUG-UNISA with the contribution of OGEPO - on the issues of emergency management, agile work and Domestic violence. A population of 899 individuals took part in the survey (36.6% made up of teaching or research staff, 35.9% technical-administrative staff and, for the remaining 27.5%, fellows, contractors or fellows). This is in order to understand which methods, tools, proposals and services can be of support to the staff of the University of Salerno for an improvement in the quality of working life within a paradigm that places the person and his needs at the center. and that at the same time guarantees the improvement of the efficiency of the performances, in compliance with the principles of organizational well-being and equal opportunities.

- Semi-structured interviews with the members of the OGEPO team, about the network created in the area between universities, trade associations, provincial, national and international bodies and institutions, with the aim of spreading a culture of equality and equality. Non-standardized interviews ensured interviewee involvement and provided the opportunity for non-prescriptive answers and insights.

- Participation in the numerous moments of confrontation within the activities provided for in the "R&I Peers" project.

The secondary data sources are:

- Annual reports and other social reporting tools (Gender Report and Social Report) and external communication such as the code of ethics were analysed together with the University website, press releases and other documents intended for external communication (brochures and information) .

Tertiary data, derived from estimates, average values, analysis of time balance models, etc. They were used to make appropriate comparisons and support the working hypotheses through comparative sector analyses.

The quality level of the collected data was assessed and defined with an acceptable degree of approximation. It is based on the following indicators: reliability of the source; completeness and representativeness of the data; temporal correlation between the study and data collection; geographical correlation between the production context and the reference conditions of the data.

Subsequently, the data were aggregated, organized and classified in such a way as to provide understandable and comparable results to support hypotheses and work results. Any discrepancies between the data were overcome through clarifications with the OGEPO team.

In light of the fact that research relating to the gender perspective in universities and scientific research is relatively new and under development, our goal is to describe and evaluate the effectiveness of the many initiatives undertaken in UNISA to ensure full participation of men and women to UNISA's scientific research and organizational life through the inclusion of diversity.

Therefore, the document begins with a theoretical background focused on the analysis of the most relevant critical issues in Italy and, in particular, in the academic world. Although a particularly advanced regulatory framework formally recognizes equality between the sexes, the disparities between men and women still remain deep and in some ways increase.

The study continues with an analysis of the main initiatives undertaken by the University of Salerno that can promote gender mainstreaming in political strategies. In this regard, the results of the survey conducted at the University were presented on how the academic community and, in particular women, have experienced this period of health emergency, linked to COVID-19, from a personal and social point of view.

Based on the analyses carried out, the needs of the university community were assessed and proposals were formulated to enhance organizational well-being within the University and to remove obstacles to achieve effective equality of opportunity between students, teachers and technical-administrative staff.

The main findings of the study are highlighted in the final section.

3. Results

During the health emergency linked to COVID-19, the governance of the University of Salerno has implemented a transformation of work processes by accelerating complementary and supplementary forms of carrying out the tasks and functions assigned. The measures to combat and contain the spread of Covid-19 required the suspension of teaching activities in the presence, the provision of lessons in

e-learning mode with the support of telematic communication technologies and a reorganization of work processes which in fact has made agile work the ordinary form of carrying out work services.

By virtue of the profound change, the Single Guarantee Committee (CUG), with the contribution of OGEPO, wanted to investigate how the staff of the University of Salerno experienced the lockdown from a personal and social point of view (CUG, 2020).

From the analysis of the data of the questionnaire provided, it emerged that, during the lockdown period, over 80% of those who responded to the survey carried out their work in agile working mode every day of the week (total smart working) and about 12% alternating the agile working mode with the classic working one (partial smart working).

The possibility of carrying out one's work in an agile or teleworking mode was relevant in order to reconcile work commitments and private life, both for men and for women, and did not affect one's performance at work.

Furthermore, 83% of respondents believe that in the medium-long term the agile way of working can reduce the costs incurred to reach the workplace and about 70% argue that it can improve the reconciliation between work and private life, hoping that this method can also be used when the health emergency ends. These percentages are significantly higher in the subset of individuals who provide assistance to a disabled person and are positively correlated both with the size of the family unit and with the distance travelled to reach the workplace.

Table 1. *Evaluation of the possibility of working in smart working in the future, divided by role and gender.*

Question: Would you like to be able to work agile in the future?	Yes, but only in case of need			Yes, for a few days a week			Yes, all week			No		
	%	Female	Man	%	Female	Man	%	Female	Man	%	Female	Man
Professor	25.84	23	17	44.38	49	53	10.33	15	15	19.45	13	15
Technical-administrative staff	12.69			60.06			22.60			4.64		
Other (fellows, contractors, fellows)	23.08			47.77			10.12			19.03		

Fonte: CUG, 2020

As for the moods prevailing during the quarantine, for some they were loneliness, anxiety, fear, insecurity, insomnia; for others, psychological well-being and tranquillity.

Almost 70% of the interviewees intensified personal relationships with non-cohabiting people through video calls and telephone calls; in 80% of cases, relations with cohabiting people also changed. In particular, dialogue and mutual confrontation have intensified and the activities carried out together have intensified, but intolerance has also increased and privacy has decreased, despite the fact that more than 90% of the sample consider the space available in the home to be at least sufficient.

Almost 4% say they have witnessed some form of violence or abuse and more than 3% have suffered and carried out some form of violence or abuse. A significant percentage of those who participated in the survey (12.1%) during the quarantine period suffered or imposed unsatisfactory choices and among the respondents, almost two thirds are aware of the public number of assistance against violence and stalking.

The data provided by the analysis of the questionnaire provided a significant contribution to the evaluation of the results of the sudden change in the traditional organization of public work on the continuity of the activities carried out by UNISA. This is in order to verify levers for further expansions and organizational improvements, to mitigate or eliminate loops of managerial and administrative inefficiency resulting from the completely new scenario that has been feared starting from March 2020.

The study has, in fact, provided important insights for the formulation, by the CUG, of the plan of positive actions also with a view to gradual return to normal conditions, the re-functionalization of all the University offices, the stabilization of educational functions and research. This plan envisaged a multiplicity of objectives aimed both at favouring working well-being conditions - through the reconciliation of life, work and study times within the university community - and at combating discrimination (direct or indirect) to the aim to achieve full integration into the university community, ensuring the absence of any form of violence (moral, physical or psychological) relating to gender, age, sexual orientation, religion, language, ethnic origin, beliefs personal and political, to the conditions of disability. Furthermore, this plan provides for training, information and awareness raising actions in the University and in the reference area for the promotion of the culture of equality and equal opportunities.

Following these results, attention to the pursuit of the GEP and the realization of all its objectives was also strengthened to improve the quality of working life within a paradigm that places the person and his needs at the center and at the same time guarantees the improvement of the efficiency of the performances always in compliance with the principles of organizational well-being and equal opportunities.

4. Discussion

From the analysis conducted, new challenges emerge that UNISA will have to face in order to enhance the strengths of the experience gained and to experience agile work even at the end of the emergency as a useful step towards a cultural and organizational change of work processes.

It is an opportunity to renew and innovate the methods of carrying out the work performance also in terms of elasticity and flexibility, in order to make it more appropriate to the increased complexity of the general context in which it is inserted, to increase its effectiveness, to promote and achieve effects. positive in terms of reconciling employee life and work times. The new organizational models must be inclusive and pervasive to promote organizational well-being, ensure the exercise of the rights of workers, guarantee gender equality and remove obstacles that prevent the full personal and professional fulfilment of men and women.

In fact, the role of UNISA is central, as a place for the production and circulation of knowledge, for the dissemination of a culture of equal opportunities, also through the fight against stereotypes, discrimination and gender-based violence. A culture that manifests itself in everything that is done within the university, from disclosure to communication, from internal procedures to promotion.

In recent years, as organizational complexity has grown, Unisa has had the ability to enhance and guarantee respect for diversity and equal opportunities by putting people and human capital at the center, thanks to the implementation of diversity management strategies mainly focused on corporate welfare models oriented towards work-life balance, training, support for the family needs of employees, maternity and personal services. Models strongly aimed at making the workplace stimulating and comfortable, able to involve employees and share corporate identity and values. Among the main initiatives, it is possible to highlight:

- The organization of numerous Workshops for Master's Degree students and PhD students on the inclusion of gender perspective in research projects and in curricula;

- Promotion of courses on gender equality as free choice courses among students of all disciplines;

- Activation of Master and Postgraduate courses on GE and diversity management (Leadership Gender Equality Diversity Opportunities (LEGEND);

- Fundraising activities for financing grants for research projects that include a gender dimension, in order to trigger and support a virtuous circular process that attracts more resources and fosters the growth of Unisa in the direction of inclusion and gender equality;

- Creation of ad hoc nurseries, as dedicated spaces for breastfeeding, milk pumping, diaper changing;

- Creation of pink parking spaces for pregnant women and women / men with babies around the campus;

- Organization of seminars and workshops to inform employees about the policies on the national and organisational level aimed at improving work-life balance;

- Awareness-raising activities (seminars, brochures) on the importance of the presence of women in leadership positions, in the decision-making bodies and in evaluation committees;

- Analysis of national legislation and screening of a selection of institutional documents and communications from a gender perspective (the correct use of gender neutral language), in the belief that form is also substance and that it is necessary to "make the female gender exist" even in the lexicon bureaucratic;

- Strenghtening of existing initiatives on gender-based violence through the annual organization of training seminars for students and technical-administrative staff on "Explained violence";

- The provision of naming squares, wide streets and streets to the constituent women and to those women who have particularly distinguished themselves in the long journey of the presence of women in science and culture;

- Awareness-raising activities (seminars, brochures) on the importance of the presence of women in leadership positions, in the decision-making bodies and in evaluation committees.

The drafting of the Second Gender Report is recently underway, a tool of extraordinary importance to understand what are (and where they are) the barriers that stand in the way of the full realization of equality between men and women: it is necessary to know in order to imagine, plan, program and carry out concrete initiatives and actions that make it possible to overcome the gap between genders, aware of the centrality of the role of a cultural institution such as UNISA in indicating directions and giving tangible examples of inclusion that constitute a reference for other bodies and communities.

Thanks to the initiatives undertaken by the University, important results have already been achieved in terms of integrating the gender dimension into the research perspectives of some projects of the Departments of Law, Pharmacy, Medicine, Engineering and Computer Science, in addition to the already Departments of Human and Social Sciences gender; the local network with industries and stakeholders was strengthened, thanks to the link that the University has with the Salerno Women's Committee of the Italian Industrial Federation and with the Councillor for Equal Opportunities of the Campania Region. Furthermore, UNISA has a continuous exchange of good practices and ideas with CUGs, at regional and national level and provides advice to other universities in Italy interested in developing a GEP.

In general, there is a greater involvement of the academic community: more employees have become aware of the importance of the gender aspect in their work and students show a greater interest in gender-related events and are actively participating in seminars and workshops promoted by the R&I PEERS team on gender sensitive issues.

The challenges that UNISA will have to pursue will not be limited, however, only to achieving gender balance, but will be aimed at the adoption of diversity management measures (Ponzelli and Riva, 2014). The added value of Diversity Management arises precisely from the person's ability to develop and apply, within the organization, a broad and integrated spectrum of skills that reflects their background

and experience. It is in fact a universality of skills that recalls the richness and uniqueness of the human being who is born individually as an individual but that only by entering into a relationship with others can it be generative of new experiences, ideas, objectives but above all of new opportunities for improve workplaces, life and relationships between people. Only in this way, the University, by internally reflecting the social and economic landscape, will be able to respond more easily to the even latent needs of the area in which it operates, investing in a management approach oriented towards the enhancement of human resources at a professional and personal level.

This study contributes to literature on path to social inclusion and gender equality in university contexts and paves the way for future researchers to understand the complex issues involved in achieving the full realization of equal opportunities and affirming the culture of differences.

5. Conclusions

The analysis carried out reveals the strong commitment made by the University in promoting inclusive cultural and organizational processes aimed at concretely pursuing the objectives of equality and equality in training, research and work.

The governance of UNISA has, in fact, activated important synergies with the academic community, based on forms of sharing values, on mutual trust and on the search for organizational well-being. This in a context, such as the current one, characterized by profound transformations both in the traditional structure of work and in families, but also by strong economic and social criticalities.

The commitment undertaken in the search for greater well-being for employees therefore represents an important element of the policies implemented by the University, also in light of the centrality of the human capital resource in growth and competitiveness paths. Organizational welfare represents, in fact, an important driver for bringing workers to higher work performance, thanks to greater motivation and commitment, greater sense of belonging and growing identification with the objectives and values of the organization.

However, despite the considerable efforts made, the study carried out reveals new and important challenges for UNISA, to achieve a real transition towards a more widespread and institutionalized adoption of welfare programs. Challenges that UNISA is ready to take on through new and more ambitious objectives aimed at combining and enhancing different needs, inclusiveness and organizational flexibility, to implement a profound social and cultural change and offer a solution to the gender gap.

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Posters

The 27th International Sustainable Development Research Society Conference
13–15 July 2021
Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis
Mid Sweden University
Virtual Conference, Sweden

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Effects of Street Hawking on Adolescent Girls in Ogbomoso North, Oyo State, Nigeria.

Introduction

The need to continually provide for the family in the midst of unfriendly conditions has led women, men, youths and children to engage in street hawking activities (Ekpenyong & Nkereuwuem, 2011). In order to know the effects that street hawking has on adolescent girls, there's the need to investigate its causes. In other words, the purpose for carrying out this research is to allow the researcher to identify the causes of street hawking which has become an increasing social problem in the society.

Problem Statement

- Hawking as a form of business poses a lot of dangers to the life of the hawkers especially the adolescent girls due to how it is being carried out.
- Hawking is a horrible business to be carried out by an adolescent girl as a means of survival.
- The problem being identified here is the root causes and effects of street hawking on adolescent girls.

Conclusion

The data gotten indicated that there are different reasons why girls involve in street hawking; this include: poverty, economic status of the state, to meet an immediate need.

Objectives of the study

- Profile the prevalence of street hawking among adolescent girls in Ogbomoso;
- Identify the causes of street hawking;
- Examine the effects of street hawking on adolescent girls in Ogbomoso.

Methodology

The descriptive design is chosen in order to augment the best collection of actual information required to give answers to the research problem of the study, so as to know the underlying causes and the effects of street hawking on adolescent girls in Ogbomoso town of Oyo State. This Survey design is considered as the best research design for this study as it allows the use of various data collection techniques, such as questionnaire and interview.

Recommendation

Awareness programmes should be organized from time to time by the government to inform and re-orientate parents/guardians on the effects of street hawking on the well-being of adolescent girls.

Results and Findings

The result indicates that 28.6% of the respondents were between the ages 15-19 which implies that the category of people needed to fill the questionnaire was available. The next set of respondents 22.2% that made themselves available to administer the questionnaire were of ages 25-29. 16.5% of ages 30-34 were the next set of people that filled the questionnaire. 15.8% of ages 20-24 also administered the questionnaire.

13.8% of the respondents were between the ages of 35-40. While 3% of the respondents of ages 41 and above were available to fill the questionnaire.

The 90.2% of the respondents strongly agreed that street hawking is common among adolescent girls than adolescent boys, while 9.8% believe that street hawking is common among adolescent boys than the girls. This sums up the purpose of carrying this research and affirms that street hawking is common among adolescent girls in Ogbomoso than among the adolescent boys.

Since the asymptomatic significance P value =0.001, it is less than chosen level of probability, we accept an alternate hypothesis; which states that there is significant difference between adolescent girls that hawk and adolescent boys that hawk.

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Gender path in Italian universities: evidence from University of Salerno

Purpose

The aim of this contribution is to analyse the issue of gender equality in Italian universities in the light of the initiatives undertaken in recent decades and the changes that have taken place following the spread of the Covid-19 pandemic in the management of daily life times with reference to family commitments and to professional responsibilities. In particular, the efforts made at the University of Salerno see welfare devices as a fundamental element for the affirmation of an innovative model for the management of human resources, culture and business processes, with a view to equal opportunities. An initiative that ensures equal opportunities improves people's well-being and, finally yet importantly, makes the University of Salerno a model of "best practice" on a national and European level.

Methodology approach

The study followed a research approach that combines qualitative and quantitative techniques. This includes data deriving from questionnaires administered to all staff of the University of Salerno with documentary analysis and internal process data. The questionnaire, in particular, is aimed at investigating how women experience this period of emergency from a personal and social point of view. This is to understand what the needs of the university community are and formulate proposals aimed at improving their condition.

Table 1. *Evaluation of the possibility of working in smart working in the future, divided by role and gender.*

Question: Would you like to be able to work agile in the future?	Yes, but only in case of need			Yes, for a few days a week			Yes, all week			No		
	%	Female	Man	%	Female	Man	%	Female	Man	%	Female	Man
Professor	25.84	23	17	44.38	49	53	10.33	15	15	19.45	13	15
Technical-administrative staff	12.69			60.06			22.60			4.64		
Other (fellows, contractors, fellows)	23.08			47.77			10.12			19.03		

Conclusion

The efforts made at the University of Salerno see corporate welfare devices as a fundamental element for the affirmation of an innovative model of management of human resources, culture and business processes, with a view to equal opportunities. A management model capable of generating social value at a systemic level and which can offer a powerful contribution to resolving the gender gap.

Results

The analysis carried out reveals new challenges that UNISA will have to face in order to enhance the strengths of the experience gained and to experience agile work even at the end of the emergency as a useful step towards a cultural and organizational change of work processes.

It is an opportunity to renew and innovate the methods of carrying out the work performance also in terms of elasticity and flexibility, in order to make it more appropriate to the increased complexity of the general context (Table 1). The new organizational models must be inclusive and pervasive to promote organizational well-being, ensure the exercise of the rights of workers, guarantee gender equality and remove obstacles that prevent the full personal and professional fulfilment of men and women.

This study contributes to literature on path to social inclusion and gender equality in university contexts and paves the way for future researchers to understand the complex issues involved in achieving the full realization of equal opportunities and affirming the culture of differences.

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8. Social Foundations of Sustainability

8b. Communication for sustainability

Abstracts

7

Communicating Environmental CSR towards Consumers: The Impact of Message Content, Message Style and Praise Tactics

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Dr. Yijing Wang

Abstract

Climate change entails a direct or indirect human-evoked change in climate that impacts the constellation of the global atmosphere. Factors such as emissions of greenhouse gases and plastic pollution impact the climate to the extent that the system is in danger of becoming irreversibly out of balance, causing sea level rises, increasing temperatures, ocean acidification, forest degradation, biodiversity loss and desertification. How pressing the issue of climate change really is has arrived in the global public consciousness over the last several years. Given the global context, businesses' commitment to preserving the planet is demanded by more and more stakeholders across the globe. As a consequence, many companies have voluntarily engaged in socially and environmentally responsible behaviors. These practices are described by scholars through a container concept – corporate social responsibility (CSR). CSR continued to garner business attention in last decades because of increased pressure from climate organizations, stakeholder's demands enhanced by communication technologies, as well as possible long-term profitability of engaging in CSR for businesses. In relation to the pressing socio-political debate on climate change, this study focuses on how environmental CSR communication affects consumer perception and behavior. We examine the impact of message content (neutral vs. two types of environmental CSR), message style (greenhushing vs. uniform vs. greenwashing) and praise tactics (consumer praise vs. company praise) on consumer trust, purchase intention and consumer advocacy. We also investigate the moderating role of attributed intrinsic and extrinsic corporate motives on engaging in environmental CSR in the proposed relationships. An online experiment (N = 304) revealed that a uniform message style outperforms the other two styles, whereas greenwashing is found to be least effective. In addition, attributed intrinsic corporate motives moderate the impacts of environmental CSR communication on consumer trust, purchase intention and consumer advocacy, respectively. In contrast, no moderation effect was found for attributed extrinsic corporate motives. The findings provide important implications for effective environmental CSR communication with respect to specific message styles and attributed corporate motives.

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How sustainable are media and communication studies? On the contribution of the media and communication sciences to achieving the SDGs

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Abstract

In times of climate crisis, ecological deterioration, and related social and health problems, sustainability has evolved from the "buzzword" of the last decade to a fundamental concept in finding a new balance between ecosystem and society. As one of the main challenges of our time, sustainability, and the achievement of the 17 SDGs have also reached the field of media and communications studies. Sustainability communication is considered an emerging, interdisciplinary field, constantly challenged by the increasing amount of communication *about*, *of*, and *for* sustainability (Newing et al., 2013), and by the need to communicate “inconvenient truths of de-growth and abandonment” (Weder et al., 2021b). Therefore, sustainability communication needs on the one side to improve its information and knowledge sharing process, while on the other side to establish a communication process on what kind of values should lead societal development and stimulate stakeholder engagement, by linking the idea of sustainability to different areas of society.

Here, education can play a decisive role due to its ability to (de-)construct paradigms and drive societal change through scientific breakthroughs and the education of the next generation leaders. In the sense of a comprehensive responsibility, educational institutions must recognize current and future social relevant issues and integrate them into their teaching programs. To this purpose, the study at hand examines to what extent sustainability and its core aspects are integrated into media and communication's curricula of European post-secondary institutions. Thus, *n = 1068* bachelor and master’s degree programs and their related curricula from 28 European countries were analyzed through content analysis.

Looking at curricula is relevant from a heuristic perspective and helps verify whether Humboldt's ideal model of education is maintained in tertiary education. Furthermore, if we understand communication as a core dynamic of social behavior and take into account the importance of (mediated) communication in the attempts to achieve attitude and behavioral change, as well as to convey inconvenient truths, then the investigation of how sustainability is integrated into media and communication curricula should be seen as essential.

Results show that the curricular integration of sustainability aspects in media and communication science is low (14%) and drops to very low (6%) on module level. Here, sustainability is understood either in its environmental dimension or remains an abstract guiding principle, a buzzword among many others. This can indicate the difficulty of operationalizing such a concept as sustainability, which is experienced by higher education institutions and policy and society as a whole. Besides, the results leave space to reflect higher education institutions' social and educational responsibility and the self-conception of media and communication sciences. Sustainability (communication) should be more institutionalized, both in terms of integration in the curricula and in the sense of a consolidation of the

object area, to meaningfully contribute to sustainable development. By illustrating the underlying problem and suggesting steps needed, the study contributes to the conference's overall theme and directly relates to SDG 4 Target 7.

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The evolution of the sustainability story in corporate communication

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Abstract

The United Nations state that ”the world is making progress towards Goal 7, with encouraging signs that energy is becoming more sustainable and widely available” (UN, 2021). In this presentation, the authors carve out the central role of strategic communication for the emergence and evolution of sustainable development as a narrative of the future in the communication of the 15 biggest global energy corporations over the past 30 years.

Narrative approaches seem to be fruitful to grasp the largely amorphous concept of sustainability that gets bent into many different shapes in organizations and the wider public (Author et al., 2019a; Dimitrov, 2018). We mainly refer to Frank (2017), who explains that “if we can change narratives, we change something fundamental in the moral and political constitution of the society; thus, it is in narrative that new visions of sustainable living begin” (Frank, 2017, p. 312).

Thus, from a critical and constructivist communication perspective, we assume that over a certain period of time, there is a transition in corporate reporting from the ‘old story’ of climate change, telling us about human mastery over nature, ecological destruction, growth, individual consumerism and related struggle and resource scarcity to a new story of sustainability, of inter-being, co-creation of ecocultural identity, inter-being and harmony as well as post-growth. As guideposts to follow this process of transition or evolution of the new narrative we chose the characteristics of evolution: variation, inheritance, time, and adaption (Darwin, 2017; Pirlet, 2005).

With these characteristics, we analyzed 30 years of corporate “Environment(al) Reports” (1990-2000), “CSR Reports” (2000-2015) and “Sustainability Reports” (since 2015) of internationally operating *energy companies* (n = 15). This explorative content analysis (Bryman, 2016; Mayring 2014) supports the theory of the evolution of sustainable development as new narrative in corporate communication. In the 1970ies/80ies until the early 90ies, corporate reporting was characterized by debates about environmental problems, global warming and climate change – and possible solutions. “Corporate Citizenship”, “Environmental Responsibility” and “Future Generations” were the key words. In the

second phase, from the mid 1990es to the introduction of the SDGs in 2015, a stronger political and mainly economic discourse started and discussions about “non sustainable developments”, globalization, and the concept of sustainable developmentfound their way in corporate CSR strategies and related communication. The key terminology used was “people, planet and profit”, “public-private partnerships” and “doing better than others”. Today, we are in the third phase, the phase of radical social change and crisis, calling for new approaches dealing with anthropogenic environment problems – and with improving humanities ability to coexist in the world: sustainable development is seen as pathway of innovation, progress, transformation and even “re-birth”, “re-definition”.

The talk finishes by discussing the potential of the ‘evolutionary’ approach and the future of sustainability as moral framework for mainly SDG #7-related activities and communication.

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Public deliberation and responsible innovation in artificial intelligence: the role of AI developers

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Abstract

While many challenges for ethical AI are not entirely new—and closely resemble those found in more established fields such as bioethics—recent research discusses the unique role of 'epistemic concerns' in AI, such as *explicability* and *scrutability* (Floridi et al., 2018), which highlight the need for AI developers to contribute to explainable and accountable systems. Correspondingly, frameworks for ethical AI now place principles of 'transparency', 'explainability' or 'traceability' front and centre. These works, however, focus primarily on what ought to be, rather than making propositions on *how* these principles should be realized in practice and, more specifically, how responsible AI developers should contribute to this in engaging with citizens and policymakers (Hagendorff, 2020; Morley, 2020).

To address this question, we draw on literature on deliberation and responsible innovation (Lidskog, & Elander, 2010; Stilgoe, Owen, & Macnaghten, 2013; Voegtlin, & Scherer, 2017). Specifically, draw on work conceptualizing forms of governance that emphasize the role of corporate actors (e.g., Scherer, & Palazzo, 2007; Scherer, & Palazzo, 2011; Scherer, Palazzo, & Baumann, 2006), such as AI developers. We argue that 'epistemic concerns' pose a distinct meta-challenge in the responsible governance of AI. Linking current debates in AI ethics to a deliberative framework for responsible governance of innovation, we specify the role of AI developers in deliberation for responsible innovation, addressing epistemic inequalities (expertise) as a particular issue which can be tackled by considering the deliberative potential of *different venues* for deliberation (i.e., AI expert discourse, the public sphere at large, and 'pure' AI publics as 'minipopuli').

As such, our paper hopes to relate and contribute to two main fields of debate: First, we contribute to the recent discussion on deliberatively engaged business in responsible innovation (cf. Scherer, 2018; Voegtlin, & Scherer, 2017), exploring prospects and challenges of AI innovators' participation in public debate and substantive reasoning. We specify ways for principled AI developer engagement based on deliberative ideals and discuss the capabilities of distributed venues and temporal instances of deliberation in approximating these deliberative ideals in light of particular epistemic challenges with AI.

Second, we add to the current discussion on AI ethics by going beyond the common focus on principles of explicability, transparency, and scrutability to address these principles as questions of *AI governance* and the role of AI developers therein. Specifically, we address the related 'epistemic challenges' in AI as a problem of locating AI developers' and other actors' expertise within deliberation. This allows to tackle current questions on how to enact principles for ethical AI and AI governance with particular sensitivity to related problems of public rationality and judgement. The debate on AI governance has specifically been criticized for lacking a discussion of 'political visions and values' for responsible AI (Cath et al., 2018). Our investigation may offer arguments that allow to gauge the eligibility of the ideals of deliberative democracy in making a 'bid' for entering this normative gap.

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Sustainable development and producer-consumer communication in global food networks. A participatory video experiment with South Indian farmers and UK-based consumers

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Abstract

Theoretical context: The paper explores the role of communication in sustainable food production/consumption in the context of communication and information sharing between food producers and consumers across the globe. Communication is approached in a two-fold way. First, it concerns farmers' representation through marketing and educational material that is typically used by organizations such as Fairtrade to connect Southern producers and Northern consumers. Such material reproduces stereotypical images of Southern producers, silencing their voices and commodifying their livelihoods. Second, it concerns the role of farmers' representations for consumers' connection to and awareness about sustainable food production. The paper argues that in both cases, farmers' stereotypical representations can have implications for sustainable food production and consumption. Stereotypical images not only provide limited meaningful information to consumers, encouraging them to construct their role as benevolent saviours and perpetuating neo-colonial inequalities; they also undermine farmers' confidence and capacity of self-management since farmers are led to believe it is 'poverty' and 'victimhood' that keeps them in the fair trade market (Hassan, 2013; Dolan, 2008; Taylor, 2002; Varul, 2008). The paper advocates for more inclusive and dynamic producer-consumer communication solutions that bring the voices of Southern producers into marketing and educational material about food production.

Method: The paper employs a novel experiment that connects a South Indian farming community with a group of consumers in the UK through short videos created by the farmers. The data presented in this article was collected through focus groups with 76 farmers in India, a collaborative video- making project led by the farmers, and focus groups with 50 consumers in the UK.

Findings: The findings demonstrate that when farmers construct their representations on their own terms, they engage in reflexive and dialogic processes that increase their sense of empowerment and self-esteem. This is crucial for their sustainability, as they feel motivated to continue with their organic, traditional and natural farming methods, and to also educate their local community about the environmental benefits. From the side of the consumers, the visual images and information about production methods portrayed through the farmers' videos gave consumers access to valuable new knowledge about the material reality of food production across the globe, challenged consumers' perceptions of the 'distant' farmer and encouraged a shift from a consumer to a citizen mind-set.

SDG-targets

2.3: agricultural productivity of small-scale food producers

2.4: resilient agricultural practices

10.2: social inclusion

10.6: representation/voice

12.8.1: global citizenship education and education for sustainable development

Relevance to conference theme: This paper brings into focus a less obvious aspect of sustainable development, which lies in the farmers' need to communicate with the world; and their sense of empowerment when their voices are heard. This need is becoming more pressing during the Covid-19 pandemic, when farmers in places like India become more isolated, due to the lockdown measures that have disrupted activities such as their self-help group meetings. Discovering innovative ways for farmers to stay 'connected' with the world and the community becomes an integral aspect of their efforts towards sustainable development.

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Times of crisis – times for innovative participatory communication for sustainable development

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Abstract

Introduction: This paper studies the nexus between communication and sustainable development through the context of citizen's participation in environmental, social, and economic future policies and decision-making. It focuses on the region of Western Macedonia in Greece, a region in the transition from lignite to clean energy that has the highest unemployment rate in Greece. The financial, unemployment and pandemic crises have a strong negative impact on citizens' wellbeing and the region's sustainable development. The paper argues that sustainable futures require strengthening citizen's capacity to contribute to environmental, social, and economic policies through innovative participatory communication methods. We propose that participatory (future-oriented) workshops offer such an innovative tool, enabling citizens to engage in co-shaping the future of the region in a collective and creative way.

Method: We present findings from a pilot virtual participatory workshop, entitled 'The city of Kozani, 2040' that took place in December 2020. The workshop was organised by the UNESCO Chair on Futures Research FORTH/PRAXI Network, in collaboration with the Regional Development Agency of West Macedonia, Greece (ANKO SA/Enterprise Europe Network) and the School of Journalism & Mass Communications of the Aristotle University of Thessaloniki, Greece. Twenty-five members of the public and civil society participated in virtual collaborative, experiential actions and discussions about sustainable development and societal change in the future. Role games allowed the participants to imagine and project possible futures for their lives and their region and communicate their thoughts, expectations, and ideas for a common just future. Participants' comments and contributions during the workshop were shared and stored in the MIRO platform and analysed with an inductive, thematic content analysis.

Findings: The data revealed innovative ideas pertinent to issues of environmental, social, and economic sustainability that can be implemented by local networks and regional authorities. It also indicated participants' enthusiasm for being able to have an active role in the region's future and decision-making process. The paper highlights how new tools and communication methodologies can contribute to participatory communication for sustainable development by enabling citizens to develop skills for future transformations, and to co-shape the societal partnerships for sustainable development and resilience.

SDG-targets

11.a strengthening national and regional development planning

12.8.1 education for sustainable development

16.7 inclusive, participatory, and representative decision-making at all levels

17.17 public-private and civil society partnerships

Relevance to conference theme

First, the paper highlights the need for citizen participation in environmental, social, and economic policies and for inclusive and bottom-up action and decision making. Public engagement and participation in decision-making becomes ever more pressing during times of environmental and health crises, especially when citizen disapprove of government handling. Second, by introducing an innovative method for enabling/facilitating remote collaboration between citizens and local authorities, the paper presents a solution to the current restrictions imposed by the pandemic, and a tool for future, more sustainable modes of working and sharing understanding.

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Lobbying, Strategic Communication and Sustainability - Some Remarks for the 21s Century

Lobbying, Strategic Communication and Sustainability - Some Remarks for the 21s Century João Simão
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Abstract

It's intended, with this communication, to understand what is the relationship between Lobbying and the field of Public Relations and Strategic Communication. We defend and define the activity of Lobbying as persuasive communication in favor of a legitimate interest, which can allow more information on different decision making. And this is specially important in today's VUCA (volatility, uncertainty, complexity, and ambiguity) world. Organization's are understansing even more the importance of Sustainability and social responsible actions to face crisis and to better project their identity to several key stakeholders.

At the same time, when defining Strategic Communication as a communication directed towards a certain outcome that generate organizational and societal changes, it's also importante to understand that the lobbying activity must be seen and perceived as an area of intervention of communication professionals in this area. Different interests and perspectives on certain subjects lead to the need to establish understandings in favor of certain subjects, specially sustainability issues, and the activity appears as an important tool for organizations to defend their different interests and, also, make their voice known.

Thus, through a theoretical and bibliographical survey of the main authors in the field of Public Relations and Strategic Communication, we try to understand the different associations made between this area, the activity of Lobbying, and organizations activities and interests in Sustainability and CSR. Also, we try to understand why communication professionals must develop skills about communication for social change.

The results suggest that these three areas (Public Relations, Lobbying and Sustainability) can be an integral part of the core business of most communication professional. Being a legitimate practice in the service of organizations' communication, Lobbying (as well as Strategic Communication), has its own body of knowledge and specific professional skills and can be important for organizations defend their interests and actions.

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Pandemic Stories: How COVID Life Changed Consumption Habits for Greater Sustainability

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Hadil Abuhmaid

Abstract

Introduction
Undergirded by Postmodern Theory, this critical essay explores findings of interviews with U.S. citizens who described their lived experiences and changes in their consumption routines throughout the

pandemic that forever may alter their purchase behaviors. Use of social media channels for information seeking heightened awareness of sustainable options useful for developing greater awareness about sustainable development. Findings reveal how some people made more strategic purchases given that working from home afforded greater flexibility to fully consider their own ecological footprint and that of their favorite brands.

Method
Formal in-depth interviews (N=25) have been conducted with U.S. citizens who volunteered to engage in a discussion about "how has pandemic life impacted your consumption practices?"

Findings
Patterns/themes emerged from in-depth interviews which shed light on U.S. citizens' increased consciousness about environmental issues that is influencing amended consumption behaviors.

This essay will offer five important lessons for manufacturers as they map new messages for strategically communicating with stakeholders post-pandemic.

Discussion
As viewed through a postmodern values lens (e.g., Featherstone, 1991), findings suggest that manufacturers and service providers face new realities after pandemic life that must be considered to revise their sustainable development goals and amend traditional messaging with consumers. Change is a constant state (Lyotard, 1988, 1992, 1993) and because so many organizations acquiesced to stasis pre-pandemic, the spread of COVID-19 was supported by silenced voices, crumbling infrastructures, and decay in decision making due to strongly held differences in opinion.

Findings explored in this essay offer key insights into revising sustainable development goals during the second decade of the century in the aftermath of the COVID-19 pandemic; a crisis for which the planet's policymakers had been entirely unprepared. Economic development must be conducted without the depletion of natural resources. Hence, as decried in the title of this conference, we must quicken our response to sustainability goals, revise them, and replace indecision with action.

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Local or Global Climate Consequences - The Role of Communication on Sustainable Consumption Regarding Environmentally-Relevant Nutrition

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Abstract

Animal-based food generates 24% of global greenhouse gases (Risku-Norja & Kurppa, 2009). Individual yearly meat usage is at 43.2 kg (FAO, 2019). For sustainable consumption at most 15 kg yearly is suggested (EAT-Lancet Report, 2019). Which role can the most used socia media platform Instagram (Beisch, Koch, & Schäfer, 2019) play in informing about environmentally-relevant nutrition to contribute to sustainable consumption (SDG-12)?

One relevant communication strategy in other environmental communication contexts (e.g. Dahlstrom, 2012; Jones, 2014) are narratives, content presented as a story instead of facts (Green & Clark, 2013). Narratives can be effective due to mental immersion into the story (*transportation*; Green & Clark, 2013), which increases emotional processing (Green & Brock, 2000). As Instagram is mostly used in entertainment-based contexts (Beisch, Koch, & Schäfer, 2019), portraying the relevance of consumption choices via narratives might lead to better reader engagement than a portrayal as facts.

Another strategy to present information in media is *framing* (Entman, 1993), making specific aspects salient. As in other environmental communication, nearby instead of distant locations have triggered higher concern (Swim et al., 2009), framing local instead of distant climate consequences – *local framing* – seems to be relevant within environmental communication. Local Framing showed as effective in various communication contexts (e.g., Shih & Lin, 2017; Zhang, Ritchie, Mair, & Driml, 2019). Guilt (Nabi et al., 2019) and responsibility attribution can be triggered and contribute to sustainable behavior (Ferguson & Branscombe, 2010).

Consequently, for an Instagram post on reducing animal-based nutrition, narratives rather than factual portrayals combined with framing of spatially close versus distant consequences are expected to foster environmentally-conscious attitude and behavioral intentions.

A 2 (narration vs. facts) x 2 (spatially close vs. distant framing) between-subject online-experiment was conducted (144 participants: 56.3% female, 18-39 years, M = 22.89; SD = 3.46). As in Bilandzic and Sukalla (2019), climate consequences are narrated as a future scenario – here by an Instagram user reporting consequences of current animal-based nutrition from a future perspective – or presented by the user factually. Framing is spatially close (recipients‘ country) or distant.

Two-factorial ANOVAs showed no effects on attitude and behavioral intentions (ps > .05) (Appendix A). Mediation analyses showed significant effects of narratives via transportation on attitude (a) and behavioral intentions (b) (Appendix B). No significant mediation effects were found for local framing via guilt or responsibility on attitude or behavioral intentions.

Results show narratives as stimulating mental immersion, but narration and local framing as overall not persuasive. Effects might be inhibited on Instagram, as authenticity and similarity, relevant for parasocial interaction, might be impeded by the future perspective, and a younger Instagram-sample might experience lower location-connectedness. Parasocial interaction processes should therefore be incorporated more strongly into Instagram narratives and the audience‘s location-connectedness analyzed further.

Contributing to fostering sustainable consumption (SDG-12) via informing the public to consider this information in their consumption choices could help effectively reduce emissions and global warming, as demonstrated in the introduction. The role of communication for target 12.1, 12.2 and 12.3 should therefore be further analyzed.

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Plastics in the World Ocean: How numerical model-based communication can help address the global problem of marine litter

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Abstract

Numerical models that depict complex scientific phenomena can capture people's interest and provide them with foundational knowledge in ways that raw data or narratives alone cannot. They allow us to visualize robust datasets that otherwise would be unwieldy or incomprehensible to many audiences. Narratives (audio-visual and written) can also explicate impenetrable data. Further, narratives joined with numerical models can expand their capacity to translate scientific and/or societal material for lay audiences, potentially increasing perceived salience and intent to act on the information.

A World Ocean model of marine litter, developed by a research team at the Center for Ocean-Atmospheric Prediction Studies (COAPS; Chassignet et al., 2021), provides actionable information in support of four resolutions passed by the U.N. Environment Assembly that address the marine litter initiatives. SDG 14.1 also recognizes marine litter as an emerging threat to global environmental health and SDG 4.7 seeks to ensure that the knowledge and skills needed to promote sustainable development through "(i) global citizenship education and (ii) education for sustainable development." Thus, the proposed presentation aligns well with the SDGs and the conference topic.

The Global Model for Monitoring Marine Litter (http://marinelitter.coaps.fsu.edu/) simulates the motions of debris in the oceans and test marine litter scenarios. The model specifically looks at the origins and fate of mismanaged plastic waste. It shows the flow of marine litter from one country to another or its concentration at sea (e.g., the Great Pacific Garbage Patch). As communication liaison for the project, I have explored ways to complement the model with audio-visual and text narratives that expand its appeal beyond scientific audiences. Recently, our team was approached by NOAA's Marine Debris Program to incorporate the model into Science on the Sphere (https://sos.noaa.gov/What_is_SOS/), a projection system that presents high-resolution video on a three-dimensional globe. This led to a coordinated effort between NOAA, COAPS, and a digital communication team. Once completed, I will investigate the efficacy of three communication approaches (1) the model alone, 2) the model integrated into Science on the Sphere, and 3) the Science on the Sphere integration as the basis of a 3-5 minute 1-D video presentation. In order to expand the utility of scientific model-based communication, this study seeks to identify the ways in which inclusion of audio-visual and text narratives influence the impact of a numerical model approach on viewers' perceived salience and intention to act on information.

In my presentation, I will discuss how numerical models, such as COAPS's marine litter model, not only allow scientists to investigate some of our most pressing sustainability issues, but also to efficaciously share their findings with decision makers and the public. I will demonstrate how well developed narratives in conjunction with these models can help them resonate with non-scientific audiences and support transformational change at the individual, community, or societal level.

Chassignet, E. P., Xu, X., & Zavala-Romero, O. (2021). Tracking marine litter with a global ocean model: Where does it go? Where does it come from? Manuscript submitted for publication.

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Collaborating on crisis communication to manage the COVID-19 crisis

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Abstract

Large scale societal crises, like the COVID-19 crisis which is classified as a global pandemic, demand collaboration among organizations in order to manage the crisis. A community's ability to recover from such a crisis and enhance resilience depends on organizations coordinating their crisis communication and collaborate on establishing adaptive capacity through activity coordination (Jahn & Johansson, 2018). The scale of emergency and technology development influence what new approaches to developing community resilience are implemented. Also, the division of responsibility among involved organizations may hamper activity coordination.

This study focuses on the activity coordination of crisis communication in Sweden during the first months of the COVID-19 crisis in spring 2020. A large number of telephone conferences with organizations coordinating their crisis communication are analyzed together with selected interviews of organizational representatives from public health organizations, national crisis management organizations, regional and local organizations.

The results illustrate the challenges these crisis managers face when coordinating their crisis communication and the success factors of effective crisis communication coordination. The study contributes to enhance our knowledge on crisis communication coordination as a means of crisis management in order to establish resilient and sustainable communities.

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Crisis Communication Leadership for sustainable organizing

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Abstract

Crisis communication is important to manage crises and enhance resilience in order to organize for and achieve sustainable communities. In public health emergency responses, communication skills were an important attribute for crisis leadership together with the ability to inspire trust, coordinate diverse participants across different disciplines, decisiveness with flexibility, situational awareness and competence in public health science (Deitchman, 2013).

Leaders are responsible for and expected to minimize the impact of crises, enhance crisis management capacity, and coordinate crisis management efforts. In essence, crisis leadership is a communicative process, in which leadership actors communicate to fulfill a common goal (Johansson, 2017). However, existing crisis communication research more often focuses on organizational leaders' communicative management of the organization's reputation (e.g., Coombs, 2016; Littlefield & Quenette, 2007; Ngai & Falkheimer, 2017; Waymer & Heath, 2007). Hence, the research record predominantly reduces crisis leadership to managing organizations' images, with the notable exception of discourse of renewal research, which focus on establishing resilience post crisis (Seeger, et al., 2005; Ulmer, et al., 2007). As Wouter, Dückers, and van der Velden (2016) noted, "much remains to be clarified in terms of how actual leadership tasks are undertaken and balanced by way of crisis management" (p. 56).

This study answers that call and focus on the process of communicative crisis management by leaders. The study develops a new framework for effective crisis communication leadership based on an explorative study including 40 interviews with Swedish and U.S. government officials, addressing: (1) How crisis leaders communicatively create resources, organize and prepare for crisis management, (2) How crisis leaders develop communicative strategies for crisis management with internal and external stakeholders, (3) How crisis leaders communicatively enable inter-organizational collaboration in order to organize for sustainable communities.

Full papers

Corporate activism trends and public relations strategies for the UN Sustainable Development goals

Engagement Between Private Companies and Human Rights Activists

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Abstract

This article is based on the case study of a non-profit NGO, GAT–Portuguese Activist Group for HIV/AIDS, that advocates for legal and political changes within the scope of the United Nations 2030 Agenda for Sustainable Development. Through an ethnographic approach to GAT, a "hybrid multifunctional voluntary organization" that shows the territories where third-sector organizations mix with social movements, and the consultation of 12 communication and public relations experts, the purpose of this research is to understand better the factors surrounding the engagement between private companies and human rights activists. A literature review addresses the significance of activism and social change to public relations theory and practice, exploring the concept of corporate political advocacy (CPA) or corporate activism, meaning companies that become actively engaged with public action on a controversial socio-political issue. Findings suggest that, beyond the strong cultural resistance that still exists about this kind of partnership in Portugal, this is a future communication trend that can be an opportunity for activists to advance causes within the scope of the 2030 Agenda and for companies if they know how to position wisely on these issues.

Keywords: public relations, advocacy, activism, organizations, human rights

1. Introduction

According to the UN SDG Progress Report 2020, the COVID-19 pandemic affected the Sustainable Development Goals (SDGs) social indicators by reversing several positive trends and increasing several inequalities within and between countries. The pandemic challenge reinforced the reality that a global collaborative response from governments, the private sector, civil society, and the general public is needed to achieve the goals.

Several contextual conditions have led to the emergence of "hybrid multifunctional voluntary organizations" with an activist culture that can mobilize resources and obtain commitments (Hasenfeld & Gidron, 2005), like GAT–Portuguese Activist Group for HIV/AIDS, which is the object of this study.

The engagement between private institutions and non-profit associations to advance specific causes is well known, mainly in terms of corporate social responsibility (CSR). However, cases of corporate

political advocacy (CPA), such as the support of Ben & Jerry's for the Black Lives Matter movement (Ciszek & Logan, 2018), the support of Starbucks, Google, Microsoft, and Ben & Jerry's for the legalization of same-sex marriage in the US (Wettstein & Baur, 2016), and Gillette's videos about toxic masculinity in response to the #MeToo movement (DiRusso, 2021), are not so common.

This form of CPA or corporate activism is one new dimension of influence management, with all the ingredients to become a relevant area for demonstrating companies' CSR and reputation (Monaghan & Monaghan, 2014; Peterson & Pfitzer, 2009). These trends present an organizational reality that public relations practitioners may eventually have to deal with (Ciszek & Logan, 2018, p. 118).

Through an ethnographic approach to GAT organizational dynamics and the consultation of 12 communication and public relations experts, this research analyses the engagement between private companies and human rights activists. It begins with a literature review that addresses activism's significance to public relations theory and practice in different organizational contexts. Next the methodology is described, followed by the findings that suggest that, beyond the strong cultural resistance that still exists about this kind of partnership in Portugal, this is a future trend that can be an opportunity for activists to advance causes within the scope of human rights and the 2030 Agenda and for companies, if they know how to position wisely on these issues.

Public Relations and Activism in Different Organizational Contexts

Because strategic communication is fundamental to promote social change, its applicability in an organizational context is relevant for activist movements. It facilitates the organization of collective action, the call for civic participation, and the relations with other social actors. Ciszek (2017) analysed a transnational activist network for LGBT rights in 15 regions, concluding that activists are producers of strategic communication for social change and that activism and public relations are not antagonistic but occupy a fluid space influenced by cultural and economic forces.

Various forms of activism through history have contributed to the appearance of "hybrid multifunctional voluntary organizations" (Hasenfeld & Gidron, 2005) that fought for social change, challenging dictatorships, protecting workers from exploitation, protecting the environment, promoting equality for women, opposing racism, helping vulnerable communities, and being actively involved with many other issues. Depending on their legal nature and the causes they advocate, interest groups within the third sector[1] and the organizations they establish to achieve their objectives can vary

[1] The "third sector" is a field of study that is difficult to define. The term refers to very different types of organizations that are designated as non-profit, voluntary, intermediary, non-governmental (NGOs), social economy, civil society, etc., and that do not fall under the first sector (public / State) or in the second sector (private / market) (Corry, 2010: 11-20; Ferreira, 2004).

substantially, showing territories where third-sector organizations mix with social movements (Ferreira, 2004; Hasenfeld & Gidron, 2005; Martins, 2003).

Just as private organizations cocreate relationships with each other and their surroundings to achieve their business goals, activists' organizations also do that to achieve their advocated social change (Taylor & Botan, 2006). Holtzhausen (2000, 2012) and Holtzhausen and Voto (2002) have claimed that although public relations can create, maintain, and reproduce powerful, dominant discourses, they can also resist and disrupt such discourses. Assuming that advocacy[2] is a central function of public relations that involves several practices, most practitioners know this function, in itself, is neither good nor bad. Instead, it is how the function is performed that makes the difference (Edgett, 2002).

In the corporate, private organizational context, while some corporations are engaging in socially responsible initiatives related to their businesses or benefiting their communities, other companies have advanced further in this area, supporting controversial causes related, or not, to their core business. Researchers Florian Wettstein and Dorothea Baur from the University of St. Gallen's Institute for Business Ethics label this activism "corporate political advocacy" (CPA). This perspective argues that businesses should publicly communicate their positions on socio-political issues and try to engage different public types on complex subjects (Wettstein & Baur, 2016). CPA is a public relations initiative and implies the acceptance that not all stakeholders will agree with the ideologies and values advocated by an organization (Ciszek & Logan, 2018; DiRusso, 2021).

Although it is not an easy decision for companies, CPA is emerging as a new and dynamic communication trend. It suggests that implied political values on behalf of companies are likely to precipitate divergent consumer reactions. This practice causes simultaneously "disapproval and boycotts from those that oppose the company's position, but approval and buycotts from those that support the company's position" (Hydock et al., 2019, p. 76).

This type of advocacy requires that companies are not just concerned about doing no harm but speak out publicly, which can be critical to advancing human rights and the 2030 Agenda. However, a company must be careful about the choices of issues to advocate. The criteria to make this selection are (a) consistency—the issue must be consistent with the values of the company; (b) plausibility—the topic chosen must be part of a long-term commitment to specific causes or issues; and (c) authenticity—supporting a cause implies more concrete actions than words. Only within these criteria will a company's cause's advocacy be credible (Wettstein & Baur, 2016, p. 211). Furthermore, an experiment by DiRusso (2021) provided several key takeaways for companies planning CSA communication, pointing to the utility of negatively toned CSA communication about highly salient social issues.

[2] Advocacy is defined as "the act of publicly representing an individual, organization, or idea with the objective of persuading targeted audiences to look favourably on—or accept the point of view of—the individual, the organization, or the idea" (Edgett, 2002, p. 1).

This communication landscape addresses significant change confronting public relations with corporate activism, that is, corporations taking public stances on political (Wettstein & Baur, 2016) and social (Dodd & Supa, 2014) issues.

2. Methods

Public Relations Ethnographic Approach

Ethnography has been presented as a methodology that brings relevant developments to public relations research, namely within the scope of sociocultural traditions (Everett & Johnston, 2012; L'Etang et al., 2012; Xifra, 2012). L'Etang (2006) argued that placing research in public relations more broadly as "cultural and ideological practice involved in complex intercultural processes and away from technocratic concerns can help in developing an understanding of public relations work in international society and its relations with the world of life and the public sphere" (p. 393). Although it is not yet a frequently used methodology, when investigators are looking for descriptive inferences to identify the interactions between an organization's culture and its social environment, ethnography has been identified as a methodological imperative in public relations (Everett & Johnston, 2012). In public relations research, ethnography will examine how a group understands and experiences its environment and how it seeks to adapt to that environment (Sutton & Anderson, 2004; Winthrop, 1991).

Research Design

In this investigation, we intended to articulate the data transmitted to us with the existing theories about the phenomena under observation. Following the methodological imperative in public relations ethnographic research proposed by Everett and Johnston (2012), the study's analytical approach was based on two data collection stages and analysis. In the first moment, we resorted to an ethnographic immersion in the organizational dynamics of GAT using participant observation, interviews, informal conversations with the different members of the team, social media monitoring, and analysis of documents, compiled in a field diary (a document in which all the interactions and information are noted daily).

In a second stage, we consulted experts from 12 communication and public relations agencies associated with APECOM—Portuguese Association of Council Companies in Communication and Public Relations—to understand their position on the topic under study. We focused on the interviewees' designated "expert position" (Demo, 1995), and we asked all 12 experts the same question:

Some authors talk about a new type of corporate activism that presupposes that companies take a public stand in defence of specific causes (for example, the support of Starbucks, Google, Microsoft, and Ben & Jerry's for the legalization of marriage between people of the same sex in the US in 2015). What is your perspective on associations of this type between private companies and human rights activist

organizations/2030 Agenda in Portugal, mainly concerning the so-called controversial socio-political issues?

Through these two moments of data collection and analysis, we intended to answer the following research question: Can the public endorsement by private companies of human rights activist groups on controversial socio-political issues (like homophobia, racism, xenophobia, and women's rights (Guterres, 2021)) be seen as a communication trend in Portugal?

Case Study

Ethnographic Immersion GAT and Expert Consultation

GAT is a non-profit NGO based in Portugal and founded in 2001. This organization works with groups of people infected by HIV or at risk (migrants, prisoners, sex workers, drug users, gay men, and others). GAT advocates for legal and political changes within the scope of human rights and the 2030 Agenda, namely the third objective of the United Nations Sustainable Development Goals: ensure healthy lives and promote well-being for all at all ages. GAT activity highlights the territories where third-sector organizations mix with social movements (Ferreira, 2004). GAT's mission is to advocate and work with other stakeholders for social changes that positively affect the health, rights, and quality of life of people living with HIV-associated diseases, especially those from the most vulnerable groups.

Data Sampling and Sources

Within ethnography, the amount of time the researcher should spend in the field has not been established, but some authors have defined a period from 3 months to 2 years depending on the research design (Fetterman, 1998; Hammersley & Atkinson, 2007; Johnston & Everett, 2012). This study's data were collected over 3 months—January to March 2021—by the author as part of her doctoral study. The methods used for data collection were adapted to the organization's reality and the interviewees, considering the confinement and restrictions imposed by the COVID-19 pandemic during the observation period. GAT's teams and the interviewees worked from home, communicating through videoconferences on platforms like Zoom. GAT does not have a formal communication team. People who currently do some communication tasks are scattered throughout project coordination.

In this sense, the field diary was fed through online meetings and conversations (Zoom platform) with these persons, and the monitoring of GAT actions was done via Facebook (the only social media platform where the organization is currently active) and through attending their online events, like live talks and conferences on different topics. we also analysed GAT's 2021 activity plan and other documents. As in the study of Johnston and Everett (2012), we used a qualitative method for data collection based on "participant observation (experiencing), interviewing (enquiring) and studying

materials prepared by others (examining)" (Wolcott, 1994, p. 10), paying attention to the details in the expressions of culture, framed in their context (Ybema et al., 2009).

Ethical considerations, mainly related to managing the observer–participant relationship, need to be addressed during all the ethnographic research stages (Fetterman, 1998). We addressed this issue by making my role explicit through all the interactions and asking for permission to record the conversations and quote the people involved. The researcher's role and the investigation's objectives were explained in the document of informed, clarified, and free consent to participate in the study signed by the executive director of GAT.

Data Analysis and Reduction

Through ethnographic immersion and interviews, we obtained a very high volume of data that required a careful selection process of meaning units. Converting data through description, analysis, and interpretation is not a linear process in ethnographic approaches (Wolcott, 1994). In the first stage of description, fieldwork observation data were documented in the field diary, and all recorded interviews were transcribed as they were undertaken (Baszanger & Dodier, 2004).

To select the relevant information from the ethnographic approach to GAT, we used two main selection criteria/categories (obtained from the literature review): (a) type of activism, according to the typology of activism proposed by Harrebye (2016, p. 3), and (b) position on private-sector companies' support for activist causes (Ciszek & Logan, 2018; Wettstein & Baur, 2016).

To analyse the responses of the communication experts, we used Nvivo software (12)[3]. The analysis started by reading, identifying, and classifying codes suggested by the data rather than collected from the literature (Lansisalmi et al., 2004). Coding was operationalized as nodes (meaning structures) and managed by computer-assisted qualitative data analysis.

3. Results and Discussion

Ethnographic Immersion GAT

Type of Activism

According to the typology of activism proposed by Harrebye (2016, p. 83), GAT presents a type of "professional" activism whose "fundamental logic" is based on "lobbying," this is, on the pressure and influence of decision makers to adopt measures that benefit the communities with which they work. Their most "typical activities" are "campaigns and meetings," and their "intended objectives" are the "reform" of the system. The "types of slogan" that these activist groups use most are "we are going to

[3] QSR International. (1999). NVivo Qualitative Data Analysis Software. https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/home

commit ourselves all in writing to the real reduction of carbon emissions." The case of a similar slogan used in a campaign during the period of observation is "to end the HIV and AIDS epidemic as a public health problem in the city of Lisbon by 2030, by improving access to the various responses available" (Campaign #ZERODISCRIMINATION, Lisbon Without AIDS), in partnership with the Lisbon City Council[4]. Concerning the "dominant perception of institutional agents (police, politicians, media)," these types of activists are considered "impertinent specialists (the relationship is appreciated, but often ignored)."

Position on the Support of Private-Sector Companies for Activist Causes

On partnerships with the private sector to advance activist causes, GAT Executive Director Ricardo Fernandes said that "it is a complex issue since many activism movements in Portugal (which is not the case with GAT) have strong links to leftist movements and there is an ideology related to what a company stands for—capitalism—that does not welcome sponsorships by companies and brands for activist events. In some cases, in which these sponsorships occur, namely within the scope of the LGBTI+ community, there are even strong internal divisions between activists since some consider that the communication strategies oriented to the promotion of institutions, countries, people, products, or companies, invoking their sympathy for gay-friendly territories are a form of 'pink washing' [appropriation of causes to improve public image]."

Ricardo Fernandes explained that "GAT has several donors, including the pharmaceutical industry, who have a vested interest in having us testing for HIV; the more we test, the more people consume their products." Margarida Santos, one of the coordinators of the "MORE PARTICIPATION, better health[5]" project (in partnership with GAT), with whom we had an informal conversation via Zoom, explained that "GAT is certainly critical of the pharmaceutical industry, but it knows that it depends partly on its funding." She clarified that there must be a shared interest and responsibility between the government and private entities in funding activism.

In the most relevant communication moments, companies from the pharmaceutical industry with which GAT collaborates provide their communication and public relations agencies' services. Ricardo Fernandes explained that "the main difficulty in these partnerships with the private sector is that it is not systematic, there is no continuity. It is when the organization has availability, but this does not always coincide with our communication needs. I think that if an organization wants to move forward, it must have a mixed regime. We have to use what is in the community, but we need to find internal resources to do things for us."

[4] Campaign #ZERODISCRIMINATION. https://www.lisboa.pt/lisboasemsida

[5] https://www.participacaosaude.com

Expert Consultation

Regarding the consultation of communication experts from APECOM-associated agencies, as seen in Figure 1, the categories for this type of consultation are the following (by order of highest frequency with which they were mentioned):

Companies and Brands Public Positioning. All experts agreed that this kind of public positioning is not "innocent." Despite the differences of views on whether they advised their clients or not to engage in this type of more ideological involvement, the majority of the participants agreed that if it happens, "this positioning must already be part of an organization's DNA" and "what is essential is that it is something genuine, transparent; otherwise, it is a very dangerous path."

*Future Trends***.** Nine of the 12 experts believed that the organizations' purposes are being redefined, and the involvement of companies in social issues, considered controversial, has been growing globally. They agreed that this is a communication trend that will also reach Portugal, although later than in other cultures.

*Business Interest and Objectives***.** Seven of the consulted experts agreed that this type of positioning is a marketing and communication strategy. These companies said that they agree with specific causes because most people are also in agreement, which serves their business interests. One of the respondents said that if activist groups "explain and show Portuguese companies that their market segment, their audience has a high percentage of people who belong to or defend certain causes, they may be interested in these causes and even finance them."

Culture. Six experts reported that the Portuguese business culture is not yet prepared for this type of positioning. One respondent highlighted that "I think that in Portugal we do not have the business maturity for this path. Our leadership and CEOs do not get involved at this level. We do not have that kind of strength, neither in large companies nor in smaller ones." Another explained that "Portuguese companies do not want to get involved in controversies" … "there is a big difference in how we walk the talk here compared with Anglo Saxon companies."

*Causes***.** Six experts agreed that this kind of endorsement in Portugal depends on the causes. Within the scope of their social responsibility actions, Portuguese companies are more oriented toward solidarity on universally accepted values such as charity.

Kind of Activism. The experts' responses also showed that very aggressive and unreasonable communication styles do not work well in the context of business partnerships. One of the interviewees highlighted that "activisms often have to use the classic tools of capitalism to achieve their goals."

*Social Change***.** On current social changes, it was mentioned that "societies are changing, young people ask for another type of communication and this activist communication, more interventional, reaches both young people and older people."

Financing Strategies for Activists. One of the interviewees analysed this issue from an interesting perspective for activists: "I think it is a smart choice and one that should be sought. For all of what we are talking about, it does take some money, even if some work can be offered, some things will always need money and companies have money, and therefore, it is a source that must be explored."

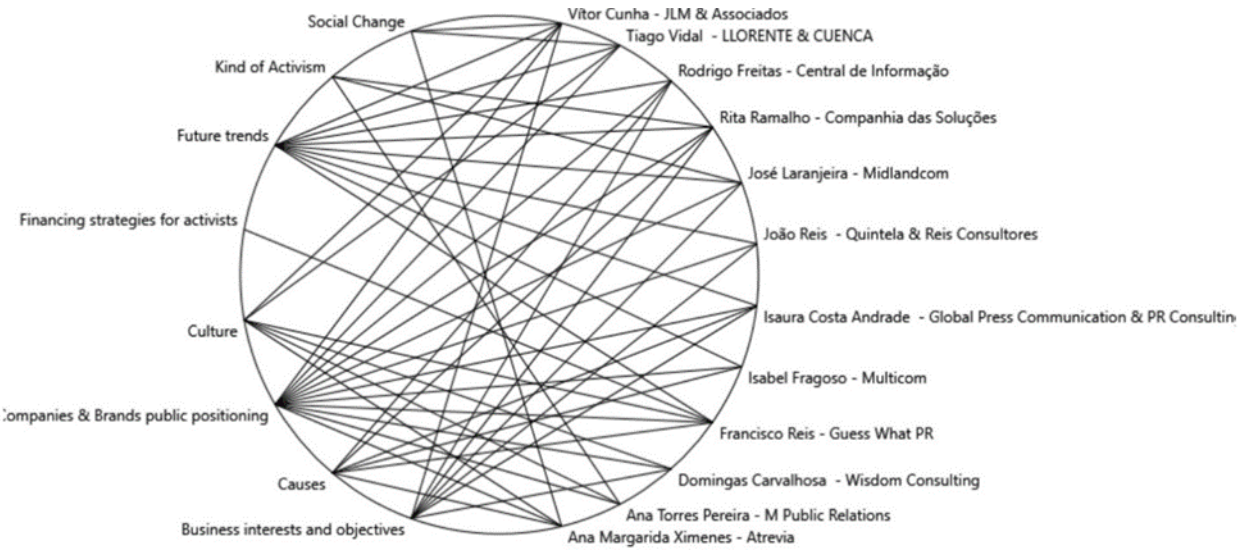

Figure 1*. Visual Representation of the Connections Between Respondents and Response Categories (NVivo Software)*

4. Conclusions

This study made it possible to analyse private companies and human rights activists' engagement through two distinct but related organizational perspectives. We observed the relevance of the public relations function within the scope of activities by "hybrid multifunctional voluntary organizations" such as GAT (Hasenfeld & Gidron, 2005). Through the ethnographic approach, it was possible to observe how activism and social movements can be considered as a form of public relations work concerned with advocacy, promotion, events, public interest, lobbying, and public affairs, communicating with a wide range of audiences, clearly oriented toward social change and for the realization of idealized objectives. In this way, public relations can be understood as an intervention directed toward collective action (L'Etang, 2016).

The observation also allowed to perceive the distrust that some activist groups in Portugal have concerning companies due to political ideologies. Nevertheless, one of the main challenges activist groups face is the scarce financial resources available. As the communication experts mentioned, structured partnerships with the private sector to advance causes can be a strategic option for these

organizations within the framework of human rights and the 2030 Agenda. GAT presents a pragmatic view of its organizational objectives, characteristic of strategic planning in public relations, focusing more on win–win advantages that these partnerships can bring to the causes and less on ideological divisions that may not have concrete consequences for their mission. In this case, the pharmaceutical companies that support GAT do not practice corporate political advocacy. It is recognized that their support for associations such as GAT is fundamentally related to their core business and commercial objectives. Nonetheless, they are important partners in terms of financing GAT's activity. Furthermore, that support does not prevent GAT from having a critical social voice, if necessary, about the pharmaceutical industry.

However, strategic partnerships between activists and companies are not so common in Portugal. On the one hand, this is due to the suspicions that exist from several activist groups toward companies based on political and cultural oppositional traditions. On the other hand, Portuguese culture, in general, and business culture in particular, and its leaders, do not have the maturity for this positioning in progressive causes such as gay marriage. In answer to this study's research question, the public endorsement by private companies for human rights activist groups on controversial socio-political issues is not currently a practice that is followed in Portugal. The communication experts consulted expressed doubts about the specific contexts in which this may occur. However, they also agreed that this scenario is changing. Portuguese companies will have to adapt to these new trends and choose wisely what causes and groups to support. This can present an opportunity for activists in the human rights scope and the 2030 Agenda.

Lidl supermarket, for example, recently launched a campaign that quickly went viral on social media. To present its toy suggestions—for the Portuguese Christmas 2020 campaign—the company decided to break gender stereotypes, reversing the roles generally associated with girls and boys (Imagens de Marca, 2020). Several commentators applauded this initiative and underlined the importance of steps like this in breaking stereotypes. Portuguese MEP Maria Manuel Leitão Marques congratulated the company's decision on Twitter, stressing that any help to dismantle gender stereotypes, as "one of the main barriers to equal opportunities," is "welcome."

A recent study from Parcha and Kingsley (2020) revealed that a "corporate statement on a controversial social issue is effective in changing an individual's attitude toward the issue depending on how much the issue is relevant to the individual's goals and/or if the corporate statement is supported by other corporations" (p. 350). Apparently "corporations are making conscious efforts to improve their social responsibility by taking stands on controversial social issues," but "corporate social irresponsibility is still occurring" (Parcha & Kingsley, 2020, p. 377). Regarding future research concerns, authors such as these raise important questions about the balances and imbalances resulting from this attribution and/or appropriation of, even more, powers of social intervention to corporations. In the face of growing social polarization, the tendency is for companies to adopt more explicit positions concerning specific political

or ideological issues. In the context of the struggle for human rights and the 2030 Agenda, these circumstances can represent an opportunity for strategic communication and public relations.

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From Data to Discourse

How Communicating Civic Data Can Provide a Participatory Structure for Sustainable Cities and Communities

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Abstract

This study explores how Civil Society Organizations (CSOs) have leveraged civic data to facilitate democratic participatory structure for sustainability transitions around the case of bicycle counters in three US cities over a ten-year period (Seattle, San Francisco, Portland). We identified that CSOs have played crucial roles in public discourse by (1) sustaining long-term public issues through shaping affective as well as analytical discourses and (2) fostering citizens' sense of ownership and contributions toward sensor devices and the data they generate by contextualizing them through local civic life as well as connecting issues to actors in other cities.

Keywords: Civil Society Organizations, Civic Data, Bicycle counter, Participatory structures, Sustainable Development Goals

1. Introduction

Civil Society Organizations (CSOs) is an umbrella term that encompasses different types of networks and institutions ranging from transnational non-governmental organizations to small community groups (United Nations, 2018, para 20). CSOs enable democratic participation and are regarded as central for achieving the UN's Sustainable Development Goals (SDGs). Despite their recognized importance, conventional forms of CSOs have struggled to recruit supporters especially from younger generations (Wells, 2015). New types of CSOs address citizens through performative and quotidian media practices (Foellmer et al., 2018; Mattoni, 2016) creating forms of political activism as "connective action" (Bennett and Segerberg, 2012). The present study analyzes the roles that these new types of CSOs have in sustainability transition, looking specifically into bicycle counters as sensor devices that are visible in public spaces and that become "communicative objects" (Raetzsch and Brynskov, 2018) in public online discourses.

This exploratory case study makes a contribution to understanding new democratic participatory structures in cities and communities (SDG 11.3.2) in the context of CSOs, citizen-centered innovation, and public contestation through social media. We analyze how electronic bicycle counters are becoming accepted and owned by communities in the transition to sustainable cities where the modal share of cycling is required to increase to reduce carbon emissions from car traffic. Such sensor devices generate "civic data" (Hamm et al., 2021) by monitoring citizens' movement but also by generating crowd-sourced, collective representations of change in the city itself that citizens can contribute to. To make civic data actionable, however, data alone is insufficient (Assad et al., 2017; Chen and Aitamurto, 2019; Foth and Brynskov, 2016; Raetzsch et al., 2019; Foth et al. 2011). We want to understand how civic data in the case of bicycle counters are made actionable in public discourses and which roles CSOs play in this process.

Bicycle sensors are visible interventions in urban space, their data represents and monitors diffuse patterns of collective mobility. Through social media, citizens are likewise referencing, challenging, or embedding their own experiences into new forms of understanding change in the city. These overlapping processes of technological intervention and cultural contestation exhibit a slow and rather inconspicuous process of infrastructuring, where different actors circulate different kinds of "communicative objects" (Raetzsch and Brynskov, 2018), highlighting the processes of negotiating and contesting individual and collective meanings of technical infrastructures. By drawing on longitudinal as well as case-based data collections, discourse, and network analysis of social media data, we retrace how the communicative object of the bicycle counter triggers community-oriented perceptions of sustainability transitions around the subject of cycling in the city.

The research question of this study is:

RQ: How have CSOs leveraged communicative objects to facilitate democratic participatory structures in cities around bicycle counters in public spaces?

The study will explore how data generated by the interaction of citizens and bicycle counters becomes a communicative object across stakeholder groups, highlighting the importance of CSOs to shape, moderate and influence such public discourses. In this exploratory mixed-method study, we analyze English-language discourses on Twitter and Facebook around bicycle counters in three US-American cities, focusing on three CSOs in particular. The study makes two core contributions to understand the roles of CSOs to shape participatory structures and make civic data actionable for sustainable cities and communities:

1. CSOs play a significant role in sustaining long-term public issues such as the safety of cycling in the city through affective as well as analytic discourses based on data collected by bicycle counters.
2. CSOs contribute to citizens' sense of ownership of sustainability transitions through enabling and eliciting the circulation of communicative objects, fostering a collective process where the impact of civic data is contextualized in local civic life.

This paper is organized as follows: We first review literature on CSOs' changing use of digital media and the role of civic data in Section 2. We then introduce our data collection, case selection, and methodology in Section 3. In Section 4, we summarize our findings. Then, we discuss the case studies and point out the CSOs' roles in sustainability transitions in Section 5. In the conclusion, we call for a central acknowledgment of CSOs as anchors of civic engagement in networked publics, arguing for the need for democratic participatory structures in the use of civic data for fostering sustainability transitions.

2. Literature Review

2.1 Civil Society Organizations, Connective Action, and Digital Media

Recent social movements such as the Occupy protests in the United States, have created much attention toward the roles of social media as a participatory structure and mobilizing people. As Wells (2015) pointed out, civic participation in the context of digitally-enabled social movements, contributes to the decline of activity in institutional CSOs. Communication is essential but often theoretically underdeveloped to account for the disaffection from politics especially among younger citizens and its link to concrete actions (Kim et al., 2010). Bennett and Segerberg (2012) emphasized that communication itself becomes the organizational structure of the movement. Compared to traditional CSOs these emerging new forms of "connective action" loosely offer variegated ways of public engagement through individual sharing of political ideas, memes, and information on digital media (Bennett and Segerberg, 2012). Similarly, Diani (2015) argued that networks are not just precursors or building blocks of collective action: they are in

themselves organizational structures that engage individuals beyond formalized demands for membership in organizations.

In these new activist contexts, social media play a central role in enabling variegated types of sporadic as well as long-term participation, creating opportunities for mobilization in key instances of a movement as well as forging a joint community spirit from individuals interventions and experiences, a new form of "cloud protesting" (Milan 2015). These developments shift the role of CSOs from being a single institutional and representative actor in political discourses to a networked logic that creates the "glue that binds public and private activity together" (World Economic Forum, 2013, p.5). CSOs and associations of individuals act as a "facilitator in loosely linked public engagement networks" (Bennett and Segerberg, 2012, p.758) of democratic participation (United Nations, 2018; Karph 2015). The creative use of social media and digital communication formats by CSOs is well recognized as crucial for developing inclusive discourses and narratives around sustainability transitions across different stakeholder groups through experimentation and interventionist practices rather than formalized processes of political participation (Hamm et al., 2021; Köhler et al. 2019; Sengers et al. 2019; Brynskov et al. 2018; von Wirth et al. 2018; Werbeloff et al. 2016).

Many CSOs struggle to transform their traditional participatory structure based on formal membership. New kinds of CSOs have successfully adopted digitally enabled communication modes to leverage a wider participatory potential from their supporters and followers (Karph 2017). Prominent examples of these participatory modes employed by CSOs include publicizing social issues (Bruns and Burgess, 2011), increasing public discourse visibility (Andrews and Caren, 2010), linking diverse actors (Wonneberger et al., 2020), and mobilizing public attention (Wang et al., 2016). Karpf (2017) emphasizes the need for CSOs to listen to these articulations, arguing that "analytic activism" leverages affordances of digital technologies to fashion new strategic interventions in the political arena. Protest movements filter and moderate both internal and external communication processes where "mediation opportunity structures" are exploited to give voice and visibility to issues of public concern (Cammaerts 2012). CSOs and dispersed social movements are then challenged to both observe, facilitate, articulate, and channel diverse communication streams through new kinds of distributed media and protest practices that link to personalized habits and communication routines of their supporters and followers (Mattoni 2020).

In the broader discourse on sustainability transitions, we conceptualize social media communication as a democratic participatory structure for emerging topics in which CSOs play a central role. While being aware of the various shortcomings of social media technologies, e.g. digital divide, platform logics, algorithmic content amplification, these platforms also offer affordances for CSOs to build up and sustain networks of engaged citizens.

2.2 Civic data

Civic data is commonly understood as data that is both captured and owned by the citizens as a form of the crowd-sourced, open data asset. Its aim is to provide citizens with the means and knowledge to act upon pressing local issues through evidence-based data collections, e.g., on air pollution or radiation (Hamm et al., 2021). The public distribution of civic data needs to be complemented with broader communication strategies that include citizens' shared opinions, emotions, and experiences relating to pressing social issues (Brynskov et al., 2018; Hamm et al., 2021). Collaborative knowledge creation and social change here coalesce with wider public discourses through deliberation in multiple communicative spaces, e.g. in local urban spaces, in the news media, and on social media. Civic data is connected to what Wells (2015) calls "civic information" that is conceptualized as "the continuous flow of facts, opinions, and ideas that help citizens understand matters of potentially public concern and identify opportunities for action" (p.7). While civic data refers to data assets created by and for activists and citizens, civic information refers to the processes of making sense of data and leveraging the impact of big data for social change (Cuquet and Fensel, 2018; cf. Zins 2007).

To make civic data actionable for various actors, however, there is a need to design and implement interfaces that make data accessible to the broader public (Assad et al., 2017; Raetzsch et al., 2019), a structure to appropriate their city to take action for change (Chen and Aitamurto, 2019; Foth and Brynskov, 2016; Hamm et al., 2021) and to be able to institutionalize and grow communities of socio-technical practice in symbiosis with other systems and institutions (Foth and Brynskov, 2016; Gordon and Mihailidis, 2016). In detail, Foth and Brynskov (2016) underscored the importance of civic engagement in a way that allows a multiplicity of voices to be listened to, instead of merely using the pool of data for specific purposes. Finding information that matters requires contextualization based on the specific individual needs of actors. Successful deployments of civic data have been backed up by the process of co-developing a novel technology to solve a target problem by mediating an entire network of social practices and galvanize multiple organizations and user groups (Liu et al., 2019). In addition, social media has become an important structure to generate and disseminate citizen information in local communities and CSOs have assumed important roles as communicators and information producers (Thorson et al., 2020). Meanwhile, generating large amounts of civic data (i.e., civic data overload) has created challenges in processing the data, such as which voices are to be heard and considered by authorities (Chen and Aitamurto, 2019). Thus, we are now more in demand for what research on Digital Civics call for: exploring the potentials of digital technologies "to reconfigure power relations between citizens, communities and the state" (Vlachokyriakos et al, 2016, p.1096).

3. Methodology

3.1 Data collection and Case selection

In this study, we analyze bicycle counters as prominent subjects in English-language online discourse, principally on Twitter and Facebook. The corpus of social media data was constructed through the following two stages. First, we compiled a data set from Twitter and Facebook Pages (excluding Retweets) containing the words "bicycle/cycling/bike counter(s)" for the past 10 years. Twitter data were gathered through the Twitter API with an academic account while Facebook Pages' posts were gathered through CrowdTangle API with an academic account. We found the oldest available posts in CrowdTangle was in February 2011. Thus Facebook Pages' data in our corpus covers the data from February 2011 to December 2020 (119 months) while Twitter data covers the tweets from January 2011 to December 2020 (120 months). Due to search queries posted in English, the resulting data set showed a strong majority of activity in US-American cities, the three most prominent ones being Seattle, San Francisco, and Portland. These three cities were identified based on the number of posts that contain location information. We decided to focus on these cities to illustrate the dynamics between civic data, citizens, and CSOs while fully acknowledging that a future study could contain a more targeted search for cities in which bicycle counters were prominently discussed (e.g. Aarhus/Denmark, Amsterdam/Netherlands, Berlin/Germany).

Secondly, we found the most commonly used hashtags related to bicycles in local contexts in the corpus, collected additional Twitter and Facebook data for the past 10 years with those location-based hashtags, and added them to the corpus. The hashtags for the additional data collection are #SEAbike(s), used in Seattle, #SFbike(s) and #bikeSF, used in San Francisco, and #pdxbike(s) (pdx is a nickname of Portland), used in Portland (all hashtags were case insensitive). In total, our corpus consists of 34,037 Tweets and 448 Facebook posts. In addition, for quantitative network analysis (described later in Subsection 3.2), we further collected retweets and replies to the Tweets in our corpus through Twitter API (we did not conduct this further data collection on Facebook Pages' data because CrowdTangle API does not allow us to do so). These additional data of retweets and replies (53,540 Tweets) are only used for network analysis, not in qualitative in-depth analysis. In addition, for qualitative in-depth analysis, we additionally collected online materials, including reports, media news articles, and press releases, through keyword news article searches and tracking social media data references.

With this corpus, we extracted the accounts of CSOs that have been the most actively communicating in Seattle, San Francisco, and Portland. As a result, we selected the following three CSO cases in three US cities:

- **Case Seattle**: Cascade Bicycle Club (WA) is a statewide bicycling nonprofit organization located in Seattle. Founded in 1970, it has continuously advocated for the safety of cyclists. In Seattle, the first bicycle counter was installed in 2012.
- **Case San Francisco**: SF Bike Coalition (CA) is also one of the oldest bicycle advocacy groups founded in 1971, which has promoted bicycling for everyday transportation (SF Bicycle Coalition, n.d.). San Francisco first installed a bicycle counter in the city in 2013 (San Francisco Municipal Transportation Agency, 2013).
- **Case Portland**: BikePortland.org (OR): BikePortland.org was founded in 2015 as a civic media organization. Portland installed the first-in-the-U.S. bicycle counter in 2012 (Portland Bureau of Transportation, 2013).

Cascade Bicycle Club (Seattle) and SF Bike Coalition (San Francisco) have long histories of cycling advocacy while BikePortland.org is a relatively new organization founded after the rise of social media. We analyze the corpus of social media posts as a whole to capture overall trends of discourses about bicycle counters. We then explore bicycle counters in the case studies of Seattle, San Francisco, and Portland as communicative objects of social media discourse.

3.2 Data Analysis

In this study, we apply mixed methods to explore longitudinal data (2011-2020) on the bicycle counter discourse in Twitter and Facebook. From this large corpus, we focus especially on three cases, which we analyze by social network analysis and critical discourse analysis of linked content outside social media.

For conducting the social network analysis, we construct retweet and/or reply networks of users in the Twitter data enriched by an additional data collection described in Section 3.1. Our network analysis was done with the Python package NetworkX. We created a network graph where each node represents a Twitter account colored according to city-related hashtags, i.e. Seattle related hashtag (#SEAbike(s)) in green, Portland related hashtag (#PDXbike(s)) in orange, and San Francisco related hashtag (#SFbike(s) and #bikeSF) in light blue. Each edge represents a retweet and/or reply connection between accounts. We apply this network analysis to accounts in all three of the selected cases.

For qualitatively examining the corpus, we applied critical discourse analysis (CDA) that has been traditionally used to uncover discourses that maintain power relations of existing elites and institutions (Willig, 2014) and is more recently used to study social media (Bouvier and Machin, 2018) and public discourses around new technologies (Hamm and Lin, 2018). We here apply CDA to understand how civic

data is used to initiate discourses that negotiate sustainability transitions by CSOs, potentially shifting power hierarchies between policymakers, citizens, CSOs, and other stakeholders.

4. Findings

4.1 Patterns of public discourse: From contested innovation to accepted infrastructure

Our corpus consists of 34,358 posts (34,037 Tweets and 448 Facebook Page posts) in the past ten years. Among them, the majority of posts were created by users located in the United States while many posts, in particular Tweets, were by users who do not share location information. In Figure 1, the monthly number of posts in our corpus is plotted over the period from January 2011 to December 2020. Yellow bars represent the posts mentioning the keyword "bicycle/bike/cycling counter(s)" and grey bars show the number of posts with hashtags (#pdxbike(s), #sfbike(s), #bikesf, and #seabike(s), if a post has both bicycle counter keyword and hashtag, the post is counted in yellow bars) in our corpus. Networking through the use of hashtags has been more active on Twitter than on Facebook, a defining feature of user practices on the platform. Over the past ten years, the highest numbers of posts per month typically occur when bicycle counters were set up in cities. For example, the number of posts was highest in August 2012 when the city of Portland installed its bicycle counter (584 posts on Twitter and 24 posts on Facebook). In Facebook Pages, the second-highest number of posts was observed in December 2016 when the city of Santa Monica, California, installed its first bicycle counter (17 posts). Similarly, the highest number of comments, replies, and shares (retweets) occurred at times when the first bicycle counter installations happened: In Facebook, the highest number of interactions occurred when the city of Victoria in Canada installed its first bicycle counters in August 2019, followed by Carmel, Indiana in May 2015. On Twitter, the highest activity occurred when Santa Monica (Dec 2016) and San Francisco (May 2016) installed bicycle counters.

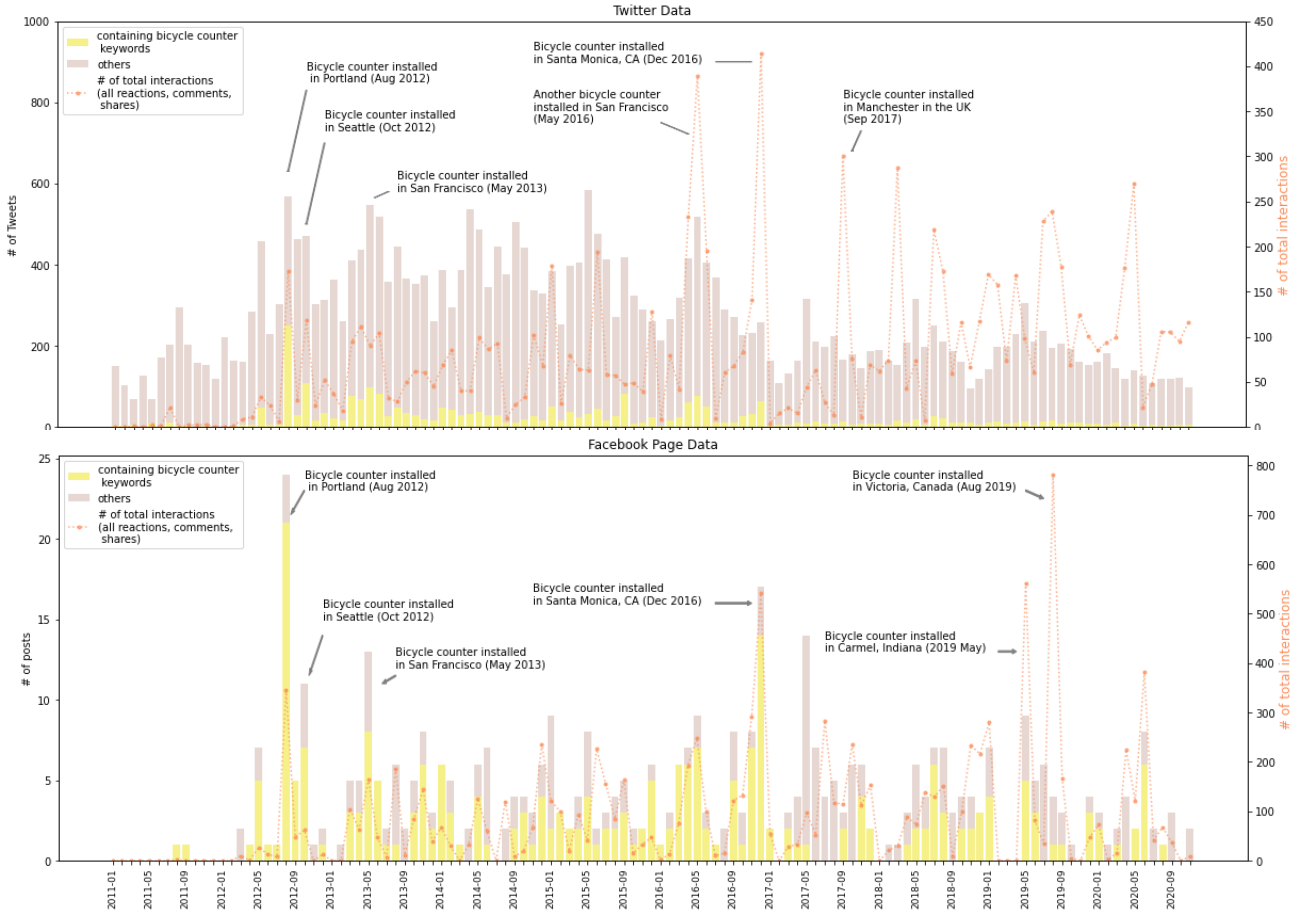

Figure 1*. Monthly number of Tweets (top) and Facebook Pages' posts (bottom). The yellow bars represent monthly numbers of posts containing the keywords "bicycle/bike/cycling counter(s)" and grey bars represent monthly numbers of posts containing hashtags (#pdxbike(s), #sfbike(s), #bikesf, and #seabike(s). Orange broken lines depict summed numbers of reactions (replies, comments, and shares) that posts in the month gained. Bars contain only original posts (i.e., no replies, comments, shares, retweets, etc.), the orange line quantifies all reactions to the original posts.). Both in Facebook and Twitter, one of the biggest peaks of communication occurred in August 2018 when the first-US bicycle counter was installed in Portland (584 posts on Twitter and 24 posts on Facebook). Similarly, the number of interactions that posts had, i.e., numbers of comments, replies, and shares (retweet), was the most intense when bicycle counters were installed both in Twitter and Facebook posts.*

There were steady numbers of posts in each month since 2011 on Twitter. Since around 2016 yet the total number of posts on Twitter has slowly declined. In particular, the number of posts that include the keywords "bicycle/bike/cycling counter(s)" have decreased since around 2012 and there were only a few posts

containing the keywords after 2017. This might reflect the process of bicycle counters becoming accepted as quotidian elements of urban infrastructures. In addition, new sources of bicycle movement data (e.g. through tracking apps) have complemented stationary counting systems over the last years. In Portland, for instance, the city started to incorporate other types of data that capture bicycle usages and travel patterns, such as purchasing the data from a mobile app company (Maus 2014; Portland Bureau of Transportation, 2018).

Overall, the general pattern of discourse on bicycle counters shows three distinct phases and subjects: installation of bicycle counters as a public event, the process of crowd-sourced data collection, and sharing collective civic data in support of mobility transitions.

4.1.1 Discourses on installing bicycle counters

Throughout the 10-year period of bicycle counter discourse, the installation phase of bicycle counters in the respective cities generated the majority of articulations on social media. The installations of new bicycle counters are typically met with both favorable and unfavorable reactions. Positive reactions are based on excitement about the new means to acquire data and the new experiences of being counted, e.g., "*Great to show car drives how many bike journeys are taken!*," "*could be useful to argue for more bike lanes*," and "*Excited I make my rides count!*" The majority of negative reactions refer to using tax money on bicycle counters, such as "*70k would be better used repairing potholes and adding raised didewalks (sic!)*", "*How about spend money on helping housing and cars than bike lanes?! Not every soul can bike!*" Such posts also stimulate citizens elsewhere to demand bicycle counters for their cities as well. Comments such as "*why hasn't the city installed a single bike counter?*," or "*OK, we are jealous of Portland's bike counter. Where would you put a bike counter in the East Bay?*," or "*Is Portland's bike counter a solution for the New York City's bike ridership debate??*" show the pioneering role of the first cities.

4.1.2 Discourses on the crowd-sourced generation of data

Alongside the collection of civic data on the counters themselves, we see several types of discourse emerging where the counters themselves are becoming communicative objects. One of the most observed types is sharing personalized experiences of being counted. Citizens excitedly document their experiences of being registered by counters through posting images and videos. There are also posts sharing how the presence of counters nudged citizens to use bicycles (more). After counters have become normal and accepted as part of the urban infrastructure, celebrating how bicycle counters hit 1 million cyclists recorded in one year also elicited many positive reactions from citizens. Compared to the installation phase, the number of critical posts about bicycle counters decreases as people contribute to generating data. Only a

few posts criticize the accuracy of data counts, the locations of bicycle counters at highly-frequented roads, or public spending on bicycle counters.

4.1.3 Discourses on interpreting a collective civic data asset

The most prominent yet unique type of discourse in our corpus is about analyzing and interpreting bicycle counter data as a collective civic data asset. The generated civic (and open) data allows anyone (who has the skills and knowledge to do so) to analyze and interpret the data to make sense of bicycles in their cities and construct their own ideas, opinions, and plans for actions. Figures or tables of data eschew an analytical perspective on cyclists' mobility. Many posts show how bicycle use has grown over the years, e.g., by comparing annual numbers of bicycle counts, peaks of commuting hours, or seasonal differences. As more data is accumulated, various types of analyzes contribute to changing people's perceptions of the issue as well as making sense of a collective civic data asset. For example, during the COVID-19 crisis, civic data accumulated through bicycle counters in the US show steep increases in cycling (e.g., a tweet with multiple colored figures showing the analytical results: "*How has COVID-19 affected biking in your city? We're taking a look at Urban Cycling Patterns During a Pandemic: Seattle Bike Counter Analysis, in our most recent blog. Read more here: [url]*"). One of these analytical results describing changes in bicycle use across the United States was shared by the international newspaper The Guardian resulted in more responses online.

4.2 Making sense of civic data: Network structures and discourse opportunities

In this section, we turn our attention to the role of CSOs' in creating and shaping civic data as a communicative object of public discourse. We first present social network analysis results on each case in subsection 4.2.1 and then present the findings of the CDA in subsection 4.2.2.

4.2.1 Networks around central activist accounts

To understand how CSOs have positioned themselves in their respective communities, we calculated Twitter network graphs of the cases based on hashtags. In Figure 2, each CSO in the three cities is shown in the purple nodes while other users in the networks are shown in uniform colors, i.e., green, blue, and orange respectively. The network graph shows how local online discourses of the three cities have evolved and become connected with each other and with different cities.

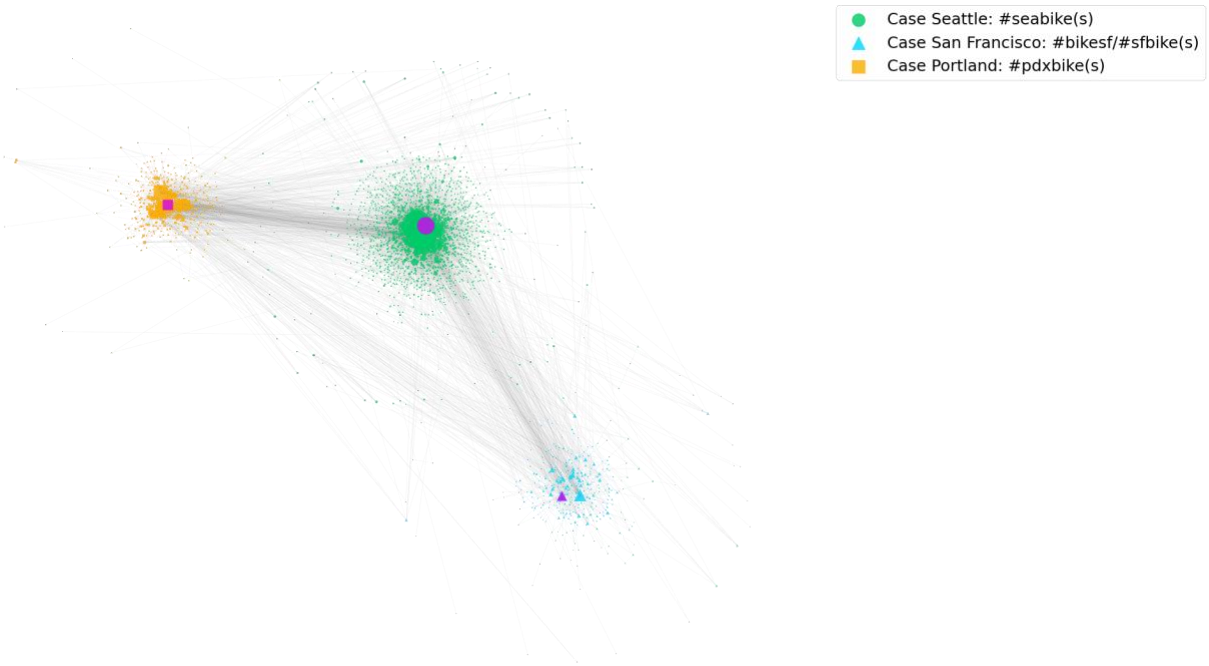

Figure 2. *Twitter networks for each CSO in the selected case studies. Each node represents an account while each edge represents a reply or retweet between accounts. The node sizes represent the frequencies of being retweeted and replied to.*

Table 1 summarizes basic indicators of each case's network structure. Case Seattle shows very closely aligned edges, i.e. a focused network of accounts, compared to a more thinly and widely distributed network of edges and accounts in Case San Francisco and Case Portland. Regarding degree centrality (i.e., the count of how many social connections each node has), all CSOs are positioned equally central in their hashtag networks. Interestingly, there is a great discrepancy between the cases regarding betweenness centrality (i.e., capturing the amount of influence a node has over the flow of information in a network): For Case B (SF bike coalition in San Francisco) betweenness centrality is comparatively higher, indicating that they serve as an important broker between otherwise rather loosely coupled actors and networks.

Table 1. *Indicators of network graph (Figure 2)*

	(i) Density of network of hashtags	(ii) Degree centrality of CSO account	(iii) Betweenness centrality of CSO account
Case Seattle	**0.012**	0.056	0.027
Case San Francisco	0.002	0.051	**0.240**
Case Portland	0.003	0.040	0.067

Note:
(i) Density of network is calculated separately on each case's sub-graph (#SEAbike(s), #bikSF/sfbike(s), and #pdxbike(s) respectively). $Density = \frac{m}{n(n-1)2}$ where *m* is total edges and *n* is total nodes in a sub-graph. A higher score reflects the sub-graph is more dense, meaning more connections between actors exist compared to how many connections between actors are possible.
(ii) Degree centrality is simply a count of how many social connections each node has. Higher values mean that the node is more central in the graph.
(iii) Betweenness centrality captures the amount of influence a node has over the flow of information in a graph. Higher scores indicate a node works as a bridge in the graph.

4.2.2. Experiences of Data: From personal encounters to long-term visions

CSOs' roles in facilitating sharing of personal experiences

After the installation of bicycle counters, the majority of posts in our corpus were about citizens sharing their experience of bicycle counters and being counted by them. These posts generally contain the excitement and positive emotions with self-portrait photos of them with a bicycle counter. Those posts include, for example, "*I've been making a point of going over the bike counter whenever I can. Sorta feels like voting..several times a day*." and "*Was secretly cheering every time we hit a bike counter today on the bicycle track*." The bicycle counter experience narratives spread into networks and it even nudged others to experience the bicycle counting as well e.g., "*[...] I wanted to be counted!*" CSOs refrained from advocacy and subjective opinions when citizens shared their personal experiences with bicycle counters. Rather, they acted as an information provider by posting new counters' information and sharing the counters' cycling data (e.g., posts with the figure showing the increase of bicycle numbers in the city, such as "*Another record! Yesterday, 5,066 bicyclists crossed the Seattle Bike Counter on the Fremont Bridge!*" (Case Seattle). In Case San Francisco the CSO nudged people to experience bicycle counters by posting, for example, "*CONTEST: Guess how many bikes the new Market Street Bike Counter will count on Bike to Work Day. Closest to the actual number wins a free pro tuneup bicycle*." These types of posts seek to connect individuals' experiences to collective and visible action on behalf of cycling in the city.

CSOs' roles in generating and disseminating data-driven discourse

Diverse communications containing bicycle counter data become part of CSOs communication, forming an analytical discourse aside from engaging citizens. Analytical discourse contextualizes civic data in a city's sustainability transition. Analytical discourse can be provided by anyone (citizens, data scientists, CSOs, or authorities) both inside and outside of the networks. For example, Case Portland (BikePortland.org) as a civic media organization, has provided numerous bicycle-related articles. These articles include basic patterns of bicycle usages in a month or year and increasing bicycle usages over time. As more data is accumulated, more types of analyzes can be done to make the local context understandable to citizens through data. For example, Cascade Bicycle Club (Case Seattle) initiated a discourse about the economic benefit of bicycle counters in local areas to support business opportunities. Other examples of analytical discourse are shown in Figure 3.

CSOs sometimes comment back to posts within the hashtag networks to address the potentials and meanings of bicycle counters in their cities, e.g., "*Collecting data to improve understanding of biking, will affect future policy*" (Case Seattle). Case San Francisco (SF bicycle coalition) pointed to the challenges of equity regarding who gets counted by sharing their own article about new counting installations in less central districts: "*Real talk: [San Francisco Municipal Transportation Agency]'s doing an increasingly strong job at making sure that *everyone* who bikes gets counted. [url]*" (Case San Francisco).

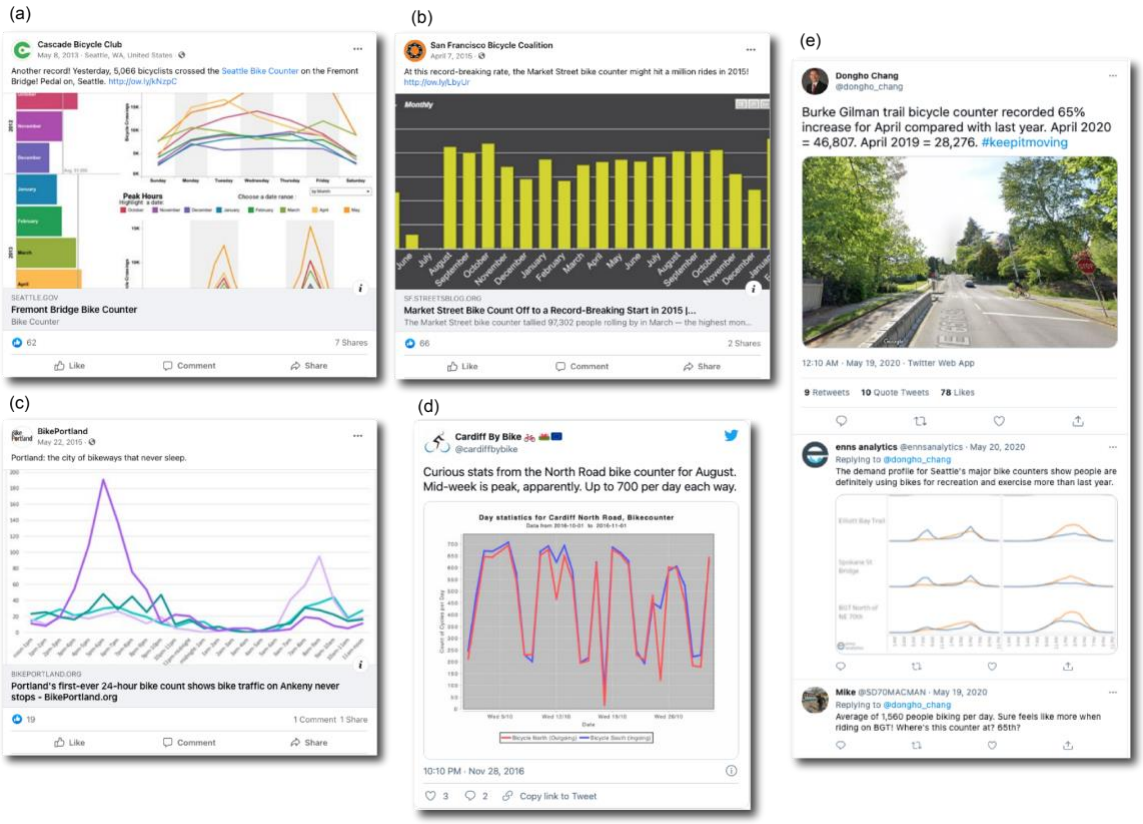

Figure 3*. Example posts of analytical discourse related to bicycle counters. The presentation of graphs allows users to understand and interact with bicycle counter data as a communicative object. The posts (a), (b), and (c) are example Facebook posts by the CSOs while (d) and (e) are Tweets from other users in the network.*

CSOs' role in connecting citizens to a shared vision of sustainable mobility

CSOs have also used hashtags to mobilize citizens for a joint vision of sustainable mobility. For example, Cascade Bicycle Club (Case Seattle) raised awareness of the city's delay in building its planned bike infrastructure, e.g., "*Build a #BasicBikeNetwork now. #SeaBikes*." They coordinated on-ground meetings at Seattle City Hall by tweeting: "*Join us tomorrow to send a resounding message to City Council: #wecantwait for the #BasicBikeNetwork. [url] #seabikes"* (Case Seattle). Through collaborations with other CSOs and citizens, this movement achieved that the plans of the Basic Bike Network were started by 2019 (Seattle Neighborhood Greenways, n.d.).

While hashtags have been mainly used to connect local actors, CSOs have also employed hashtags to connect individual communications that go across geographical boundaries. The hashtag #VisionZero is a

recent example. It is used to call for a framework to eliminate all traffic fatalities and severe injuries while increasing safe, healthy, equitable mobility for all (Vision zero network, n.d.). For example, Cascade Bicycle Club (Case Seattle) called for participation in this movement by posting:

> "*We need action on #VisionZero now. While people walking or biking are involved in 5% of crashes in Bellevue, we suffer 43% of injuries and fatalities. Join us at 6:30pm Thursday 12/12 at City Hall to tell leaders we can't wait for safe streets [url]*" (Case Seattle)

SF bicycle coalition also tweeted with the hashtag, such as: "*Show City leaders that inaction is unacceptable. #VisionZero meeting today at 2pm. [url]*" (Case San Francisco), echoed by similar calls for action from Portland. These examples illustrate that the CSOs use loosely connected networks to mobilize citizens and policymakers to take actions for sustainable mobility in their cities. The common use of the hashtag #VisionZero also supports our findings from the network analysis (see Figure 2) that CSOs from different cities connect with each other via social media to support common goals.

5. Discussion

CSOs were found to have a strong role in making civic data actionable and relatable for citizens in several ways. In their social media communication, this role can be found in two dimensions that facilitate democratic participatory structures outside the domain of formalized political deliberation through activist interventions and community-focused outreach. In particular, CSOs were found to offer both affective and analytical ways in which overarching socio-political issues can be addressed from a data perspective and a citizen perspective (5.1). They also facilitate a long-term public negotiation over crowd-sourced data as an asset that serves their communities in sustainability transitions and their pledge for safe cycling (5.2).

5.1 CSOs initiate affective and analytical discourses around civic data

The time of installing a bicycle counter typically coincides with a surge in social media activity, allowing numerous citizens to voice their approving or dismissive opinions on these innovations. Papacharissi (2016) described social media as generating a form of "affective publics," understood as "networked publics that are mobilized and connected, identified, and potentially disconnected through expressions of sentiment" (p. 311). Bicycle-counter discourses around civic data show that affective publics typically produce disruptions/interruptions of dominant political narratives by presenting underrepresented viewpoints and making a rather abstract sensor an object of affective (positive or negative) investment. CSOs here connect dispersed articulations around common concerns while seeking to articulate and promote a shared, collective vision. Once civic data through bicycle counters becomes available, CSOs initiate discourses

based on the data itself and call for participation. Apart from effective identification through personal experiences, CSOs shape analytical discourses with direct implications for policymakers. Civic data then serves as evidence for a changing mobility paradigm allowing different forms of affective connection, new visibility, and ownership. We observed that CSOs provide opportunities for affective identification while also offering analytical discourses based on civic data. Affective identification with the issue (cycling safety) and analytical discourses to endow the issue with public relevance (through civic data) contribute to the central role of CSOs as political actors.

5.2 CSOs enable ownership of civic data as citizens' data

Bicycle counters have matured as a unique form of cities' infrastructure as they gain acceptance among the wider public. Compared to citizen sensors installed in a bottom-up way (Hamm et al., 2021), bicycle counters are mostly installed by cities in a top-down fashion. Yet, bicycle counters in our case studies produce civic data as citizens gain a sense of ownership toward the counters and a feeling of contributing to the generation of data. By sharing their personal experiences of being counted, reporting issues of malfunctions, and expressing pride in their city's move to place counters, users on social media contribute to a sense of community and ownership on various levels of involvement. For example, one of the most liked Tweets (>150) in our corpus was about a bicycle counter being protected during road repair works:

> *"NOT ONLY did [account of the city's department of transportation] pave a temporary detour so that the 520 multi-use trail could still be used during construction, but they ALSO moved the bike counter so it could still be used too!"*

Similarly, some posts show forms of civic pride to see bicycle counters in cities (e.g., "*I think my favourite part of the southernmost section of the 1st street cycle track is the bike counter.*", "*Never noticed this Cambridge "bike counter" before. So Cambridge.*" or "*More scenes to love in #bikefriendly #SantaMonica: bike counter [...]*"). These articulations on being counted and creating data make cycling more visible to authorities and also car drivers, who command most of the space in public road infrastructure. It facilitates a process of generating evidence that underscores a sustainability transition in mobility that is already well underway. In addition, through dialogue on social media, civic data is interpreted through a range of "epistemic voices" (Elfin 2008 quoted in Foth and Brynskov, 2016) as people are making sense of the data in their everyday lives. In contrast to legacy CSOs, we saw that the selected CSOs have used the dynamics of circulation of communicative objects on social media to develop and sustain a democratic participation structure that "pervades across all touch points of civic life." (Asad et al., 2017, p. 2296). Coordinating and sustaining long-term discourses around bicycle counters through social media creates opportunities for

citizens to participate at various levels – from posting just one image to organizing a bike rally. CSOs here act as anchors for individuals in fragmented networks to overcome the algorithm-based biases of social media filtering (Chen and Aitamurto, 2019).

6. Conclusion

This study analyzes the role of communication for situating civic data in cities and communities in the context of a democratic participatory structure (SDG 11.3.2). We explored prominent cases of bicycle counters in the United States generating civic data as communicative objects of affective investment by citizens that make data actionable for systemic sustainability transitions. Citizens and CSOs together organize connective action, shaping a public discussion and offering incentives for participation. CSOs sustain long-term networking by fostering a sense of ownership by contextualizing civic data in local civic life as well as trans-local networks and policy. Despite the limitations of considering only social media data from US-based accounts, the study provides important contributions to understanding the challenges and opportunities for CSOs in using social media as a prime site of public negotiation of pressing social issues. Advancing SDG 11.3 in the direction of democratic participatory structures around urban innovation will require developing democratic processes for networked public interventions that bring together dispersed but committed individual actors and networks around a shared vision of sustainability, urban mobility, and safety.

From a democratic point of view, it is problematic that current developments have led to the use of non-accessible mobility data for counting bicycles, e.g. in the form of phone tracking or similar apps. Promoting civic data acquisition and widespread use will require governance structures where data generation and ownership are negotiated in a democratic participatory process in order to make such data actionable and useful for a range of different stakeholders–public and private ones. Relaying such democratic processes to the domain of social media, as this study has shown, can be only a first step towards equitable and inclusive data governance. As sustainability transitions depend on cross-sector collaborations, CSOs become more important for dispersed and networked publics to channel very heterogeneous aspirations of individuals into collective ways in which visions of sustainable society can be achieved.

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Communication Professionals As Social Change Agents In Times Of Uncertainty

Subtitle as needed

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Abstract

The pandemic highlighted the importance of the performance of communication professionals: if in the past communication professionals were able to communicate face-to-face through various communication tools and encourage stakeholders to engage in various organizational activities, the changed conditions not only forced to search for new forms of communication building and strengthening relationships with stakeholders in the 'new reality', but also to review the organisation's activities, strengthen the motivation of individual stakeholders and encourage them to continue keep in touch with the organization.

In the article the proposed model of applying corporation / market approach and selection of stakeholders to apply social responsibility and sustainability strategies highlights the role of communication professionals, proposing and implementing social responsibility and sustainability activities in organizations, especially during crisis or in the situations with high level of uncertainty.

The choice of such an approach to social responsibility / sustainability activities within the organization, which indicates the respective role of communication professionals in them, allows to evaluate the activities of communication and sustainability of the organization, highlighting the role of communication professionals as social change agents. The social change agent responds to stakeholders needs and demonstrates to them the benefits of social impact, whether he or she acts as a maintainer of the status quo, ensuring continuity, coherence of activities without pursuing dramatic change, on the contrary, by ensuring stability in the relationship [including communication] with stakeholders.

The article analyses the role of communication professionals as social change agents in times of uncertainty/ crisis to achieve an organization's sustainability goals.

Keywords: communication professional, sustainability, corporate social responsibility, social change agent.

1. Introduction

The global pandemic has forced organizations to rethink sustainability strategies and focus on communication that delivers a social impact to the organization's key stakeholders. Due to the conditions of the pandemic, hybrid activities organisations had to introduce and that led to the change of everyday communication practices. Due to the high level of uncertainty and new conditions of performance and communication, organizations have been encouraged to look for ways not only effectively communicate to different stakeholders but also to maintain two-way communication flows, strengthen communication to overcome or at least reduce uncertainty and exclusion organisation stakeholders meet.

The communication tasks and roles in organisation requires from the professionals to keep the balance between communication with a variety of stakeholders, - engagement of internal audiences through communication and harmonising communication within the organization and involving external stakeholders to implement the organization's strategies. According to Guthey, Longer, and Morsing (2006), the task of a communication professional is to orchestrate "productive social cooperation in [and outside] organizations through the balancing of a variety of interests" (Guthey et al., 2006, p. 55).

The role of a communication professional in an organization can be explored through a model that outlines two perspectives incorporating an organization's communication strategy approach and stakeholders involved in social responsibility / sustainability activities: 1) first, assessment of the internal and external factors that determine the organization's social responsibility / sustainability and communication activities, and 2) second, assessment of the specificity of the organization's performance in the context of social responsibility / sustainability and communication (see Table 1).

Table 1. Approaches towards communication and social responsibility / sustainability activities through social responsibility and sustainability initiation and stakeholder's engagement.

Approaches to communication and social responsibility / sustainability activities through stakeholder's engagement	Inside-out	Outside-in
Social responsibility / sustainability initiatives	The corporation view	The market view
Social responsibility / sustainability stakeholders and beneficiaries	Internal stakeholders	External stakeholders

The proposed model allows to analyse the actions of communication professionals in creating and developing social responsibility/sustainability initiatives and taking on the role of social change agents: it allows to assess both the role of proposing or taking over initiatives and the objectives and nature of ongoing activities.

The proposed approach can be applied to analyse the role of communication professionals, proposing, and implementing social responsibility and sustainability activities in organizations.

The corporation view approach shows that an organization, based on its strategy and based on the ideas expressed by its employees, takes the lead, and offers new social responsibility and sustainability ideas and problem-solving solutions to the market. The uniqueness of this approach is that initiatives and ideas in social responsibility / sustainability come from the organisation and these initiatives are developed and implemented through appropriate means of communication. Communication professionals play an important role in this approach, as they not only communicate the statements of social responsibility / sustainability of the organization, but also create an appropriate external representation of the organization, highlighting the leadership, citizenship and innovation of the organization thus developing the reputation of the organization accordingly.

Market view is used to assess market needs and proposes various social responsibility/sustainability initiatives based on them. In this way, the position of organizations is reactive, although the initiatives themselves come from organizations (Vallentin, 2006, p. 72-73). This approach shows that organizations are under pressure to take certain social responsibility / sustainability initiatives in response to actions by competitors, the public, other market players and public authorities, thus emphasizing that "external publics can influence corporate decision-making" (ibid., p. 73-74). This applies to the selection of social responsibility / sustainability activities, the selection of relevant activities and the assumption of responsibilities, commitments for the appropriate activities of organizations. By choosing this approach to social responsibility / sustainability activities, organizations seek not only to identify market needs, but also to "keep their eyes open in their social networks, not just to identify trends, but also to spot potential allies with whom they can collaborate to keep the track of existing trends, or even to collectively initiative new ones" (Guthey et al., 2006, p. 57). "People want to be on the bandwagon of the winning worldview" (Vallentin, 2006, p. 75), "corporate leaders don't want to get caught supporting an outdated management philosophy and therefore tend to be overly sensitive to changes in management fashions, social responsibility being a prime example" (ibid., p. 76). This approach indicates that the task of communication professionals is to anticipate the most effective social responsibility/sustainability activities for organizations that respond to their activities and positioning by monitoring the market situation and assessing all environmental factors.

However, whatever social responsibility / sustainability approach is chosen, organizations must also consider to "reflect and connect both to broader cultural ideas and to norms of rationality and progress"

(Guthey et al., p. 57). It is also worth noting that organizations, by exploiting the potential of corporate communication, "co-create the "external" reality to which they claim to be responsive" (Vallentin, 2006, p. 77), in application of pragmatic approach to gain information from market, social, political, and professional environment and based on it make decisions on adequate social responsibility / sustainability activities.

The second layer of the proposed approach highlights factor of stakeholders, involved in social responsibility / sustainability initiatives and activities, and the beneficiaries, i.e., those groups that have the potential to benefit from social responsibility / sustainability initiatives and activities carried out by organizations.

Researchers analysing social responsibility / sustainability activities emphasize not only the triple bottom line (3P: profit, people, planet (Elkington, 2018) principle, which highlights the interest of organizations in the visible and desired positive impact of social responsibility / sustainability activities (ROI or SROI are often used as the evaluation criteria) (Jackson, Harji, 2016; Sones et al., 2009; Chahal, 1999), but also their interest in the impact of these activities on the organisation culture, HR strategy, operational efficiency, etc.

In this way, organizations not only implement social responsibility / sustainability activities by selecting internal stakeholders as their target audiences, but also, strengthen the support through communication to the involvement of organizations' employees and encourage active participation of them in achieving organizations' social responsibility / sustainability strategic activities. More specifically, social responsibility and sustainability activities become an opportunity to encourage participation and engagement of employees in the organization's initiatives, proposing the ideas and implementing them by themselves, thus not only responding to SGDs statements set by organisation, but also strengthening the organization's communication culture.

The task of communication professionals in these activities is essential, as they are responsible for communication environment and relations with employees, for the development and implementation of the appropriate atmosphere using adequate communication tools, to ensure that employees can not only offer initiatives, but can get involved in and benefit from them (Duthler, Dhanesh, 2018, Du et al., 2010, Jiang H, Luo Y, 2020, Gill, 2015, Schaefer et al., 2020).

Corporate social initiatives and management fashions generally do not always clash with employees' concerns (Guthey et al., 2006, p. 53). "Employees rather than shareholders deserve to be treated as the primary concern of managers. Employers carry more risk than shareholders" (Heal, 2008, p. 17) simply because the organization's reputation, employee prestige and, to a large extent, work depend on the organization's role in social responsibility / sustainability. In this regard, communication professional operates not only as developer of environment that supports sustainability initiatives, but also as an innovator and leader that promotes social responsibility / sustainability issues by herself/ himself.

Organizations carry out many different activities and operate in different contexts, and the task of communication and social responsibility / sustainability professionals is to reconcile all interests, and especially to include "the corporate bottom line" (Guthey et al., 2006, pp. 56) to the implementation of corporate initiatives.

When choosing social responsibility / sustainability strategies, organizations often focus their activities on external stakeholders, both in formulating social responsibility / sustainability strategies, developing initiatives, and implementing them. Organizations seek not only to respond to market needs, but also, they want to involve external stakeholders in cooperation, in creating and developing of joint projects for public welfare, thus responding to the essential goal of communication: "dealing with latent, manifest and active publics through communication and dialogue, interaction and partnership" (Vallentin, 2006, p. 75).

By choosing such strategies, organizations "occupy" a certain communication space by presenting themselves and linking themselves to certain social responsibility / sustainability activities that are designed to address the problems faced by a particular external stakeholder or global issues. The task of communication professionals in this case is not only to present the position of organizations, but also to involve external stakeholders both in discussions on the topic raised by the organization and in communication activities in combination with external stakeholders.

This model strengthens the role of a communication professional as a social change agent demonstrating the leadership in promotion of social responsibility / sustainability innovations and activities in organizations. Such a development of the profession could be seen through the statements of professional PR / communication associations underlying the competencies of communication professional in relation to activities in social responsibility/ sustainability area. Studies that identify the competencies required for communication professionals and include requirements for social responsibility and sustainability competencies are as follows: The Commission on Public Relations Education (CPRE, 2006, 2012, 2018); Global Alliance Global Body of Knowledge (GBOK, 2016) and The Global Capability Framework (2018):

Ethical leaders and role models in social responsibility / sustainability. The 2017 study of the Commission on Public Relations Education (CPRE, 2018) focuses on ethical competencies: the knowledge that entry-level communication professionals need to have in social responsibility are as follows: social issues, ethics, and diversity. The 2006 study of the Commission on Public Relations Education (CPRE, 2006) report notes that graduates of public relations programs should be "the leaders in building understanding that public relations have a fundamental responsibility to society and adds value to society, (...) have an unquestionable moral obligation to act professionally, i.e., in a socially responsible manner, within their own societies as well as within an emerging global community".

Personal commitment and responsibility as driving motivation for sustainable decisions. The requirements for social responsibility and sustainability competencies for mid and senior communication professionals in the Global Alliance Global Body of Knowledge (GBOK, 2016) study are "advanced environmental scanning and trend identification". The requirement for a top-level communication professional is that he or she has global awareness and tracks global news and issues, acts with due consideration to the environment and with awareness of sustainable practices, shows leadership in corporate social responsibility initiatives. The Global Alliance Capabilities Framework (2018) includes, among other requirements for competencies, "to consider business objectives in the light of society's expectations; conduct formative and evaluation research including the collection of intelligence / insights and environmental scanning".

The choice of such an approach to social responsibility / sustainability activities within the organization, which indicates the respective role of communication professionals in them, allows to evaluate the activities of communication and social responsibility / sustainability of the organization, highlighting the role of communication professionals as social change agents. The social change agent responds to stakeholders needs and demonstrates to them the benefits of social impact, whether he or she acts as a maintainer of the status quo, ensuring continuity, coherence of activities without pursuing dramatic change, on the contrary, by ensuring stability in the relationship [including communication] with stakeholders.

2. Methods

Based on the approach on social responsibility / sustainability activities and communication with stakeholders, highlighting inside-out and inside-in initiatives, this paper seeks to answer the question of how social responsibility / sustainability activities are initiated, planned, and implemented in real conditions and how the status of organizations and communication professionals' changes in the conditions of an uncertainty – period of crisis (pandemic).

We will try to answer whether and how the organization's position changes (whether a reactive or proactive position is chosen due to ongoing social responsibility / sustainability initiatives and activities during the crisis), whether and how the organisation's focus on stakeholders and beneficiaries changes during the crisis, assuming that organizations review value-added activities in times of crisis in order to strengthen and focus their activities on key stakeholders and abandon some (internal or external) activities in order to manage crises and communication during them.

The aim of the study is to determine the role of communication professionals as social change agents in times of uncertainty/crisis to achieve the sustainability goals of organizations.

Research method: qualitative in-depth expert interviews.

The study raises the following questions:

Q1: What is the personal role and responsibility of a communication professional in initiating and implementing social responsibility / sustainability activities? It is assumed that social responsibility / sustainability activities carried out by the organizations largely depend on the personal involvement of the communication professional, of his/her interest in social responsibility / sustainability initiatives, activities, commitment, and leadership.

Q2: Is the organization's position and communication changing in times of uncertainty/ crisis towards social responsibility / sustainability initiatives and how? It is assumed that in times of uncertainty/ crisis, organizations review their social responsibility / sustainability activities and focus only on those that help to concentrate on stakeholders and keep them motivated, strengthen their involvement in the organization's activities, thus building the organization's support and strengthening its reputation. In this way, no matter what social responsibility / sustainability implementation approaches have been chosen in the past, they become outside-in, responsive to the environment and directed to internal stakeholders.

The criteria for the selection of experts are as follows: top level communication managers (heads of Communication / Public Relations / Corporate Communications departments of business organizations), responsible for social responsibility and sustainability activities. They are representing the top 10 most sustainable brands of 2021 according to Lithuanian consumers (retail chains, pharmacies, banking, energy, and agriculture), in which social responsibility / sustainability performance is under the responsibility of top-level communication managers.

The interviews were conducted in March-April 2021.

3.Results and Discussion

According to the informants, communication professionals are generators of social responsibility / sustainability ideas in their organization. This is the opinion of most of the informants: "*If your job is ONLY to communicate about sustainability and not to be a generator of social change, this is not acceptable. In that case, the organization will look at your role as follows: "please write a report, organize an event and so on*". Communication professional, who is deeply familiar with the organization from within, consistently monitors the external environment, acts as an intermediary between the organization and its stakeholders, sees the „big picture ", and who has the opportunity as a strategic manager to present his/ her ideas to top management and initiate innovations, fulfils these roles actively without fear of going beyond his scope.

Most of the informants say that communication in organizations is a strategic level position, head of communication is a top-level manager who is involved in the development of board strategic issues (including sustainability issues) at an early stage and their implementation. According to some respondents, all possible functions (including internal communication, product communication, Sustainability office, organization of events, etc.) are integrated into the communication department, or

the whole environment is under the responsibility of communication, thus communication professionals have the freedom of decisions related to it. Therefore, having such a portfolio, communication professionals can influence all processes related to the social agenda and to be catalysts for various processes.

Representatives of international corporations' mention that the guidelines for social responsibility / sustainability are centralized at the international level, nevertheless each country usually decides on the implementation of social / sustainability ideas, considering the specifics of each country (see Table 2). The communication manager has a great deal of freedom to decide for himself/herself and to suggest to the management which sustainability ideas are most suitable for his/her country.

Most communication professionals see their organizations as innovators, dictating to the certain market trends in sustainability. Respondents cite the following examples related to their organizations as innovators: the first to decide not to trade endangered species; the first to refuse to sell fish in aquariums; the first to not market the products of the polluting producer; the first to give up third-level eggs in cooking; the first to introduce the taromat service; the first to remove plastic bags from the trade; the only supermarket in Lithuania that did not sell alcohol both on the actual September 1 and the day when the students actually went to the school (Lithuania does not allow the sale of alcohol by law on September 1), although it lost hundreds of thousands of euros as a result; the first to implement the idea of sustainable agriculture, despite the fact that agriculture is one of the most polluting in the world in terms of emissions; the first to establish a Money Museum and a Finance Laboratory in the bank). Communication professionals participate in these initiatives as their initiators or active implementers.

Table 2. The role of communication professionals in initiating, planning, and implementing social responsibility / sustainability activities.

The corporation view (Inside-out)	The market view (Outside-in)	Joint approach
"the most valuable initiatives are those that come from our internal employees". *"Employees have the opportunity to submit their ideas".* *"The main impetus for implementing sustainability issues comes from the board".*	*"[communication] knows the organization from A to Z, (...) what is happening in the market, best sees the situation and global trends".* *" an organization first analyses the needs of the stakeholders".* *" for society sustainability seems to be an important issue".*	*"Ideas come from employees. (...) Ideas also come from external partners".* *"I would first single out the public and NGOs that are active in a certain branch of sustainability".* *"Competitive environment,*

"We [communication professionals] are the ones who implement the organisation's sustainability strategy, which comes from the shareholder". *"[Employees] offer their ideas to their manager. There is a special mailbox where employees can submit their ideas. They are innovative, fresh".*	*"Consumers".* *„The global situation. (...) the trends that come from Europe and from the world, will be the same in Lithuania".*	*Environment, CEO's personal approach towards sustainability".*

However, social responsibility / sustainability initiatives do not come only from the communication professional or communication unit, yet they are often promoted by employees, organizational units, the board, shareholders, or external partners (NGOS, government bodies and society in general) (see Table 3). For example, in a specific sector (energy, which is a state-owned enterprise strongly influenced by political decisions), the main impetus for implementing sustainability issues comes from the board. According to the respondents, the most valuable initiatives are those that are born within the organization, because when employees themselves are involved in creation and implementation of sustainable initiatives, it generates more value for the organization itself (stronger employee faith in the organization, better climate). On the other hand, the role of a communication professional is also particularly important here.

According to the research results, the aspect of social responsibility / sustainability is actualized during times of uncertainty, in the face of crisis. The crisis highlights the core values of organizations: focus on the organization's employees, profit, and achievement of strategic goals, maintaining market position, stakeholder relations (see Table 3).

Table 3. The stakeholders selected by communication professionals in the context of social responsibility / sustainability.

	Internal stakeholders	External stakeholders	Both stakeholders

Before pandemic		*"I had complete freedom to decide how this works, to whom it should be donated, with which organizations we will cooperate, (...) that this is an area that is not given enough attention in Lithuania".*	*"Communication is really a driver, a particularly important driver, especially when it comes to performance activities with communities, NGOs. Internal community, i.e., internal employees are also an area where communication's leadership is crucial".* *"The communicator, being an intermediary between the organization and its stakeholders, will think of them all: employees, partners, suppliers, society, communities".* *"I communicate a lot with all stakeholders, so I know their needs".*

During pandemic	*"Sensitivity to employees has changed us a lot. The pandemic only strengthened us as an organization and an employer".*	*"It is especially important to show our organization as an organization that cares, (...) organization cares about our customers and helps them to recover".* *"The pandemic has had an impact. (...) Our decision to postpone the loans was economically unjustified. So, it was a social action in the face of a pandemic".* *"At the beginning of the first quarantine we increased the sponsorships, allocated more food, gift cards, supported volunteers on duty at the airport, municipal employees. (...) But later we stuck to consistent things".* *"Overall, we did a lot of security in all the stores".* *"Our company has given up the support it received from the state with the desire to give it to those who have suffered more".*	

Sustainability is now a "must have," not a "nice to have," and that such proactivity can build trust among employees and stakeholders, as the 2019 Edelman Trust Barometer and 2018 Edelman Earned Brand studies concluded. As shown by the 2020 European communication monitor (ECM), the perceived relevance for dealing with sustainable development and social responsibility has increased sharply and 37.5 percent of ECM 2020 respondents believe that it will be a top issue for the profession in the three-year perspective (the respondents place this area in second place in terms of importance) (Zerfass et al, 2020).

Corporate social responsibility and sustainability today are at a "tipping point" as a result of three megatrends: a pervasive lack of trust; high stakeholder expectations that entities, particularly companies and government, act swiftly to tackle societal issues; and the severe environmental impacts putting a personal face on climate change (Edelman, 2019).

According to the informants, sustainability is and must be a part of the activities of communication professionals, but only if social responsibility / sustainability is the way, direction, strategy, and DNA of the organization. Otherwise, one communication unit will achieve nothing: "*I am against social responsibility becoming an area just of communication. Communication is not a goal by itself, it is a means to achieve the company's goals*". This reinforces researchers' claims about social responsibility

/ sustainability concept, stating that responsible corporations should be "more innovative" (Jagd, 2015, p. 5).

Social responsibility / sustainability in the agenda of communication professionals is a rational decision of organizations not only because a communication professional is an intermediary between organizations and their stakeholders and knows their needs and expectations, that an organization must develop corporate social responsibility policies and practices as a first step to anticipating and meeting emerging stakeholder expectations (Edelman Trust Barometer, 2019), but also because he/she has the most necessary attribute for social responsibility and sustainability. "*I think that communication has the most rational scope for sustainability in its portfolio, because the communicator, being as an intermediary between an organization and its stakeholders, will think about them all: about employees, partners, suppliers, society, communities. If an HR person had to do this, his/her activities would lack certain details. If it were the responsibility of the Marketing, there may be a lack of warmth and empathy in this area, the activities would be more outsourced. And that's not appropriate for CSR* ". Based on the interviews, its seen that communication professionals take role as social change agents ("*The DNA of the organization, the values of the shareholder himself, the desire to make the world a better place for future generations. Those things transform into the organization's policies and values"*), as society is still not so demanding around sustainability (*"In Lithuania, companies usually promote sustainability policy more than society pushes on them. Companies are pressuring the publics to pay attention to certain things"*), and communication professionals are demonstrating the leadership and are in collaboration with NGOs promoting social responsibility / sustainability issues to various groups of stakeholders, starting with internal stakeholders, ending with consumers and partners.

The communication professional, as an intermediary between the organization and its stakeholders, sees many things as a consumer, as an employee or as a responsible member of the public, as well acts as a leader and manager with suggestions and advices, thus the personal involvement and belief in sustainability of the communication professional is paramount. Such activities allow organizations to build public confidence, strengthen reputation, and reduce the preconditions for exposure - corporations could be "less exposed to risk from safety, boycotts, or other loss of reputation" (Jagd, 2015, p. 5).

In terms of leadership, an important role is played by to which extent leadership is related to a personality, faith in the actions, and support from management. As it was stated by one informant, "*communication is really a driver, a particularly important driver, especially when it comes to performance related with communities, NGOs and the internal community (employees). Here we are the driving force. But only when we have faith in that activity ourselves and when there is support from management and other functions*".

According to most of the informants, personal engagement and belief in social responsibility / sustainability is a key driver, where personal characteristics matters a lot, as on how much a

communication professional can inspire an environment depends on his / her personal qualities: "*this position needs someone who „hurts" for sustainability issues*". According to the informants, it will be quite difficult for a communication professional, who does not personally care much about social responsibility / sustainability, to achieve the sustainable goals of the organization. "*If you sincerely care, you will do your work sincerely and will seek to resolve issues promptly*", "*Everything in life depends on us: if you don't personally believe in the things you do, you won't get anything out of it*".

The research data shows that communication professionals are tending to take the personal leadership in social responsibility / sustainability initiatives and activities, however they propose these activities in the line with shareholders' position, considering customers' attitudes and expectations, and in collaboration with NGOs to promote social responsibility /sustainability goals to society in general, to make it aware of issues, prospective solutions and actions needed to take.

4. Conclusions

The pandemic highlighted the importance of the performance of communication professionals employing hybrid instruments to demonstrate organisations' social responsibility / sustainability initiatives and activities through involvement and engagement of various stakeholders while taking a personal lead in sustainability: if in the past communication professionals were able to communicate face-to-face through various communication tools and encourage stakeholders to engage in various organizational activities, the changed conditions not only forced to search for new forms of communication building and strengthening relationships with stakeholders in the 'new reality', but also to review the organisation's activities, strengthen the motivation of individual stakeholders and encourage them to continue keep in touch with the organization. Nevertheless, the social responsibility / sustainability initiatives in organisations relate themselves with allocating human, financial and other resources, in most cases they are cascaded by the shareholders, and only then implemented with the support of communication professionals.

As the research data demonstrated, in performing social responsibility / sustainability strategies communication professionals employ all communication functions (including internal communication, product communication, sustainability office, organization of events, etc.). taking the wide range of issues under the responsibility of communication, thus communication professionals have the freedom of decisions related to social responsibility / sustainability. Therefore, having such a portfolio, communication professionals can influence all processes related to the social agenda and to be catalysts for various processes. As it was stated by several informants, responsibility for social responsibility/ sustainability initiatives and strategies are mostly implied by personal drive and deep concerns on the issues.

Proposed approach allows to analyse the role of communication professionals in development and implementation of social responsibility / sustainability initiatives and activities in organisations through the inside-out and outside-in approach taking to account various stakeholders.

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Sustainable Development in the media

A literature review

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Abstract

Sustainability and sustainable development are increasingly common concepts in the public and political spheres, but their vagueness is still a big obstacle for its understanding by the general public. But vagueness of meaning cannot be confused with vacancy, in reality SD is a concept with a strong political charge. There are different visions of SD, from maintaining the status quo to reform or transformation. The press has a fundamental role in defining these terms, making them accessible to the lay audience and setting up the political agenda. Understanding how SD is being reported, the dominant narrative and which ideological vision it is based on may help to predict the evolution of policies for sustainability in a given area and also to identify the weak points of current communication. The written press gains special importance in this analysis, as it is a more in-depth form of journalism and has a great influence on the media and political agenda. The press is not only a mirror of the public debate, but actively contributes to filtering what is and is not discussed and how, simplifying complex scientific concepts for the general public. It also serves as a politics and policies evaluator. A growing number of scientific articles have been focusing on how the media treats SD, using data mining to select suitable content. This literature might become the base of a future sustainability communication framework. Our paper aims to find the most relevant articles published so far, and identify their main results and conclusions. This should enable us to recognize common patterns across certain geographical regions (e.g. industrialized versus developing countries or Europe versus North America), ideological lines (left versus right leaning titles) or type of newspaper (tabloid versus broadsheet) and how this coverage has been evolving along time. This research relates especially with SDG 16, as journalism is an essential tool to hold institutions accountable, and specifically with the target 16.10 of ensuring public access to information. The current sanitary crisis only made SDGs more urgent and the press can have a crucial role in accelerating the needed progress.

Keywords: Sustainability, Sustainable Development, Press, Information

1. Introduction

Concerns about the scarcity of resources on the planet and the need of a balanced utilization of them are old, having been studied in a pioneering way by Malthus (1766-1834), especially concerned with

overpopulation, and by William Stanley Jevons (1836 -1882), whose focus fell on the limits of coal reserves. The growing industrialization of the world and the consequent negative impact on the environment has multiplied the voices concerned with this scenario. That is how in 1972 the Club of Rome published the report *The Limits to Growth*, which predicted the depletion of the planet's sustaining capacity, maintaining the at the time trends of population growth, food production and pollution, which would cause the collapse of ecosystems, hunger and war.

The term 'sustainable development' then appeared in 1980, when the International Union for Conversation of Nature and Natural Resources (IUCN) presented its World Conservation Strategy, a strategy centered on ecological sustainability, and with less emphasis on social and economic aspects (IUCN, 1980). In 1987 the UN World Commission on Environment and Development (WCED) published Our Common Future (WCED, 1987), better known as the Brundtland Report, in reference to Gro Harlem Brundtland, then Norwegian Prime Minister and rapporteur for the document. It is here that, for the first time, the concepts of economic and social development, on the one hand, and environmental sustainability, on the other, merge under the term 'sustainable development', which now covers all these aspects, seen as compatible with each other.

The report was not limited to identifying problems, but also pointed the way to sustainable development, through a series of guidelines sufficiently specific to be meaningful and, at the same time, sufficiently vague to be accepted by a very broad range of political and social actors (Baker, 2006). This is also the strength and weakness of the concept of sustainable development. Flexible enough to become popular and be adopted by a wide and diverse audience, as confirmed after the Earth Conference in Rio de Janeiro in 1992, an event that marks its adoption in international political discourse. But vague to the point of becoming a concept easily contested or misappropriated.

Sustainability and sustainable development (SD) are thus increasingly common terms in political discourse and public debate. Both comprising a sufficiently vague and ambiguous concept to accommodate very different interpretations, thus becoming buzzwords used by voices with even opposing opinions on economic development, social justice or environmental conservation - the three main dimensions of SD.

But vagueness of meaning cannot be confused with emptiness, in reality SD is a concept with a strong political charge. Hopwood et al. (2005) mapped the different visions of SD, from defending the status quo to transformation, through reform. Davidson (2014), on the other hand, categorized the different views by making a correspondence with the main political ideologies, such as liberalism or social democracy. Understanding the meaning given to SD in the public debate is essential to understand and predict the future of policies for sustainability.

The written press gains special importance in this analysis, given that it is a more in-depth form of journalism and has a great influence on the media and political agendas. The press is not only a mirror

of the public debate (Bonfadelli, 2010), but actively contributes to filtering what is and is not debated and how, simplifying complex scientific concepts to the general public. It also provides evaluations of politics and judgments of politicians (Bonfadelli, 2010). In addition to having the ability to directly influence behaviors, particularly in terms of consumption (Chen et al., 2019).

There is already a large amount of scientific literature dealing with SD communication, although there is still no theoretical framework (Janoušková et al., 2019) and the approaches and methodologies found are thus very diverse, making it difficult to compare different countries and moments.

2. Methods

Articles were searched for and collected from different platforms of scientific articles using as keywords the same used in this article. The bibliography of the selected articles was also analyzed in order to identify all relevant articles concerning the representation of sustainable development in the press.

3. Results and Discussion

The literature on the representation of SD in the media, and particularly in the press, is a growing field of investigation. The articles tend to be divided between those making a qualitative analysis (how is it represented?) and those making a quantitative analysis (how much is represented?) of the coverage on SD. While some articles try both approaches simultaneously and other questions are also raised, as who defines SD in the press. The focus on the written press derives mainly from the importance it has in shaping the media and political agenda. The digitization of the press archives also allows for an exhaustive and systematic analysis, which would be much more difficult with audiovisual media. Most articles treat the terms “sustainable development” and “sustainability” as synonyms, as they are treated in this way by the majority of the press, although the first is considered more rigorous and in accordance with the definition used by the UN, while the second tends to be used in a more superficial or vague manner.

Lewis (2000) wrote an article already considered seminal in the field of sustainability communication, about the media representation of SD in five of the main United States newspapers, based on two questions: 1) how is the concept defined in the press? and 2) who assigns these meanings?. Adopting a constructivist approach, which understands that the media are not limited to reproduce reality, but rather frame it in certain predefined narratives, Lewis (2000) analyzes articles published between 1987 and 1997, using “sustainable development” as a keyword.

The data were treated by dividing the articles by newspaper, year, type of article, geographic focus and source of the article. While trying to answer the first question, Lewis (2000) found few articles with an explicit definition of SD, and those that contained it mostly followed the definition from the Brundtland report (understood as based on economic and environmental protection and concern for future generations). Critical formulations were also found, but they were exceptional.

To answer the question about who defines SD in the newspapers, Lewis analyzed the news sources, finding a strong presence of articles with governmental or intergovernmental (UN) origin and also from economic leaders, but a reduced number of articles originating from independent environmental NGOs and even less originated in countries from the global South. This could explain the rarity of critical views on SD in the American press. As well as the South being frequently pointed out as responsible for the lack of SD, something that could be a pretext to justify the control of natural resources in the South by the powers of the North. Lewis' qualitative analysis ends with a very critical portrait of the lack of diversity of opinion for that period, concluding that SD is portrayed as an extension of the discourse of development.

Two decades after the article by Lewis (2000), communication on SD continues without its own theoretical framework (Janoušková et al., 2019), but several studies followed, analyzing the press from different countries and from different perspectives. Some articles have focused on quantitative analysis and the main conclusion, across different geographic areas, is that SD coverage has increased, with peaks of interest centered on UN conferences becoming less relevant in more recent years.

Bonfadelli (2010) identified a clear increase in coverage by two of three main Swiss press titles between 1996 and 2004. The same trend was identified by Fischer et al. (2017) in the period from 1995 to 2015 in 6 titles of the German press. Barkemeyer et al. (2009) identified a clearly growing trajectory of coverage of this topic in 115 newspapers from 39 different countries between 1990 and 2008. In a new analysis, with a similar sample of newspapers, Berkemeyer et al. (2013) tried to explain the evolution of this coverage through two models: the issue-attention cycle and the punctuated equilibrium. Both with their merits and marked by so-called ‘trigger events’ which in this case are the UN conferences that lead to peaks in media coverage, namely those in Rio (1992), Kyoto (1997) and Johannesburg (2002). The decrease in coverage after these events never falls as low as the level of the period prior to the events. Thus, we see a global trend of greater attention to the theme of sustainability, marked by major events but increasingly independent from them. It is interesting to point out that Berkemeyer et al. (2009) noted that between 1990 and 2008 the term ‘sustainability’ surpassed ‘sustainable development’ in frequency of use by the global press.

The idea that a country's level of development and wealth positively impacts press coverage on SD does not find support in most articles that compare the press from different countries. In an analysis of 115 newspapers from 39 different countries, Barkemeyer et al. (2009) found in Spain the highest attention given by newspapers to the topic, whereas in the US newspapers, that attention was much lower and limited to issues of local impact, a tendency similar to that found by Adelekan (2009) in an analysis of the Nigerian press, which concluded that it deals with environmental and sustainability issues only within the scope of local news and above all related to the energy sector.

In another study from the global South, Liu et al. (2020) analyzed the communication of sustainability science in the news coverage of palm plantations in Indonesia, Malaysia and Singapore, having found many narratives of climate change denialism, except in the Singaporean press, the only of the three countries on the IMF and World Bank list of advanced economies. But in another study on the news coverage given to sustainable energy in the Malaysian press, Mohamed et al. (2020) found significant differences between the English-language and Malay-language press, with the Anglophone content being of higher quality, depth and with a more favorable view of the idea of sustainability. It is important to note that this linguistic division also corresponds to the division between quality and popular newspapers, and this classification seems to be a better predictor of the quality of the news coverage than a country's GDP.

Bonfadelli (2010) also found significant differences in quality and depth between the articles in the Swiss quality newspaper *Neueu Zürcher Zeitung* and the tabloid *Blick*, in addition to the aforementioned difference in the quantity of articles. Only one third of the articles analyzed used at least two of the five fundamental dimensions considered: relationship with present or future generations; North-South conflict; relations with society; relations with the environment; and economic relations. Diprose et al. (2018) reached similar conclusions when comparing the quality and popular press in the United Kingdom. Fischer et al. (2017), analyzing the German press, also found a difference in the depth of the concept used in newspapers with left or liberal political alignment, and conservative newspapers, which used poorer definitions. While Diprose et al. (2018) noted that in the UK left-wing newspapers tended to have more paid content and more appeals to corporate social responsibility and social justice. In contrast, Yacoumis (2018) didn't find significant differences in the framing of SD by Australian newspapers with different ideological alignments.

One of the difficulties encountered by several authors is the growing use of the adjective "sustainable" with meanings strikingly different from the one intended in the Brundland report. Fischer et al. (2017) found it in a description of the taste of a wine and Marinescu et al. (2021) found that in the Romanian press it is often used as a synonym for 'healthy', namely in reference to diets.

Another question that some researchers try to answer is who defines SD, whether journalists, whether activists, whether elected politicians or industry lobbyists. While in Switzerland Bonfadelli (2010) found a predominance of government politicians and also from the Green Party (at the time with little electoral weight), in the United Kingdom, Diprose et al. (2018) find a predominance of voices from the business world, with greater representation than journalists, politicians or activists. To better answer this question Davidson (2014) proposes a typology to categorize the ideologies of the different actors, this approach goes beyond the simple identification of the actors and clarifies their ideological position.

Several other authors try to answer the question of how SD is portrayed in the press, categorizing the ideology of the definition used or the dominant narrative, regardless of who produces it. Bonfadelli

(2010) finds eight dominant narratives, in turn based on three basic areas: economy; conflict; and morals, ethics and justice. About 70% of the analyzed articles fit into one of these narratives, classified as negative, positive, neutral or ambivalent in relation to SD, and none of these affinities proved to be predominant. In the English press, Diprose et al. (2018) identified a dominant narrative of sustainable consumerism and sustainability achievable through market forces, technology and economic growth.

Finally, it is clear that specific topics related to SD, which can be associated with the different SDGs, gain greater or lesser media attention. Janoušková et al. (2019) analyzed how the English-language press treats the SDGs and identified a preference for some of them (4. Quality education and 12. Sustainable production and consumption) over others almost ignored (eg 11. Sustainable cities and communities and 6. Drinking water and sanitation) and above all, they noted the lack of a framework for the SDGs within a more comprehensive narrative on sustainability, so that the concept can be learned and embraced by readers. Conclusions similar to those of Barkemeyer et al. (2013) in an analysis of different topics of SD in the press of countries of the global North and South, having been found great diversity between countries of the same region, and without clear tendencies that distinguished the North of the South, although some specific topics seemed to fit this division. This view was further reinforced by Czvetkó et al. (2021) that in an analysis using the GDELT database, which goes beyond the press and includes social networks as sources, found a huge diversity of levels of interest and affinity in all regions of the globe for the SDGs. These researchers also noted the importance of the US as one of the main hubs of information sources.

Table 1 outlines a comprehensive overview of the articles considered in the present review, including the main method of research, new sources considered, language, geography and period of analysis.

Table 1. *Reviewed articles.*

Title	Method	News sources	Language	Geography	Period	Reference
The Nigerian press and environmental information for sustainable development.	Qualitative content analysis	*The Daily Times*, *The Guardian*	English	Nigeria	1999 - 2003	Adelekan (2009)
Sustainability-Related Media Coverage and Socioeconomic Development: A Regional and North–South Perspective	Comparative analysis Text mining	115 leading national newspapers	English, French, German, Spanish, Portuguese, Dutch, Danish, and Italian	41 countries	2008	Barkemeyer, Figge, Holt (2013)
What the papers say: Trends in sustainability: A comparative analysis of 115 leading national newspapers worldwide	Comparative analysis Text mining	115 leading national newspapers	English, French, German, Spanish, Portuguese, Dutch, Danish, and Italian	39 countries	1990 - 2008	Barkemeyer, Figge, Holt, Hahn (2009)
Environmental Sustainability as Challenge for Media and Journalism	Content analysis	*Neueu Zürcher Zeitung*, *Tages-Anzeiger* and *Blick*	German	Switzerland	1993 - 2003	Bonfadelli (2010)
The intertwining of world news with Sustainable Development Goals: An effective monitoring tool	Quantitative analysis and data mining (GDELT data base with SQL queries)	All types of online sources including social media	Over 100 languages	Global	2019	Czvetkó, Honti, Sebestyén, Abonyi (2021)
Corporations, Consumerism and Culpability: Sustainability in the British Press	Qualitative content analysis	*The Guardian*, *The Telegraph*, *The Daily Mail*, *The Mirror* and *The Sun*	English	United Kindgom	2015	Diprose et al. (2018)

What Does the Media Mean by "Sustainability" or "SD"?	Quantitative qualitative analysis	6 leading newspapers	German	Germany	1995 - 2015	Fischer, Haucke, Sundermann, (2017)
Sustainable Development - A Poorly Communicated Concept by Mass Media. Another Challenge for SDGs?	Data mining (Factiva data base) Quantitative analysis	9553 national and regional newspapers	English	160 countries	2009 - 2018	Janoušková, Hák, Nečas, Moldan (2019)
Media Representations of "SD": Sustaining the Status Quo?	Quantitative and qualitative analysis	*CSM, LA Times, NY Times, WSJ* and *Washington Post*	English	United States	1987 - 1997	Lewis (2000)
Contrasting communications of sustainability science in the media coverage of palm oil agriculture on tropical peatlands in Indonesia, Malaysia and Singapore	Qualitative analysis	13 national newspapers	English, Chinese, Indonesian and Malay	Malaysia, Indonesia and Singapore	2016	Liu, Ganesan, Smith (2020)
Talking about Sustainability: How the Media Construct the Public's Understanding of Sustainable Food in Romania	Quantitative thematic content analysis	News websites listed on Google News	Romanian	Romania	2014 - 2017	Marinescu et al. (2021)
Framing Sustainable Energy: A Comparative Analysis of Malay and English Newspapers in Malaysia	Quantitative and qualitative analysis	*Harian Metro, Berita Harian, The Star* and *New Straits Time*	English and Malay	Malaysia	2019	Mohamed, Yusoh, Wan Ghazali (2020)

Making Progress? Reproducing Hegemony Through Discourses of "SD" in the Australian News Media	Critical discourse analysis	8 national newspapers	English	Australia	2004 - 2013	Yacoumis (2018)

4. Conclusions

Press coverage of SD has gradually increased during recent decades and is no longer dependent on UN conferences to gain media attention. The urgency of environmental issues, especially climate change, has been the main driver of this dynamic.

In contrast, the word "sustainability" has been gaining ground against "sustainable development", a term usually associated with a more deep definition and closer to that used in the Brundtland report, while the first is often used in a more shallow or vague manner. However, both are used simultaneously in many contexts and are considered synonymous by most researchers. The growing use of the adjective "sustainable" with different meanings from the one intended to be analyzed is also evident, this means a growing noise in these analyses, which should be eliminated in order to obtain a correct picture. Bonfadelli (2010) concludes that the multidimensional and interdisciplinary complexity of the concept means that sustainability receives less attention by the Swiss press. A clarifying discussion of the concept is seen as essential for it to gain the deserved attention.

There is still a big difference in the attention given to the topic between quality newspapers and popular newspapers, identified in several different countries. This should be expected given the complexity of this theme. Regarding the difference between newspapers depending on their political alignment, as identified by Fisher et al. (2017) and Diprose et al. (2018), this is a difficult exercise to do in several countries, as most newspapers do not clearly assume this alignment and therefore most authors leave this point aside, while Yacoumis (2018) found few significant differences. Moreover, it is not possible to find a clear tendency that distinguishes the press coverage of rich or poor countries, or of more or less developed countries. It may thus be more likely to see SD reported in a quality newspaper from the South than in a tabloid from the North.

Three decades after the publication of the Brundtland report, North-South imbalances remain relevant, although the international order is now more complex than it was then and the North-South divide seems no longer sufficient to describe a world in which emerging powers take ever greater prominence, capable of rivaling traditional powers. The world press thus seems to follow this growing multipolarity, and only when looking at specific SDGs we can find relevant geographic tendencies.

The absence of a theoretical framework for SD communication, however, makes it difficult to take this comparison between countries one step further. Therefore the proposal by Davidson (2014) deserves

the greatest attention, as it establishes a typology to categorize the ideologies of the different frames in which SD is presented that could be used in different geographical contexts.

It is also evident that most articles dedicated to news coverage of SD or ODSs is limited to analyzing the press of a country or a certain language. However, the use of databases and specific software allows to broaden the scope of the investigation, as did Barkemeyer et al. (2013) or Czvetkó et al. (2021). This approach necessarily implies a focus on quantitative analysis, with no scope for an in-depth interpretation of the content, but it allows a valuable and direct comparison between the press from different geographies and languages.

Finally, it is important not to forget in this analysis the different ways of funding the written press and how this may influence the framing given to SD. Diprose et al. (2018) found that reducing consumption was almost never identified as a solution, something that can be explained by the economic dependence of newspapers on advertising revenue. Yacoumis (2018) also pointed out the virtual absence of voices critical of green growth. The current economic fragility of many historical titles and the difficulties of adapting to the growing digitalization of the press is a factor that can be decisive for the way SD is reported and debated.

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9. Governance, Power and Institutions and Weakness of SDGs

9a. Peace and sustainable development

Abstracts

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The Nigerian Political Elites and Covid-19 Pandemic's Management Deficits: Implications for Nigeria's Sustainable Development Goals

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Abstract

The impact of the novel covid-19, otherwise known as the corona-virus on the entire spectrum of Nigeria's national life, as elsewhere, remains yet indelibly unquantifiable at present. No thanks to the Elite culpability in the management of the corona-virus epidemic that has now rendered the entire Nigeria's national life halted and, on the brinks of spontaneous discontinuity. Conceptualized in this study to mean negligence of duty, this study unpacks how the Nigerian political Elites and leadership's inefficiency has contributed inversely to the eventual outbreak, sporadic rise and the negative consequences of Covid-19 on the entire populations' Nigeria's economic and sustainable development goals. Drawing from David Hume's theory of causation, this study discovers that leadership and Nigerian political elites' failure in the management of the Covid-19 pandemic, before and during its eventual outbreak and manifestation in Nigeria triggered the incident Covid-19 case in Nigeria, and its manifold effects on Nigeria's prospects for the actualization of her economic and sustainable development pursuits.

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Hope: a necessary condition for reintegration and reconciliation of ex-combatants in Colombia. How a positive view of the future life adds to sustainable peace.

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Abstract

The SDG movement has stated its Objective 16 as the promotion of just, peaceful and inclusive societies. Conflict, weak institutions and limited access to justice constitute one of the most important threats to the idea of sustainable development. Without peace, protection of human rights, and governance systems based on the rule of law, it will not be possible to achieve sustainable development. This is particularly true for countries and societies that have suffered from prolonged periods of social and armed conflict as in the case of Colombia. After an armed conflict that have lasted more than sixty years, and that have involved large parts of the population and regions in the country a peace agreement was finally negotiated between the Colombian government and the guerrilla group of FARC. The peace agreement includes initiatives to implement an integral rural reform, to combat illicit crops in conflicted regions, to assure political participation to the demobilized guerrilla group and excluded sectors, to compensate victims through a truth, reconciliation, reparation and transitional justice system. One of the most controversial issue discussed so far is how to demobilize ex-combatants and how to solve the grievances that exist among groups in society. ¿How the demobilized ex-combatants face their futures life's and which are their expectations for a better life once they are reincorporated. It Is a critical issue to be considered. In this article we discuss the importance of hope as a crucial variable for a successful reincorporation of ex-combatants. Hope seems to be an existential need in every life situation (Bloch 1959) particularly in extreme crisis. Hope is a prerequisite to live in dignity and to experience a fulfilling life (Beck et al. 1990).

Hope is principally based in human agency and connected to people's individual goals, motivation and cognitive capabilities (Snyder 1994).

I discuss in this article a reliable measure that was developed to measure hope, Then, I present how hope can be related to the idea of sustainability and present the results of a survey applied to a group of ex-combatants. Those results are compared with ordinary citizens. Finally, I develop a discussion of how hope is an essential variable to be considered for a successful reincorporation process that can sustain peace and add to sustainable development.

Full papers

Challenges in Achieving Access and Benefit Sharing through a Private Collaboration Agreement or Access and Benefit Sharing Law

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Abstract

Access and benefit-sharing (ABS) mechanism, a concept under the Convention on Biological Diversity (CBD), if appropriately applied, would create a win-win situation for both the user and provider of biological resources. In reality, this goal is not easy to achieve without a strong domestic legal framework to regulate any ABS initiatives. Using a 1988 case study on the Calanolide discovery in Sarawak, this article evaluates the success in attaining a fair and equitable benefit-sharing arrangement and the protection of indigenous rights as defined in the CBD, via a private collaboration agreement. The case study demonstrates that a private collaboration agreement is not a suitable mechanism in achieving the ABS goal for developing states like Malaysia. This article further argues that comprehensive ABS law such as the Malaysian Access to Biological Resources and Benefit-Sharing Act 2017 may provide a better mechanism for attaining a fair and equitable benefit-sharing arrangement. And examine if the protection of indigenous rights is compatible with the CBD standards and there is a strong implementation mechanism. The findings of this paper should motivate developing States to formulate a comprehensive ABS law to regulate access to their genetic resources and ensure benefit-sharing and adopt effective implementation of such law. Through effective implementation of an ABS law, States' conflicting interests could be reconciled to achieve sustainable development at the international level. Additionally, State will guarantee the protection of rights, dignity, and capabilities of the indigenous peoples or tribes involved through relevant domestic institutions. Arguably, attaining a fair and equitable benefit sharing and protection of indigenous rights will facilitate the attainment of SDG goal 16 in promoting just, peaceful and inclusive societies. Discussion in this paper establishes the relationship between sustainable development and peace, including security and reconciliation, particularly SDG 16, which promotes peaceful and just societies and builds effective and accountable institutions. Finally, the findings and recommendations of this paper will assist developing states like Malaysia, in making accelerating progress towards sustainable development goals.

Keywords: access and benefit sharing, private collaboration agreement, Convention on Biological Diversity, indigenous rights, legal framework

1. Introduction

Access and benefit-sharing (ABS) mechanism, a concept under the Convention on Biological Diversity 1992 (CBD), creates a win-win situation for both the user and provider of biological resources. In reality, this goal is not easy to achieve without a strong domestic legal framework to regulate any ABS initiatives. By adopting a doctrinal legal approach, this research is divided into two parts. In part one, using a 1988 case study on the Calanolide discovery in the State of Sarawak in Malaysia, this research evaluates the success in attaining a fair and equitable benefit-sharing arrangement and the protection of indigenous rights as defined in the CBD via a private collaboration agreement. This evaluation confirms whether a private collaboration agreement is a suitable mechanism in achieving the ABS goal for developing States like Malaysia. In part two, this research examines whether comprehensive ABS law such as the Malaysian Access to Biological Resources and Benefit Sharing Act 2017 may provide a better mechanism for attaining a fair and equitable benefit-sharing arrangement and the protection of indigenous rights.

2. Methods

This research adopts a doctrinal legal analysis. For purposes of the case study, the author has scrutinised the contents of the relevant agreements which laid down the access and collection rules and the rules for the benefit-sharing in the event of the commercialisation of the genetic resources and the policy on distribution of possible benefits, if any. Most of the data are primary data from international and domestic legal instruments, agreement and interviews. For purposes of this study, the author used the standard model agreement which has been used for similar ABS arrangement between NCI and other source States since 1992. However, the terms and conditions contained therein are much similar to the signed agreement.

3. Results and Discussion

3.1 ABS Arrangement under CBD, Indigenous Protection and Attaining SDG 16

Primarily, CBD recognises States' sovereign rights over their genetic resources and power to regulate access in bilateral arrangement with interested users (CBD, Art. 3). According to Brody (2010), State sovereignty stands for the territorial right to self-determination. This includes the right to territorial integrity and control over resources within that territory (Rhodes, 2016; Deplazes-Zemp 2018). CBD reaffirms the sovereign rights of States over their biological resources by giving States the authority to determine access conditions and ownerships of their biological resources (Engels & Henson 2011; Smith *et al* 2017).

CBD thus provides for a concept that will lead to an appreciation of biodiversity and facilitate a trade in which the genetic resource of developing States is traded for money, technology and knowledge from the developed States, thus creating a "win-win solution". Parties to this bilateral arrangement will generally have different interests and positions. These differing interests need to be reconciled so that every party will make equal contributions and share the benefits equitably. However, in reality, the reconciliation is not easy to achieve. This is because foreign companies' willingness to follow the new rules and share benefits, commercial interests, and access to their technology and expertise are questionable. It will normally touch upon their intellectual property rights (IPR). Since they normally provide the technology and knowledge, IPR to their views will always remain with them. For the source State, domestic distributional conflicts commonly arise between stakeholders. While the user State has the sovereign right to regulate access, private property issues are still to be resolved domestically between the State and relevant indigenous communities.

Indigenous peoples in Malaysia is divided into two groups, namely the Orang Asli in Peninsular Malaysia and the natives of Sabah and Sarawak in Borneo (Hassan & Nordin, 2020). In Sarawak, the indigenous population consists of more than 40 ethnics, and Dayak is one of the community recognised in Article 161A (6) of the Federal Constitution as Natives (Morris *et al* 2021). Even though the Natives of Sabah and Sarawak are given equal legal recognition and "special position" to the Malay under Article 153 of the Federal Constitution, the indigenous Dayak remains one of the marginalised communities in Sarawak whom traditionally live in the rural area of Sarawak (Ronald Agan *et al* 2019). According to Dayak, their rights and connection to the land are more genuine than the mere felling of trees to open up land for cultivation to create customary rights land (SUHAKAM 2013). We may now ask, to what extent is sustainable development relevant to the protection of indigenous rights generally and the Dayak's rights specifically.

The 2030 Agenda for Sustainable Development is a comprehensive and inclusive framework, and various targets set out in the sustainable development goals (SDGs) are highly relevant to indigenous peoples (A/RES/70/1). 73 out of the 169 targets in SDGs have significant ties to the UN Declaration on Rights of Indigenous Peoples (UNDRIP) (OHCHR 2017). The Office of the High Commissioner for Human Rights (OHCHR) highlighted four fundamental elements in the Agenda 2030 and SDG framework pertinent to indigenous peoples: leave no one behind, human rights, equality, participation, and accountability. In addition to that, the UN General Assembly has adopted Resolution on the Agenda 2030 for Sustainable Development, highlighted indigenous peoples' issues related to Goals 2 and 4 (A/RES/70/1). Besides, indigenous peoples are inextricably linked to core elements of achieving SDGs, including fostering peace and inclusive societies in SDG 16. Indigenous peoples' right to self-determination, way of life and their institutions are deserved global recognition as they contribute to peaceful and inclusive societies.

While indigenous peoples are inextricably linked to SDGs, effective ABS may contribute to SDG attainment, particularly goal no 16 in promoting just, peaceful and inclusive societies. The society in discussion is indigenous peoples in Malaysia. Although Malaysia is a State Party to CBD and has enacted the Access to Biological Resources and Benefit Sharing Act 2017, there must be an effective mechanism in place to ensure that indigenous people's rights to biological diversity and traditional knowledge is protected. The government has to adequately assure their commitment to implement the 2030 Agenda and the SDGs towards indigenous peoples (EPU 2017). The lack of recognition and protection of indigenous peoples' rights is a source of conflict and will impede the realisation of SDGs and Agenda 2030. Failure to uphold the indigenous rights, particularly their rights to education, land, health and economic, will hinder achieving SDG 1 to end poverty, SDG 5 on gender equality, and peacebuilding and inclusive societies in SDG 16. When their rights are not protected, they become excluded from development, and inclusive societies in Malaysia will not be established.

The institution that is important to ensure attainment of SDG 16 in regards to indigenous peoples are the *Jabatan Kemajuan Orang Asli* (JAKOA), Federal and State governments and the Malaysian Focal Point for CBD. These institutions must work hand in hand to ensure indigenous peoples are not left behind by introducing a framework to warrant inclusive participation of indigenous peoples in all decision-making processes, including decisions related to ABS initiatives. UNDRIP and other international law instruments such as ILO Convention 169 should be the framework to address the target set out in Agenda 2030, including SDG 16 for peacebuilding development (ILO undated). Victoria Tauli-Corpuz, UN Special Rapporteur on the Rights of Indigenous Peoples, rightly suggests that the government should introduce special measures to have an appropriate mechanism to protect the rights of indigenous peoples (IPMD undated). Thus, proactive measures to realising the SDGs and enhancing the protection of the indigenous peoples' rights and localising and implementing SDGs towards indigenous peoples in Malaysia.

Failure on the part of the government in ensuring ABS and protect indigenous rights in ABS initiative via private agreement are discussed in the following sub-heading *vis a vis* the collaboration between the State Government of Sarawak (SGOS) and the National Cancer Institute (NCI). It is via this case study that the difficulties and the respective implications are examined. This case study demonstrates that the terms and conditions underpinning the collaboration have not attained the equitable benefit-sharing arrangement as defined by the CBD and secure indigenous rights. It may work in theory but not in practice.

3.2 Access and Benefit-Sharing through Private Agreement (Bintangor Tree Case)

In 1987, NCI of the USA discovered a bioactive chemical compound, Calanolide A in the plant species *Calophyllum lanigerum. Var. austrocoriaceum* or locally called Bintangor from Sarawak's forest. A sample test conducted on Calanolide A has exhibited positive activity against the HIV and could be

developed into a drug for the treatment of AIDS. In June 1992, Calanolide A was approved for drug development. The Malaysian Government has issued a written permission for NCI scientists enter Sarawak to collect more materials for screening. The collection was carried out in accordance with the Guidelines on Conducting Research in Malaysia with strict compliance to the Code of Conduct requiring for foreign researchers and Malaysian nationals domiciled overseas intending to conduct "scientific and objective research in a particular area or problem" in the relevant State to obtain permission and the necessary visas from the Government of Malaysia (Reg. 1).

On 21 Jun 1994, NCI and the SGOS signed a Letter of Collection Agreement (LCA) permitting subsequent collections. The involvement of the SGOS and NCI to develop anti-AIDS drugs from the Calanolide has resulted in collaboration between NCI and its licensee, Medichem Research Inc. (MRI) on one part and SGOS and its agent, CRAUN Research Sendrian Berhad (CRAUN) on the other part, in the form of a joint venture agreement 1996 (the JVA) to establish a joint venture company, Sarawak Medichem Pharmaceuticals (SMP). In 1999, MRI transferred its proprietary assets to Advanced Life Sciences Inc.[1]

As the first-ever anti-AIDS drug to be developed from Sarawak's genetic resources, this collaboration has received extensive coverage by the media. People have been asked about the collaboration and the comments were generally positive. The Sarawak Attorney General, Fong J.C was quoted to remark that the SGOS was hoping for some financial reward, but also stressed that financial reward was not the only consideration of having this collaboration (Anne 2001). He further confirmed that Malaysian scientists have received training at MRI and some of them will staff a new drug screening and discovery facility that is being added to the government-funded Sarawak Biodiversity Centre in Kuching. MRI Chief Executive, Michael Flavin has said that the partnership could be a good model for other governments and businesses to use in the development of natural product discoveries (Jenta *et al* 2000). Tuah Jenta, the Malaysian Vice President of SMP added that as at 2001, the partnership has already derived significant benefits and proven a lot of scientific and business principles.

At that time, there was no law regulating access to genetic resources in Sarawak as the law was only passed in 1987 which introduced the permit system as an access mechanism. the LCA and the JVA which form the collaboration were not subjected to the ABS law. The LCA set out the terms of collaboration between SGOS and NCI for the collection and supply of plant materials for screening on the part of SGOS on the one hand and the screening, fractionation, structural elucidation and isolation of active compounds from the materials supplied by NCI, on the other. At face value, the contents reflected significant evolution in the benefit-sharing arrangement with a primary undertaking by NCI to provide the transfer of screening and isolation capabilities to SGOS's organisation. The LCA also

contained provisions on the option of collaboration between NCI and SGOS for the pre-clinical development of promising drug candidates. However, discussions in the following paragraphs will demonstrate that despite the extensive written commitment and undertaking made by NCI in the LCA, Sarawak's opportunity to participate in the discovery and development of the drug candidates in question is limited in terms of number and scope.

3.2.1 Participation and Training of Malaysian Scientists

While Article 3 of the LCA provided that suitably qualified scientists nominated by SGOS may participate in the isolation and fractionation process, this provision remains unsatisfactory as only two scientists (no justification stated) are allowed to participate. Furthermore, the participation of SGOS's scientists in the process is subject to "availability of suitable laboratory space and other necessary resources" and the period is limited to only one year (LCA Art. 4). This provision contains unnecessary restrictions and limitations regarding the participation of local scientists in the isolation and fractionation process. By virtue of this provision, it is at NCI's sole discretion to determine the availability of suitable laboratory space and other resources.

According to the JVA, scientists nominated by CRAUN are to be trained at MRI's facilities in the USA and allowed to participate in the clinical trials, development, manufacture, marketing and distribution of future product (JVA Art. 3.5). In this respect, as of 2006, only one scientist from Malaysia, Tuah Jenta, has been trained, been involved, and participated under the training programme pursuant to the collaboration. When Tuah Jenta resigned from CRAUN and work with SMP, no replacement has been made for him (CRAUN 2006). It is submitted that this may happen because there is no "non-solicitation" provision that has been incorporated into the JVA to control the soliciting of employees especially key employees like Dr Tuah Jenta. Although Dr Tuah Jenta has resigned, SGOS could still appoint other scientists for training but this has not been done. The period of one year for training is unreasonable. It is a well-known fact that clinical trials for drug development are a very long process and any scientists should get involved in the whole process for proper training without any time limit. Furthermore, CBD's legal framework on ABS requires parties to conduct joint research (CBD Art. 15(6)) and by allowing one scientist to get involved with other ten scientists from the other end is not joint research as defined by CBD.

3.2.2 Capacity Building

Article 3 of the LCA provides that NCI will assist SGOS to develop the capacity to undertake drug discovery and development, including capabilities for the screening and isolation of active compounds during the course of the contract period pursuant to the agreement. However, this provision is not clear on the scope of the assistance. This provision should specify the required knowledge and technology to develop SGOS's capacity to undertake drug discovery and development on its own. SGOS's scientists will have another opportunity to participate in the process i.e. when "a promising agent has been isolated

and approved for pre-clinical development" (LCA Art. 5). However, participation is not absolute and is subject to a discussion between NCI and SGOS. NCI will make a "sincere effort" to transfer any knowledge, expertise, and technology developed during such collaboration in the discovery and development process subject to mutual guarantees for IPR' protection (LCA Art. 5). It is the author's view that the phrase "sincere effort" does not carry much weight and can be loosely interpreted as social obligations rather than contractual obligations.

3.2.3 Intellectual Property Rights

SGOS will only have the right to seek patent protection on all inventions developed under this agreement in the event that such inventions have been developed by NCI and SGOS employees jointly (LCA Art. 6). SGOS should also become joint applicant for such inventions even if the same has been developed by NCI's employees alone. This is because by giving the access to NCI for collection of the genetic resources, SGOS should be entitled for the right to participate in the drug development process at all times and should have IPR on any inventions developed during such collaboration. The main right given to SGOS by virtue of the LCA is the power to negotiate directly with the potential licensees (pharmaceutical company), for production and marketing of any product developed under this collaboration, and to enter into an agreement to address the issue on royalties and forms of contribution (LCA Art. 8). This power had earlier never been given to any source State (Kerry, 1998), instead was the right of NCI until 1992.

3.2.4 Nature of Collaboration of the JVA

The JVA is the result of Article 8 of the LCA upon which SGOS has been given a right to collaborate with the successful licensee on the production and marketing of any potential drug. In this case, the successful licensee is MRI. Earlier, in 1995 by virtue of a Patent Licence Agreement between MRI and NCI (the PLA), MRI has been given the use of the patent right licensed under the PLA to undertake research into Calanolide with a view to developing a drug for the treatment of AIDS, and to use and sell any drug derived therefrom (Para 3.01 PLA 1995). The PLA also stipulated that MRI had to negotiate financial considerations with either NCI or SGOS, and MRI chosen SGOS for negotiation. MRI has also entered into a Licence Agreement on 27 Dec 1995 with the SGOS whereby in consideration of SGOS agreeing that MRI may use the compound, sell and distribute the drugs, MRI agreed to pay royalties to the SGOS at the rate mutually agreed (Art. III Licence Agreement 1995). The PLA and the Licence Agreement are the basis of the JVA between MRI and the SGOS and were referred to in the JVA as Appendix A and Appendix B, respectively.

Pursuant to the JVA, the collaboration will involve the provision of an expert from MRI and financial resources from SGOS for purposes of enabling SMP to carry out the clinical trials. MRI shall make available to SMP, at MRI's standard cost, ten scientists to undertake the clinical trials and shall train scientists nominated by CRAUN at its facilities in the USA and permit such scientists to participate

in the clinical trials, development, manufacture, marketing and distribution of the products (JVA Art. 3.5).

3.2.5 SGOS's Financial Contribution

Under the JVA, SGOS has agreed to finance Phase I of the Calanolide clinical development, the cost of which is estimated within the range USD 100 – 200 million. The amount of money that SGOS has to contribute is more than forty percent (40 %) of the total cost. Out of the total estimated cost of USD 21 million, SGOS shall provide USD 9 million through subscription in SMP stocks to cover the full costs of Phase IA/IB clinical trials and part of the costs of Phase II of the trials (JVA Art. 6). The payment is however always subject to the condition that prior to each payment, the results of the clinical trials are shown to be satisfactory, and the Benchmark (JVA App. D) was attained (JVA Art. 6.2). However, the JVA does not define what it means by satisfactory, and the relevant yardstick is the Benchmark. SGOS / CRAUN has given funds of USD 9 million and in 2001 the State Legislative Assembly approved an additional fund by way of a loan of USD 12 million to SMP for Phase II of the clinical trial (BRIMAS, 2001). According to the representative of CRAUN, as at 2006, SMP has failed to repay its loan and CRAUN was considering enforcing its rights under the Loan Agreement to take charge of the company upon its maturity (CRAUN 2006). Due to this financial problem, the project halted in 2001.

3.2.6 MRI's Expertise and Facilities

MRI has given warranty that the ten scientists provided for the conduct of the clinical trials shall "possess the requisite knowledge, skill and experience and will undertake the responsibilities to the best of their professional competence and to the best standard of professional conduct and ethics" (JVA Art. 5.2). At the same time, MRI has undertaken to recruit or engage other scientists whose skills and professional abilities are required for the conduct of the clinical trials (JVA Art. 5.3). This provision may be beneficial for SGOS if MRI is required to consider any of the Malaysian scientists for purposes of the recruitment prior to any other candidates. This will give Malaysian scientist an opportunity to participate more on the drug development process.

3.2.7 Out-sourcing and Redundancy

SMP claims that "its experienced management team has nurtured good working relations with world-class contract service providers" (SMP's Website 2006). By using a business model that "out-sources all of its manufacturing, pre-clinical and clinical research requirements, the company is able to manage its product development programs efficiently and cost-effectively" (SMP's Website 2006). However, this out-sourcing business arrangement has incurred additional costs to SMP and consumed most of the allocated funds. The out-sourcing has made MRI's scientists redundant. While SMP has to pay the external company for the out-sourcing jobs, it also has to pay the salaries of its in-house scientists. Arguably MRI has committed a serious breach of the JVA by not conducting the clinical trials using its

own scientists and facilities. Any unnecessary expenses incurred due to out-sourcing are also a serious breach.

3.2.8 Termination

Termination of the JVA under Article 8 provides that the collaboration may be terminated if the SGOS fails to provide share subscription funds required for the clinical trials and it does not provide further on MRI's failure to provide the required scientists and technology (JVA Art. 8.1 (b)). If the JVA is terminated due to CRAUN's failure, MRI's IPR shall be reassigned by SMP back to MRI, who shall be entitled to continue with the development of the compound (JVA Art. 8.2.2). A breach of any of the provisions of the JVA shall not result in its termination, but the party in breach shall be liable to compensate the other party for all damages and loss suffered or sustained by the innocent party in consequence of such a breach (JVA Art. 8.4). The effect of termination is not equal between the parties. While MRI gets back its IPR, SGOS is not entitled to any monetary or non-monetary rewards except for damages in the event that a breach is committed by MRI.

SMP has started with and completed Phases IA and IB of the clinical trials in 1999, two years later than the target completion date as per the Benchmark (JVA, Appendix D). Commencement of Phase II clinical trials should have occurred in January 1998 and it has not commenced as scheduled due to insufficient financial resources. The reason put forward by CRAUN was the delay for the completion of Phase I. It took more time for SMP to complete the trials and due to this extended period, SMP has paid more money to the scientists for their salaries. The delay was not clarified specifically by MRI or SMP at any of its Board of Directors' meetings (CRAUN 2006). The JVA has provided CRAUN with a right to terminate the collaboration at any stage if it feels that the progress of the trial is unsatisfactory and thereafter release CRAUN from its obligations to provide further funds. However, this provision has never been invoked.

3.2.9 Protection of Indigenous Rights

In the event that SGOS has knowledge on the medicinal use of any plants by the local population or traditional healers, this knowledge shall be disclosed and used to guide the collection of the genetic resources by SGOS. Details of the methods of administration used by traditional healers will be provided to enable suitable extracts to be made. In these circumstances, permission from the traditional healer or community will be sought before publication of their information and acknowledgement will be made of their contribution (LCA Art. 2 Part 2). This provision is inadequate as it does not provide further that the "permission" sought should be in the form of a "free prior informed consent" of the indigenous community concerned and it has not required financial rewards to be given to them in consideration of such traditional knowledge.

The collaboration has also failed to attain the relevant indigenous communities' involvement in decisions affecting their resources and has failed to protect indigenous rights (Richard 2001). The

same view was expressed by the indigenous communities through Mark Bujang of the Borneo Resources Institute (BRIMAS), a non-governmental group for the Dayak community in Sarawak. According to him, the indigenous communities who live in the peat swamp and the kerangas forest near Lundu, where the genetic resources were found, were never consulted or invited to participate in the discussion in respect of the JVA (Richard 2001). They have never been called by the SGOS to provide their input or asked about how they wish their rights towards the benefits to be reflected in the JVA and they have also been neglected by the SGOS. Mark claimed that "only scientists and industry participants will get the benefits". "The indigenous community want to get involved in the drug development" Mark added (Mark 2005; 2006). Mark said that "SGOS should provide direct benefits to the indigenous communities by giving job opportunities and financial resources for environment preservation" (Mark 2005; 2006).

The Dayak, who live in the jungle of Sarawak, claim that they know that the poisonous latex that oozes from the Bintangor tree can be stunning fish, and that a poultice made from the bark will ease headaches and skin rashes (Richard 2001). The Dayak were asking for their shares from the benefits due to their unregistered traditional knowledge, according to Mark. On the other hand, SGOS has claimed sovereignty and acted as the owner of the genetic resources. Benefits are for SGOS and scientists only, without the possibility of sharing the benefits with its local and indigenous communities (Mark 2005; 2006). CRAUN argues that as the land where the genetic recourses were found were never legally owned by the indigenous communities and the drug was developed without any reference to their traditional knowledge and therefore there is no basis for the indigenous communities in Sarawak to claim their share of the benefits (Wong 2002). There was no policy or mechanism in place for the distribution of possible benefits between SGOS and local and indigenous communities in respect of this collaboration.

Thus, SGOS has not recognised the right of its indigenous communities to the benefits arising from the commercialisation of Bintangor tree. It is an established principle that when these communities seek protection for their rights, they also wish to interact with it and therefore education, capacity building and assistance in asserting such rights are necessary (Thomas 1998). However, the principle has not been applied in this collaboration.

3.3. Failure to Reach Benefit Sharing through Private Agreement

The above analysis on ABS arrangements in the Bintangor tree case concludes that relevant agreements do not provide for sufficient ABS arrangements in favour of SGOS and the relevant indigenous community. The factors contributing to weaknesses in this collaboration are discussed in the following paragraphs.

3.3.1 Lack of Knowledge and Bargaining Power

Any biotechnology-related collaboration such as the JVA requires knowledge in many areas including corporate finance, commercial and IPR law and the manner in which biotechnology-related contracts are normally negotiated (Gregory, 2005; Rachel, 2004). In making sure that all issues are addressed duly, any negotiation of this nature should have designated representatives with adequate competency and authority to deal with (i) contractual and business; and (ii) technical and scientific matters. The negotiations for this collaboration involved a small number of personnel on the part of SGOS. It was the State Attorney General, the Chief Minister and the State Financial Minister who became the main negotiators for SGOS and they have not been assisted by any technical or scientific teams (CRAUN 2006).

3.3.2 Risks Management

When the JVA is poorly drafted, it reveals that the draftsperson has not thoroughly thought out the transaction, identified the risks and reasonably allocated them between parties (Fecenko 2002). Joint ventures and other forms of collaboration arrangements are common means used by parties to share risks and to combine resources in an effective manner to achieve the results sought by the parties involved in the arrangement. One main example demonstrating whether the risk has not been properly and equally shared is in the event of termination. It is provided by the JVA, that in the event of termination, MRI's IPR shall be reassigned by SMP back to MRI, who will be entitled to continue with the development of the drug (JVA Art 8.2.2.). The provision however has not mentioned SGOS's risk of not getting back its funds and has not managed this inherent risk accordingly. The JVA should provide for the possibility of SGOS getting back the funds that it has provided or anything equivalent to the value.

3.3.3 Lack of Authority

As of February 2006, four directors were representing CRAUN and five for MRI were on the SMP's Board of Directors (CRAUN 2006). However, as a joint venture company, the number of directors in SMP should be equal to MRI and CRAUN. MRI and CRAUN are equal shareholders of SMP and should have an equal number of representatives on the Board of Directors to protect respective interests. Many issues are normally resolved at the Board of Directors' meeting. Any product created jointly by the parties to the JVA shall belong to SMP and such IPR shall be the SMP's IPR and held in the name of SMP (JVA Art. 7.1(a)). In the event of infringement, SMP shall take all reasonable steps necessary to enforce SMP's IPR at its expense (JVA Art. 7.1(b)). It is therefore SMP's management that will have the say and ultimate decision on any IPR issues and if CRAUN is not equally represented in SMP's management, MRI will then have the greater authority. Therefore, joint ownership *per se* without equal authority and control in the management of SMP is insufficient to protect SGOS's interests in this collaboration.

3.3.4 Transparency

The JVA was also examined on its transparency as CRAUN has been alleged "for not being transparent and keeping too many secrets" (Mark 2005; 2006). The contract was not made accessible to the public and was not discussed by the SGOS with members of the public for obtaining any public opinion. The SGOS should be "more transparent about what is going on with the first-ever anti-AIDS drug to be developed from Sarawak's genetic resources, including the difficulties encountered in and how research works on the compound is being done" (Mark 2005;2006). The public at large is entitled to the information regarding this collaboration. They are the stakeholders of the genetic resources and the funds used by SGOS for this collaboration are public funds.

3.3.5 Absence of ABS Legal Framework

As mentioned earlier, the collaboration was initiated and finalised in 1994-1996 and during this period, Sarawak had no ABS law. This fact may also be the contributing factor for the weaknesses of the collaboration, as without legal framework on ABS, SGOS is not guided while negotiating the collaboration as all the relevant issues and concerns have not been addressed earlier by SGOS. Arguably, if at the time of the negotiation, Sarawak were to have a strong ABS law, this collaboration could be a success. This is because with a strong ABS law, the negotiation, drafting and enforcement of the collaboration will be well guided by the legislation. All issues and concerns may have been deliberated earlier and it is just a matter of incorporating it in the JVA with necessary adjustments.

In the following sub-heading, this research examines whether a comprehensive ABS law such as the Malaysian Access to Biological Resources and Benefit Sharing Act 2017 may provide a better mechanism for attaining a fair and equitable benefit-sharing arrangement and the protection of indigenous rights. Such mechanism is discussed and followed with an in-depth analysis on its strengths and weaknesses in attaining ABS and protection of indigenous rights.

3.4 Access and Benefit Sharing through Malaysian Access to Biological Resources and Benefit Sharing Act 2017

Given the downside of the ABS arrangement through private collaboration, it is argued that comprehensive ABS legal and regulatory framework may provide a better mechanism for attaining a fair and equitable benefit-sharing arrangement. Furthermore, to ensure the protection of indigenous rights if it is compatible with the CBD standards, there is a robust implementation mechanism. Specific legislation will enable a focused administration and compliance of the ABS regime (Zakariah 2017).

Malaysia has enacted the Access to Biological Resources and Benefit Sharing Act 2017 (ABS 2017), which recently came to force on 18 Dec 2020. The Act obtained royal assent on 9 Oct 2017 and was gazetted on 17 Oct 2017. The Act was enacted to implement the CBD and Nagoya Protocol which put in place a legal and institutional framework in the national legal system to regulate access to

biological resources and traditional knowledge to ensure fair and equitable benefits resulting from the use of such resources.

The legal framework created by the ABS 2017 seeks to ensure that the method used to access and utilise biological resources maximises the benefits for users, providers, the ecology and (indigenous) communities in which the resources are found. A legal and institutional framework ensures that a transparent framework exists to facilitate access to biological resources. This is also significant to ensure that benefits resulting from using the resources are shared equitably and fairly. The essential features of the ABS 2017 are discussed below.

3.4.1 Permit

A permit is required for any person who intends to access a biological resource or traditional knowledge associated with it either for commercial/potential commercial purposes (Section 12); or non-commercial purposes (Section 13). The permit must be applied to the relevant Competent Authority, the First Schedule's authority body. The Competent Authority has jurisdiction over all matters relating to access to biological resources in its specific region (Section 9(1)).

3.4.2 Prior Informed Consent and Benefit Sharing Agreement

The ABS 2017 in Section 23 requires that, where traditional knowledge of indigenous peoples and local communities on the biological resources is used, prior informed consent of the communities must be obtained. The benefits gained from its use must be shared with the communities. Users shall negotiate mutually agreed terms with the providers before accessing any biological resource. Section 23 of ABS 2017 provides for requirements for prior informed consent and mutually agreed terms for any access to:

> *(a) a biological resource on land to which such indigenous community and local community have a right as established by law; and*
>
> *(b) traditional knowledge associated with a biological resource that is held by such indigenous community and local community.*

The prior informed consent must be obtained prior to commencement of access activity, without coercion, undue pressure or inducement and that all relevant information concerning the access to the biological resource or associated knowledge is disclosed to the indigenous community and local community (Regulation 10 of the *Access to Biological Resources and Benefit Sharing Regulations 2020* (the Regulation). The term ‘indigenous communities’ include the Orang Asli communities and natives in Sabah and Sarawak (Section 4). The ABS 2017 also provides the manner to obtain the consent of the communities (Section 23(2)). The prior informed consent of the indigenous community and local community shall be obtained in accordance with customary laws and practices, protocols and procedures of the communities.

In addition, the prior informed consent must be obtained from, and the benefit-sharing agreement must have entered with 'the representative, organisation or body identified in accordance with the customary laws and practices, protocols and procedures of communities (Section 23(4)(a)). Therefore, the customary laws and practices of the communities in decision-making are important to determine whether consent is lawfully obtained. Furthermore, in a situation where access to biological resources or traditional knowledge is for commercial purposes or potentially for commercial purposes, Section 23(3) requires that a benefit-sharing agreement be made with the relevant communities. This is also subject to the requirement of the permit as provided under section 12(1).

In a situation where the traditional knowledge associated with a biological resource is shared by more than one indigenous or local communities, the applicant shall obtain the prior informed consent of and enter into benefit-sharing agreement with the duly identified representative or organisation of all the holders of the traditional knowledge associated with the biological resource (Section 23(6)(a)).

However, in a situation where it is not practicable to ascertain all such holders, the applicant shall obtain the prior informed consent of, and enter into the benefit-sharing agreement with, the duly identified representatives or organisation of such of the holders as may be ascertained by the applicant, subject to the satisfaction of the Competent Authority (Section 23(6)(b)). However, where there is no such representative or organisation of the traditional knowledge associated with a biological resource can be identified, the prior informed consent must be obtained from, and the agreement must be entered with the holders of the traditional knowledge associated with a biological resource within the indigenous community and local community (Section 23(4)(a)(i)). If the holders of the traditional knowledge associated with a biological resource cannot be identified, the prior informed consent must be obtained from, and the agreement must be entered with the Federal Government or State Authority (Section 23(4)(a)(i)).

The procedures for claims by other communities claiming to be the rightful holder of the associated knowledge under section 23 is provided in detail in Regulation 11. The monetary benefit obtained from the benefit-sharing agreement must be deposited into a fund established by the Federal or the State Government. If any, the benefit, including non-monetary benefit, shall be applied for the interest of the indigenous and the local community (Section 23(5)).

The form and terms of the benefit-sharing agreement are detailed out in Regulation 9. The agreement must be in writing. The agreement must provide for important particulars to be incorporated into the agreement. The details, among others, include the details of the parties, the timing and frequency of entry to the place of access, the description of the biological resource to be accessed, the quantity of the biological resource that can be removed from the place of access, The purpose of the access i.e. whether for commercial or potential commercial purpose, the use of the biological resource or traditional knowledge associated with the biological resource, the ownership of the data and results

of any research about the biological resource or its associated knowledge, information on the monetary and non-monetary benefits; and the conditions relating to intellectual property rights.

3.5 Comment/Critics against the ABS Law

Although Malaysia does not sign the Nagoya Protocol, the ABS 2017 has considerably adopted the provisions in the protocol (Wan Talaat, 2020), making it comprehensive to address its objectives. With the involvement of multiple authorities, complicated by the volatile political environment during these recent years, its effectiveness remains to be seen. As at March 2021, there are approximately 13 applications submitted under the ABS 2017 and are still in their initial stage. These applications are for permit to access a biological resource or traditional knowledge associated with it for non-commercial purposes (R&D), thus will not require prior informed consent and benefit sharing agreement (Arief, 2021).

4. Conclusions

Generally, this research examines the question as whether a private agreement is a better way to protect property rights and resolve any associated issues as compared with direct regulations. In this context direct regulations will be any legal measures in the form of law, including, but not limited to any national ABS law while a JVA has been selected as the means to resolve property rights issues between MRI and the SGOS.

The nature of a ABS agreement is not straight forward one-to-one dispute. It normally involves numerous stakeholders in genetic resources. The Bintangor tree case study demonstrates that the concept of bilateral ABS agreement to create win-win solution between the parties as inspired by CBD not easy to achieve. This case study demonstrates significant justification for biodiversity-rich developing States to make sure adequate national ABS law is formulated on an urgency basis. Any access to any genetic resources has to be properly supervised as unregulated bio-prospecting and drug development can be very detrimental to the survival of biodiversity and rights of the relevant indigenous communities. ABS agreements executed without a proper legal framework may end up with a failure due to the limited capabilities to cope with the nature and scale of such agreement.

Through effective implementation of any ABS law, such as ABS 2017 of Malaysia, States' conflicting interests could be reconciled to achieve sustainable development at the international level. Additionally, State is required by the legislature to guarantee the protection of rights, dignity, and capabilities of the indigenous peoples or tribes involved through a permit system and ABS agreement, duly regulated by the relevant domestic institutions.

Discussion in this paper establishes the relationship between sustainable development and peace, including security and reconciliation, particularly SDG 16, which promotes peaceful and just societies and builds effective and accountable institutions.

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Harnessing Big Data in Health Sector: A Dichotomy between Sustaining Development Goals and Preserving Rights of Privacy?

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Abstract

This article draws upon a legal concern towards the rights of privacy of health data in Big Data applications and its dichotomy. The Sustainable Development Goals (SDGs) generally aim to strengthen universal peace and humanity. This stands under one of the pillars of sustainable development; the social pillars. The dependency on big data technology and health data is proven to be extremely important to achieve sustainable development by the year 2030. Big data technology has so many potentials for organisations or institutions to develop the health economic sectors i.e to enhance data sharing among institutions, improve the decision-making process, and others. Nevertheless, the application of this technology had raised the issue of privacy of health data. The privacy of an individual or patients is of utmost importance. In this article, we instill the idea by suggesting for privacy rights of health data within big data application to be included within the framework of universal peace and humanity and to propose a jurisprudential understanding to harmonise the dichotomy between SDG and privacy rights of health data and Big Data. The methodology applied in this study is a legal analysis of selected works of literature and jurisprudence analysis by analysing the General Data Protection Regulation 2018 of European Union a model with a comprehensive data protection law system This article found that the limited interpretation of this issue could be expanded specifically through Goal 9 and Goal 16 of the SDGs. This paper also proves that it does not amount to dichotomy and merely inconsistency that should be harmonised.

Keywords; Sustainable Development, SDG, Health Data Privacy, Big Data.

1. Introduction

Sustainable Development Goals or SDGs is a global agenda that aims to achieve sustainable development by 2030 (UN SDG, 2017). SDG stands under three important pillars of sustainable development; economy, environment, and social (Mensah, 2019a; Dalampira & A. Nastis, 2020a). In the context of social pillars, it encompasses various types of issues including human rights which promote peace and social stability for sustainable development (Mensah,2019b). Moreover, the SDG is also explicitly grounded in human rights (Privacy International, 2018), and this may include the right to privacy of health data.

Underdeveloped discussion on what encompassed social pillars under sustainable development (Murphy, 2012) has opened the way for us to argue that the rights of privacy of health data are part of the social aspects. This right is being challenged with the application of big data technology in health. However, the analogy that this technology works for the betterment of the global health system has always been the reason why health data could be used under certain exceptions under the law which has also become a legal threat towards the privacy of individuals or patients. It is cliché to rely on the agenda that technology could improve the economy, assist in combating environmental and social issues i.e protection of human data, which makes sustainable development look like it is a comprehensive plan for global agenda, but human rights as in the privacy of health information of indvidual is also an important goal that must be discussed and established.

In this study, we aim to focus on the aspect of the rights of privacy of health data within the application of Big Data technology. We believed that the application of this technology should be in line with the data protection of health data. The jurisprudence analysis applied in this study is a general jurisprudence on the theory of law and is not bound to any specific jurisprudence school. By this, we meant to look into the nature of the rights of privacy of health data from the eyes of data protection law in one region as a sample to prove that there is no dichotomy between health privacy law and the application of big data technology in practice. In this legal analysis study, we took European Union's data protection law to legally analyze the implementation of health data privacy to achieve sustainable development.

This article aims to contribute to expanding the interpretation of the concept and idea of strengthening universal peace and humanity within the realm of Big Data according to the law and harmonizing the inconsistency of big data application and health data privacy. First of all, we present the conceptual legal framework that is the foundation of this article. We started by analyzing the concept of sustainable development and social sustainability, its relation to the concept of peace and humanity under sustainable development. Once the relation is clear, we explain big data technology and its application in the health sector. The application of this technology had also raised the issue of privacy rights on health data under the wings of human rights and social sustainability.

The second part of this article is the legal analysis of the jurisprudence of health data privacy in the European Union which consists of twenty-seven European countries. This jurisdiction is chosen as a case study based on two important facts (Rynagaert & Taylor, 2020); i) the jurisprudence framework on data protection law is proven to be adopted and applicable in so many states and, ii) the legal preparation in facing the advancement of technology specifically in terms of big data application in health.

The third and final part of this article will lay out the findings from analyzing all important points. Out of seventeen goals, only two goals are considered to be relevant with this study namely Goal 9 and Goal 16 of SDG. The discussion would be on positioning the health data privacy and big data technology to achieve sustainable development. This article ended with suggestions to harmonize the dichotomy between health data privacy and big data.

2. Methods and Data

We employed legal qualitative analysis methods to analyze the works of literature and the issue beforehand. It is suitable for our research because it involves jurisprudence analysis as to how the law is perceived and how does it help in bettering the perspective that we have in looking into sustainable development issue from social aspects, which is one of the important pillars

of sustainable development. The focus of sustainable development has always been seen from the perspective of economic and the environment. Therefore, in this study, we employed a legal perspective in analyzing this issue.

There are three stages to complete the whole process of legal analysis. The first stage is collecting relevant literature under four important keywords. There are four important keywords that we used in searching for the relevant literature; big data, health data, privacy rights, and sustainable development. These four keywords were found to be in journal articles, legal documents, and related books to the topic.

The second stage is data collection. The data collection process includes journal articles, legal documents i.e Acts, official international reports, and policy papers and books. The journal articles that we have collected range from the year 2011-2021. As for the legal documents, we decided not to set the year range as we believed that these works of literature are important to be analyzed flexibly without limiting the year range because it builds up the conceptual framework for this study.

The third stage is the data analysis process. This process will be presented in the next part that is the finding of this study. In the analysis process, we will be explaining the importance to include the rights of privacy of health data within the application of big data technology. We will also discuss and propose the importance of jurisprudential understanding to harmonize the dichotomy between SDG and rights of privacy in health and big data.

The objectives of the study; i) to include the privacy rights of health data witihin the application of big data technology in health and ii) to propose a jurisprudential understanding to harmonize the dichotomy between SDG and privacy rights in health and big data will be achieved through this final stages.

3. Result and Discussion

3.1 Conceptual Framework: Social Pillars of Sustainable Development as the basis for the rights of privacy for health data and big data.

Sustainable Development comprises two important keywords. These two words, if defined separately, have a different connotation. Sustainable or sustainability is a concept that explores the relationship between economic development, environmental quality, and social equity (Purvis et.al, 2008). It has become popular in policy-oriented research as an expression of what public policies ought to achieve. According to Kuhlman & Farrington (2010), the concept was originally coined in forestry, where it means never harvesting more than what the forest yields in new growth. The term development on the other hand is a multidimensional undertaking to achieve a higher quality of life for all people. This term has been inflated or reduced to only cover the aspect of economic growth (Sachs,2001a).

The definition of sustainable development is often referred to Brundtland Commission (Baharuddin, 2017a). According to the commission, sustainable development must rest on the political will of the governments as critical economic, environmental, and social decisions are made. It is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Baharuddin, 2017b).

There have been three pillars which are economic, environmental and social which are all related to the long-term stability of the economy and environment (Sachs, 2001b). This overall goal of sustainable development is only achievable through the integration and

acknowledgment of those three pillars throughout the decision-making process. This study is going to focus on the third aspect of the pillar, the social aspect.

For decades, our world had focused on economic sustainability and it is time for the focus to be broadened (Kandachar, 2014). Social sustainability or social aspects of sustainable development is not only about ensuring that everyone's needs are met (Kolk, 2016) but it goes beyond that. Mensah (2019c), claimed that social sustainability encompasses many issues such as human rights, gender equity, and equality, public participation, and rule of law all of which promote peace and social stability for sustainable development. Relatively, it aims to provides enabling conditions for everyone to have the capacity to realize their needs. Brodhag & Taliere (2006), Pierobon (2019), and Mensah (2019d) stated that anything that impedes this capacity is considered a barrier and needs to be addressed for individuals, organizations, or community to make progress towards social sustainability.

Thus, the social aspect of sustainable development system could be achieved through distributional justice, adequate provision of social services including health and education, political accountability, and participation (Baharuddin, 2017c). This article will futher discuss to prove that a sustainable social system could be attained through distributional justice and adequate provision of social services of health data privacy.

The right to be left alone is the foundation for the rights of privacy (Warren & Brandeis, 1980). However, this classical concept is not exhaustive to be applied in the age of big data. Abu Bakar Munir et.al (2014) explained that the rights of privacy in new era is related to informational privacy, the usage of data which contained personal informations of individual. It involved the establishment of rules governing the collection and handling of personal data such as medical records, and the privacy of a private person to choose and to determine whether, how and to what extent information about himself is communicated to others under this type of privacy information which usually includes sensitive and confidential information.

Accordingly, health data may contain personal data of an individual (Ismail & Cieh, 2013). Health data has always been categorised as special categories of personal data because when the processing of such data took place, it might pose a risk to the rights and freedom of a natural person (Tzanou, 2020a). Health data is the type of data which contained personal information of individuals such as names, medical profiles and any data concerning the health of a person.

In the age of big data, the right to privacy is of utmost importance. With so much data available, it will be possible to trace, determine and recognize the individual identity even after anonymization or data aggregation.

Big data is not a single concept - it is a growing collection of sources, technologies, techniques, and procedures. Big data refers to an enormous volume of structured and unstructured data that is difficult to process using conventional database and software techniques. Data has become an increasingly important part of our world. As more data is generated and referred to as "big data" in popular literature, its use becomes more pervasive, and its potential for policymaking and international development is only beginning to be explored.

According to Maarof (2018a), big data can be defined as large volumes of high velocity, complex, and variable data that require advanced techniques and technologies to enable the capture, storage, distribution, management, and analysis of the information. It can be characterized by 3Vs: the extreme volume of data, the wide variety of types of data, and the velocity at which the data can be processed

Big data in health has not much different from big data technology itself except for the fact that it is used and applied in the health sector. Big Data Value Association (2016) defined big data in health as " encompasses high volume, high diversity biological, clinical, environmental, and lifestyle information collected from single individuals to large cohorts, in relation to their health and wellness status, at one or several time points". Raja et.al 2020 laid out healthcare big data definition using the systematic literature review method. The definitions that are relevant as followed;

Author	Definitions
Raghupati & Raghupati,2014	Healthcare big data can be defined as digitalized version of health information which is so vast and complex that they are not easy [7] to manage using traditional software and/or hardware, nor can they be easily handled using conventional data management tools and methods
Baro et.al, 2015	Big data in healthcare refers to the data sets with log $(n \times p) \geq 7$, and that they have high variety and high-speed characteristics
Priyanka & Kulennavar, 2014	Healthcare data generally incorporates electronic health records (EHRs) such as patient's medical history, physician notes, clinical [11] reports, biometric data, and other medical data related to health, as well as social media posts such as blog posts, tweets, Facebook postnotifications, and publications in medical journals.

Figure 1. Definitions of heath big data.

Healthcare institutions are generating data at a breakneck pace, which poses both opportunities and obstacles. With the advent of computer systems and their potential, digitization of all clinical examinations and medical records in healthcare systems has become a standard and widely adopted practice in the modern era. In 2003, the Institute of Medicine, a division of the National Academies of Sciences, Engineering, and Medicine, coined the term "electronic health records" to refer to records maintained to improve the health care sector for the benefit of patients and clinicians.

Information technology has become increasingly important in managing and utilizing such healthcare data. The development and use of wellness monitoring devices and associated software capable of generating alerts and sharing a patient's health-related data with their

respective health care providers has accelerated, particularly in the establishment of a real-time biomedical and health monitoring system.

By digitizing health data, such as through an Electronic Health Record or a Health Data Warehouse, advanced analytics, and clinical decision-making can be facilitated. However, a sizable portion of this data is unstructured at the moment. Unstructured data is data that does not follow a predefined model or hierarchical context. This preference may be because we can record it in a variety of formats. Another argument to use an unstructured format is that standardized input options such as drop-down menus, radio keys, and checkboxes often fail short of collecting complex data.

The usage of such technology had raised the issue of privacy especially in health (Salas-Vega, 2015; Abdoulemehdi et.al, 2018; Dash et.al, 2019; Khanra et.al, 2020). As big data transform healthcare to achieve better health deliveries and sustainable development, the privacy of health data and data subjects is paramount in driving this technology.

The dichotomy between technology and human rights had always been an issue to achieve sustainable development. In the case of big data technology and privacy of health data, the dichotomy existed when the application of big data is needed for innovations and economy to achieve sustainable development goals. The privacy of health data is jeopardised when it is used to be processed by big data technology to achieve certain purposes.

On the one hand, big data technology is an enabler if used appropriately, and on the other hand, it may well be perceived as an oppressive instrument if used subversively to topple the rights of privacy of health data. Health data is the essence of big data application in health. According to Michael et.al (2019), without the necessary circumstances, technologies may fail to function well because they may not appropriately safeguard citizens from misuse, abuse, manipulation, or misapplication by those in authority. The establishment of appropriate technology policies will allow institutions to operate more efficiently and to serve communities and to enable robust and reliable on-line and offline infrastructures to attract enough investments if risks are reduced. In the context of technology, it is essential to grasp what privacy, data rights and protection imply for good in order to prevent some of these hazards, especially for complicated technology such as big data.

Therefore the application of big data technology and the practise of good health data privacy law should be seen from practical perspective. The European Union is chosen to be a very good sample on how they protect the rights of privacy of health data and individual in reaching for sustainable developement.

3.2 European Union legal approach on privacy rights of health data: Promoting the idea of peace and justice towards health data application

In Europe, the rights concerning health are generally structured in the constitutions or principal legislation of countries. While some European countries have reviewed and updated their existing laws related to patient rights, some other countries have passed new laws (Emre O,2014). The European Patient Rights Charter (2003), which was prepared in the context of the European Union's Constitution and the protocols associated with it, and which aims for harmony in terms of patient rights in Europe, includes both additional new rights on top of the patient rights contained in previous documents, as well as explanatory information about the scope and content of all patient rights. The content of this Charter was adopted by European countries shortly after it was published (Demirsoy & Kirimlioglu, 2016b). The EU

Commission, in consideration of the WHO documents on patient rights and medical professionals' actions and attitudes, drew up the EU Patient Rights Charter, which takes into account parameters and services provided illustrations. The document's objectives were to ensure that individuals' rights are protected and not violated when they receive health care, to ensure that European countries' patient rights are respected, and to prevent violations caused by the national health system.

J Braunact & Mulligan (2003) and Demirosy & KirimliogluMac (2016c) in his view wrote that privacy and confidentiality are vital for establishing and maintaining an effective and respectful clinical relationship. It constitutes social merit as it encourages the explicit discussion of health-related problems between clinicians and patients. Privacy requires physicians to keep confidential information that patients provide or that they obtain in their professional interaction with patients.

Jurisprudentially, the rights of privacy has also become what we call fundamental human rights in most international law such as the Universal Declaration of Human Rights 1948 and International Covenant on Civil and Political Rights 1966. Article 8 of European Convention of Human Rights proved that European Union is one of the nations in the world that uphold the rights of privacy, especially regarding personal data (McDermott, 2017). We could also see the development of the right of privacy within the context of data protection law such as the Data Protection Directive and has now been changed to General Data Protection regulation 2018. The European implementation in May 2018 of the latest GDPR is to strengthen citizens' rights to data protection, including, inter alia, the “right to be forgotten”, which shows that privacy remains a serious concern (MacFeely, 2019).

Based on a report by European Commission, health data includes structured data but also data generated from outside of healthcare settings such as wellness devices. The previous regulation is no longer applicable to the current challenges of law. Realising this fact, the European Union had stepped up the protection of personal data in each area including health (Paget & Patterson, 2020). Therefore, the General Data Protection Regulation 2018 sets out the general principles that apply to all users of health data.

Principles	Explanations
Lawfulness, fairness and transparency	Data must be processed in accordance with the European Union and Member State laws, data controllers have to be transparent with patients regarding what happens to their personal data.
Purpose limitation	The data must be collected for a specific explicit and legitimate purpose and cannot be used for other purposes beyond that. It is, however, considered that further processing for scientific research, archiving or statistical

	purposes is not incompatible with this principle. So data can be re-used for research.
Data minimisation	It means that the data controller should only ask for patients information that is needed and relevant for the purpose for which they are collecting data.
Accuracy	Controllers have to ensure that their data is accurate. If it is not, the controller should take every reasonable step to rectify it.
Limited storage	Data can only be stored for a limited period, except for archiving and scientific research purposes.
Integrity and Confidentiality	Data has to be processed in a manner that minimises risks to confidentiality and integrity of the data (which means ensuring its consistency and accuracy, as opposed to data corruption).
Accountability	This is a new principle compared to the 1995 Directive. It means the data controllers should not only apply the principles in the law but they also have to be able to prove that they are accountable and respect the above principles, it means the burden of the proof is with them.

Figure 2. The principles of data protection (which also applicable to health data) under GDPR 2018.

The European Unions through the implementation of GDPR 2018 recognized the challenges brought within the realm of data protection law, which includes the rights of privacy(Yuan & Li, 2019). They are also aware of the legal challenges brought by new technologies such as big data towards the privacy of health data (Mostert,2015; J.Nahra, 2017).

The European Union has always supported the idea of technological development in health and sustainable development (Paget,2020). The GDPR 2018 proved that European Union is aware of the legal challenges from technological advancement thus preparing their data protection law accordingly to be able to reach the goals of sustainable development.

3.3 Positioning the rights of privacy of health data in Big Data application under Goal 9 and 16 of SDGs

To place the rights of privacy in health data within sustainable development goals, we must first understand why does it matter? With the advancement of technology of big data and when it is applied in the health arena, the production of data or more specifically, health data will also attract threats towards the privacy of human beings.

Goal.9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well being, with a focus on affordable and equitable access for all.

9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestick product, in line with national circumstances, and double its share in least developed countries.

9.3 Increase the access of small scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.

9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people as well asand public and private research and development spending.

9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing State.

9.b Support domestick technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.

9.c Significantly increase access to information and communications technology and strive

to provide universal and affordable access to the Internet in least developed countries by 2020.

Figure 3. Global 9 of Sustainable Development Goals

Figure 3 shows Goal 9 of SDG and what it represents. Clause 9.5, 9.a, 9.b, and 9.c depict the relevance of technological development to achieve sustainable development and this includes big data technology. Generally, big data is being applied to allow governments or

institutions to process information and act quickly in response. In a more specific manner, health data is also among the important data that is currently generated through so many sources to ensure that this technology could be applied in the health sector. In other words, big data technology relies on health data to process the outcome needed by the institutions or organizations. According to Maarof (2019b), big data is quite complex, ranging from practical or technical challenges to legal and regulatory limitations.

Goal.16.Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.

16.1 Significantly reduce all forms of violence and related death rates everywhere

16.2 End abuse, exploitation, trafficking and all forms of violence against and torture of children.

16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all.

16.4 By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime.

16.5 Substantially reduce corruption and bribery in all their forms.

16.6 Develop effective, accountable and transparent institutions at all levels.

16.7 Ensure responsive, inclusive, participatory and representative decision making at all levels.

16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance.

16.9 By 2030, provide legal identity for all, including birth registration.

16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements.

16.a Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime.

16.b Promote and enforce non -discriminatory laws and policies for sustainable development.

Figure 4. Goal 16 of Sustainable Development Goals

Goal 16 of SDG laid out ten important targets to promote peace and justice. According to Md. Khalid (2020), Goal 16 is not merely about ensuring peace and justice, it also encompasses any activities that promote peaceful and inclusive societies for sustainable development, provides access to justice for all and build effective, accountable, and inclusive institutions at all levels. Peace and justice could only be achieved in the development process through an effectively enforced legal framework and strong institutions.

It is suggested that Goals 9 and 16 are interrelated to achieve sustainable development. Broad interpretation towards Goal 9 and Goal 16 as to how they could be related to each other might be applied in reading the other goals under SDG. It is further submitted that big data technology and the rights of privacy of health data should be important aspects to be achieved under SDG. Learning from European Union and their effort in sustaining technology and providing proportionate rights of health data privacy under GDPR should be a good example for other nations.

3.4 Harmonizing the dichotomy: rights of privacy of health data vs Big Data technology

Peace and justice within the realm of sustainable development could be attained through a comprehensive understanding of jurisprudence. For example, the European Union promotes the idea of peace and justice to be respected through legal charter and legal regulation i.e GDPR 2018. We might not be able to gain total justice out of everything, but we must wear the jurisprudence worldview to distribute peace with just.

We are suggesting that Goal 16 be read together with Goal 9 to achieve fair rights of health data and reasonable usage of big data technology. The application of big data technology and the privacy of health data has come in between the agenda of achieving sustainable development by the year 2030. Even though there is no clear evidence that shows there is a dichotomy between the application of big data and the privacy of health, we believed that it is merely an inconsistency that existed due to a lack of understanding of the technology. When technology becomes a legal subject within the realm of law, it is perceived to raise a dichotomy that conflicted with the law.

In harmonizing the dichotomy between achieving health data privacy and big data, the effort had also been done by United Nations Development Group. They had prepared a guidance note titled " Data Privacy, Ethics and Protection Guidance Note on Big Data for Achievement of the 2030". It sets out general guidance on data privacy, data protection. There are nine principles mentioned in this guidance note. Principle four that is sensitive data and sensitive contexts provide for stricter standards of data protection for data in this category. Health data is included as part of sensitive data under this principle and still relevant to be included as it contained personal data of individual which possibly amount to protection under the rights of privacy.

Even though this document does not constitute any legal effects, but it could be a reference in developing a legal document in providing protections for health data privacy and the usage of big data technology. Personal information in health data could contained information about an individual. It could bring direct recognition if big data could identify their identity through data processing.

If this is purely a dichotomy, it would be impossible to reach harmony. Based on our research, this is merely an inconsistency and we could reach harmony if a comprehensive legal framework of health data protection is implemented and transparency is practised among governments or institutions or states that are using individual's health data for a better cause. We are not against the fact that health data also contain information that could assist in improving healthcare. We also realised that for the betterment of the health system, it is impossible to avoid using health data in big data technology. Nevertheless, health data is not completely protected privacy in its nature, epecially with the application of big data and still lacking in terms of legal regulations for protecting health data. The main goals should be on

how to maximize the technology for its benefits and at the same, be fair and proof that justice is given in handling human health data to avoid putting human at risk.

4. Conclusion

The abilities of big data technology will assist the health sector in lowering healthcare prices, improve healthcare services, and breakdown barriers between industries. However, concerns about the potential of big data technology to violate privacy rights especially health data privacy are legitimate and grounded in the experiences of communities currently vulnerable to inequality and surveillance.

To harmonize the dichotomy between big data technology and protecting the rights of privacy of health data, we suggest for the idea of peace and justice to be included as part of data protection law to achieve sustainable development. In European Union, the key values of data protection should be a legal practical sample to other nations in preserving health data privacy with the applications of big data technology.

The rights of privacy of health data and big data technology are part of sustainable development goals. With a broader interpretation of how Goal 9 and 16 are interrelated to each other, sustainable development could be achieved by giving balance to technological innovation and human privacy. We may not be able to give total justice in dealing with this issue, but the least we could do is providing balance through legal mechanism.

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9. Governance, Power and Institutions and Weakness of SDGs

9b. Collaboration and co-creation for sustainability, SDG initiatives and scale of governance

Abstracts

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Governance factors and their inter-relationships to promote sustainability in organisations

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Abstract

Organisations have recognised that they need to become more sustainable and better address global challenges. A key element for this, and to implementing sustainability into organisations, is governance. Most of the research on governance for sustainability has been on corporations, with limited research on civil society and public sector organisations (PSOs). Seven governance factors were identified (vision and mission, policies, reporting, communication, the board of directors, sustainability department, and person in charge); however, their importance and interrelations are still under-researched. In this study, empirical data was collected from 5,299 organizations (including corporations, civil society, and PSOs) from which 305 responses were received. These were analysed by using descriptive statistics, rankings, comparison between organisation types, correlations, and centrality.

The results provide insights into the ranking of the seven factors, where vision and mission, person in charge, and reporting were the highest ones ranked. The results show a more complete picture of the interrelations of the governance factors, which are complemented by the centrality analysis. The comparison between organisation types shows statistical differences in five of the seven factors. The analysis shows that the whole, organisations, behaves different that its parts, the organisations types, where communication plays a key role in implementing sustainability. This research highlights the importance of recognising the governance factors that have the highest importance and influence for each type of organisation, in order to encourage them and make the structures of organisations more sustainable. Each factor and its relation to other factors can contribute to better governance for sustainability, and better governance can contribute to a more holistic implementation of sustainability in organisations and enhances all sustainable development goals (SDGs), directly or indirectly.

This study contributes to achieving SDG 16, Target 16.5 (Substantially reduce corruption and bribery in all their forms); Target 16.6 (Develop effective, accountable, and transparent institutions at all levels); Target 16.7 (Ensure responsive, inclusive, participatory, and representative decision-making at all levels); and Target 16.8 (Broaden and strengthen the participation of developing countries in the institutions of global governance; Promote and enforce non-discriminatory laws and policies for sustainable development).

A better understanding of governance factors and how they interrelate to each other can provide organisations with better structures to accelerate their progress in contributing to the SDGs.

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Addressing Partnerships for the SDGs Goals Through "BEKAL Pemimpin" Nurturing Emerging Environmental Leaders of Indonesia.

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Abstract

This paper will show the first initiative to nurturing Indonesia's emerging environmental leaders towards equitable, sustainable, and locally rooted natural resource management. The program is so-called BEKAL Pemimpin that BEKAL is an acronym from Bersama Kelola Alam Adil Lestari, meaning managing natural resources together with justice and sustainability. Besides Pemimpin meaning is leadership. In the 2019's first cohort of BEKAL Pemimpim participants, it is carefully curated to assemble a "microcosm" that replicates Indonesia's natural resource management complexity. Therefore, the 58 participants who comprise the first cohort represent 19 provinces and the various sectors with direct influence on Indonesia's natural capital. They work in equally diverse fields such as terrestrial, maritime, coastal, and cross-cutting issues. This microcosm then becomes a holistic training ground where participants hone their leadership capacity to address complexity through their interactions with one another —in a controlled environment and equipped with various tools to transform together. This microcosm also provides a rich source of learning, giving participants access to the many perspectives, paradigms, and practices that shape Indonesia's natural resource management's complexity. Afterward, in the last three months of their learning journey, the participants were invited to exercise and actualize these leadership capacities to address natural resources management's real challenges. Hence nine prototypes are borne out of the genuine intention of BEKAL Pemimpin to transform their realities, supported by their peer as consultants and coaches, who convene out of their authentic callings. These prototypes are the next training ground for the participants. Those prototypes then become a new laboratory to generate solutions and other actors in the system, transcending sectoral and institutional boundaries. BEKAL Pemimpin initiative will accelerate the progress towards the 17 Partnerships Goal of SDGs, particularly in crisis times. Furthermore, this Indonesia experience for nurturing an agile and adaptive environmental leadership in the context of VUCA (volatile, uncertain, complex, and ambiguous) shows to what extent the exercise of U-Theory and transdisciplinary multi-stakeholders co-creation worked. The result of the first year of BEKAL Pemimpin saw the journey of BEKAL Pemimpin as a seed for systemic transformation is just starting, and the capacity building seed will not flourish if not supported

by good stewardship and good soil and/or climate. Therefore, the 2019 pioneers replicate the transformation and multi-faceted approach in the coming years for much larger systemic ecosystem leadership.

Keywords: sustainability, transdiscplinary, natural resources governance, co-creation, leadership

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Parcel delivery by shared economy in trust

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Abstract

The spread of the sharing economy initiative in recent years has had a significant impact on various industries, including logistics. Creative solutions have been developed to share resources for individual cost reductions, supported primarily by platforms developed by start-up companies. Platform-driven resource sharing has resulted in unprecedented collaborations between ordinary people (e.g., car sharing). Various companies have teamed up to ensure that the bicycles, scooters and electric cars are used as much as possible in the cities. The opportunities inherent in the concept of the sharing economy are still untapped and in addition to private people, there are also opportunities for companies and institutions. Parcel delivery, i.e., last mile delivery, is one of the best researched areas of the logistics profession as companies want to operate as cost-effectively as possible in the face of increasing competition. Environmental regulations, increased traffic and parking problems are causing additional problems for last mile providers. In the field of parcel delivery, various solutions have been developed as an alternative to delivering parcels to the customer. Large number of consumers requesting home delivery; therefore, service providers have an interest in developing different solution. In such situation, the last mile delivery providers have been forced to cooperate. The concept of cooperation is not unknown in the logistics industry, although it is more typical of classical transportation. Cooperation between last mile delivery providers, while not unprecedented, is not typical. The forced closures caused by the Covid-19 pandemic in 2020 have further increased the already strong upward trend in e-commerce, placing an increasing burden on parcel deliveries, along with the environment, traffic and the quality of life of ordinary people. Sharing resources in order to reduce environmental and traffic burdens, and last but not least to increase efficiency, almost requires cooperation between horizontal service providers.

The lack of collaboration is thought-provoking and certainly encourages researchers to map the underlying causes. The lack of cooperation between last mile delivery providers can be due to a number of reasons, such as inflexibility, fear for cultural reasons, mistrust, and the need to perpetuate competition. Cooperation is definitely based on trust. This article primarily examines the question of what is the reason of not collaborating each other and seeks the answer to the question of what influences the willingness to cooperate; if trust really plays a role. Furthermore, this article studies the creation of a digital platform that will help last mile providers to collaborate and to have more flexible capacity planning, faster service to the customers and reduce cost. To build the platform, the conditions should be known under which service providers would be willing to cooperate, which also requires an understanding of their current motivation and their trust level, especially in a digital environment.

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On the way to new forms of governance for environmental planning and protection? Administrative decentralisation in Portuguese coastal municipalities.

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Abstract

Appropriated forms of governance are crucial for transformative change. In governance studies, transferring competences from central to local government is called Administrative Decentralisation(AD). AD is highly recommended for increasing autonomy and it offers new ways for achieving equity. AD affects all spheres in human and non-human agency and its implementation requires consensus between central and local government.

As transformations to sustainable development entail profound structural changes and reforms of institutions, implementing AD could also address climate crisis and earth-system transformation by catalyzingclimate neutrality, equitable use of biodiversity and population development, through collaboration, co-creation of sustainability visions and transformation policies. Consequently, AD can contribute to the achievement of the SDG's through integration of transformation policies within local strategies (SDG13), protection of ecosystems and biodiversity in oceans and on land (SDG14 and SDG15), increased access to drinking water (SDG6) and transition to sustainable urbanization following demographic trends (SDG11).

This study aims to analyze to what extent the process of AD influences key issues in earth-system transformation from local government and expert's perspective.

Portugal was selected as a case study since it is a centralized State; it began its decentralisation process in 1976, being enacted in 2018/2019 and partially postponed to 2022. Portugal has two layers of subnational government on its mainland (municipalities, parishes) elected by universal suffrage. Portuguese political and economic power is found on the mainland, specifically on municipalities geographically-located on the coastline, where most of its population is concentrated.

Municipalities were the unit of study selected; each one has a different capacity for implementing the competences transferred from central level; however, the competences are being transferred with no regards to municipality capacity and to the asymmetries within Portuguese mainland territory.

This analysis is the first qualitative approach and an introductory section into a wider innovative study relating AD and earth-system transformation. It is organized in two phases: *i*) interviews with experts in environmental management, governance, social geography, and in urban planning for proposing a list of competences and functions; *ii*) voluntary online-surveys to municipalities geographically-located on the coastline for understanding their perspective about AD and earth-system transformation.

This analysis allows to understand the different perspectives each municipality has about competences and functions to be transferred, and its own identification of the main earth-system transformation on their territory, which vary from each other: heatwaves, floods, livestock affluents, recycle of raw materials, access to drinking water, mismatch between biodiversity conservation and urban planning, pollution accumulation, among others. Overall, it is necessary to recognize AD as a factor in socio-ecological systems facing earth-system transformations, as it allows to anticipate which competences, related to environmental planning and protection, should and could be transferred to each municipality.

Since AD is a complex process, each municipality must be strengthened through combined approaches. Each municipality has closer links to people and detailed knowledge about their territory.
Therefore, scientific evidence and advice must support municipalities for rethinking new and objective transformative changes, co-creating sustainable plans and advancing innovative competences to be transferred towards transformative governance.

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Investigating Indian Parliamentary Questions and Answers on SDGs

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Abstract

Sustainable development, insurance for our future generations, to survive and thrive, has come to the center-stage for governments around the globe as exemplified by the adoption of the SDGs in 2016. The biggest challenge in achieving sustainability is inherently a political one, especially in transitioning and developing economies. In India, the world's largest democratic nation, the government has played a leading role in the country's multi-dimensional development in social, economic, and environmental aspects through various programs, missions, schemes, and legislation.

Building sustainable ecosystems, political commitments, and parliamentary actions shall determine the success rates of accomplishing such a humongous task of achieving these goals in their true spirit. However, due to SDGs' relatively recent inception, hardly any academic work has been undertaken to study the political (parliamentary in particular) discourse surrounding SDGs. In this context, the paper looks at the Sustainable Development Goals (SDGs) related questions raised by peoples' representatives in the Parliament and the responses received thereof.

This study provides a benchmark for political discourse analysis towards key-issues using parliamentary discussions. We find that the concerned parliamentary discussions in Q&A sessions have evolved from its nascent stage. However, we find significant skewness in participating gender, aspects of SDGs discussed, and discussions targeted only towards a few particular goals. Moreover, it identifies opportunities for parliamentarians to fill the gaps in political discussions towards SDGs. Thus, India has a long way to bring rapid and robust efforts to fulfill the SDG Goals by 2030.

Keywords: Sustainable Development Goals (SDGs), Discourse analysis, *Lok Sabha* (Lower House), *Rajya Sabha* (Upper House), Indian Parliament.

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Co-creation process for indicator-based sustainability assessment of river basin regions

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Abstract

Sustainability assessment tools are currently influencing sustainability strategies and activities across the world to improve evidence-based decision making in different sectors. Using indicator-based assessment methods as compared to other assessment approaches seek to achieve the integration of all sustainability issues by consolidating the goals of sustainability-related policies as a powerful decision-making tool as well as evaluate and manage the actual status of sustainability.

By providing open access data on social, environmental, economic, and institutional dimensions, Sustainability Indicators (SIs) aim to build the knowledge and capacity of regions to improve the level of actions towards sustainability. However, there is still a lack of research on assessing the sustainability level of river basin regions in Latin America. Also, current SIs used for the river basin region rarely develop based on the co-creation process by involving different groups of internal and external stakeholders including policy makers, citizens, and NGOs and so, the existing indicators have low effectiveness while assessing the practices and performance towards sustainability. In this sense, co-creation was explored to help in the collaborative development of new values related to sustainability together with stakeholders and experts, as a form of collaborative innovation.

This paper aims to develop a set of SIs for the river basin region by using a co-creation process Sustainable Development Goals (SDG) into practice and foster the path of their operationalization for the stakeholders and other experts in this field. A large river basin region of Brazil was used as a case study. The SDG conceptual framework offered the possibility of a more balanced and integrated approach to monitoring regional sustainability. In the same measure, additional research is needed to understand how to adapt the indicators to SDGs targets, considering the specific contexts of a river basin area. Then for each selected indicator, the relevancy was evaluated through applying the BellagioSTAMP approach including its principles.

The findings demonstrated that the implementation and effectiveness of this proposal at regional levels are limited and filled with challenges. Also, the social indicators were the most selected to the final list (from SDG 1, 2, 3, 4, 5, 7, 11, and 16). This demonstrates the predominant concerns of the 2030 Agenda, which is social justice as the greatest global challenge, and an essential requirement for the actualization of the sustainable development implementation. This paper provides an overview of the issues surrounding the SIs selecting-process, as well as the constraints on stakeholder engagement as some of the main challenges faced. A sustainability assessment structure should depend on integrated conclusions from, identifying gaps and priority policies for regional sustainability.

The transferability potential of the proposed co-created SIs is high and it will be also applicable to Basin committees, public environment organizations/ ministries/ agencies, and governments as well as not only at the regional level but also at the local or national levels to increase the effectiveness of sustainability initiatives through a participatory process, hence contributing to continuous progress towards SDG 17, particularly target 17.17.

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The COVID-19 Pandemic not only Puts Challenges but also Opens Opportunities for Sustainable Transformation

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Abstract

The COVID-19 pandemic has affected humankind worldwide, slowing down and even reversing the progress made in achieving Sustainable Development Goals (SDGs). It has negatively impacted most SDGs but with positive impacts on a few. We discuss some initial impacts observed and explores potential impacts on the achievement of SDGs for Nepal. The study followed a knowledge co-creation process with experts from various professional backgrounds, involving five steps: online survey, online workshop, assessment of expert's opinions, review and validation, and revision and synthesis. We conducted online surveys and workshops with experts from various professional backgrounds. Afterward, we assessed expert's opinions articulated in the surveys and workshops. The experts reviewed and validated our assessment. Then, we revised and synthesized the assessment. The pandemic has restricting impacts on the progress of most SDGs. However, it has also opened a window of opportunity for sustainable transformation.

Many of the negative impacts may subside in the medium and long terms. The negative impacts on SDGs resulted from factors linked to the pandemic or the measures taken to control it. The key five impending factors are lockdowns, underemployment and unemployment, closure of institutions and facilities, diluted focus and funds for non-COVID-19 issues, and anticipated reduced support from development partners.

The generated transformative opportunities are lessons learned for planning and actions, socio-economic recovery plan, use of information and communication technologies and impetus to the digital economy, reverse migration and 'brain gain,' and local governments' exercising authorities. For sustainable transformation, the window to grasp these opportunities is short-lived and will get narrow over time, i.e., before rebounds occur following the past trajectories. Key insights and learnings from the Nepal case study may also be applicable in other parts of the world, particularly in the developing world contexts.

More specifically, the pandemic's perception as a challenge and an opportunity to reset priorities, resources, capacities, and planning can be useful elsewhere in devising appropriate pathways for sustainable transformation.

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The contribution of Digital Transformation to the Accomplishment of SDG: Implementing a collaborative cloud computing based platform to promote efficient drinking water resources management.

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Abstract

Defining and implementing adequate sustainable development strategies for a certain territory in order to assure SDG achievement is a very difficult task to undertake.

It requires knowledge over several domains and the ability to define and evaluate different scenarios, combining economic growth with natural resources preservation. It involves integrating different equally valuable perspectives and interests, support each strategy and alternative definition and monitor its implementation to assure the effective accomplishment of desired goals.

Water is essential for human survival and crucial for economic growth. Being so, it is one of the most relevant issues within the SDG. Water allocation is always aligned with land use and other human activities. Integrating water management into a development strategy taken for a particular area, considering all the existing and programed initiatives is therefore essential.

It requires taking into consideration the expected developments in terms of water availability, distribution, and needs over time and space while aiming to(?) prevent water stress; it entails permanent knowledge update, the availability of vast amounts of data, an adequate legal framework, knowledge based responsible government involvement, and participation of many stakeholders.

To address this problem, an innovative artificial intelligence Matrix dashboard is proposed, created to support and develop water and land use planning and to help monitoring land or water plans and programs implementation, thus seeking an evaluation "*on the fly"* of the SDG accomplishment progress.

This "co-laboratory" integrates land search engines, decision schemes and decision trees, mailing lists, internet forums, as well as user profiles and ISO based data structures and profiles. It will be based on cloud computing, integrating tools able to access analyse and combine quality known data with raw data and performing data analysis based on location.

Using all different available communication channels, this "co-laboratory" matrix will allow to share responsible science based perspectives and promote open and responsible discussions.

Once exported to a cloud based environment, it will promote the development of new applications, aligning private and public sector aims, promoting economic development, creating opportunities for remote collaboration and opening new perspectives even for less developed countries.

The “co-laboratory” matrix is presented as a demonstration prototype created to support Castelo de Bode watershed reservoir, which it is integrated in Tagus River watershed and it is crucial for drinking water supply.

It combines water with land use management, registers changes in land use and water allocation, integrates water stress concerns within final decision making.

The platform allows users to combine the Matrix available datasets and develop applications align with water preservation. It can be explored within the gaming industry or used for education and training. Users inputs are always evaluated before integrated in the co-laboratory tools, or datasets.

This approach clearly demonstrates the advantages of digital transformation in order to extend the knowledge and involve users in SDG achievement, creating an open, responsible and cooperative environment.

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Towards the exploration of the Sustainable Development Goals (SDGs) interlinkages: A review of the clustering frameworks

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Abstract

The Sustainable Development Goals (SDGs) are characterized as the most widespread policy framework in the area of sustainable development. Each goal interlinks the different aspects of sustainable development including social, economic, environment, as well as institution, cultural, and technical, among others. The integrated nature of the SDGs is of crucial importance in ensuring that the purpose of the new agenda 2030 is realized. Several studies have shown that SDGs outcomes are interdependent and interlink. They have proposed different conceptual and methodological frameworks for categorizing the SDGs by considering the interlinkages between the goals and their relevant targets. These approaches mainly developed based on different target audiences and show how the SDGs are an intertwined framework instead of a group of siloed goals.

However, in terms of conceptual aspect, some SDGs targets might not be properly translated into policy actions due to the conceptual complexity. Also, in terms of operationalization, the data for assessing the interlinkages between the SDGs in a comprehensive manner are not always available. So, the policy makers and academia are still considering how to integrate SDGs implementation and how the SDGs interdependencies and interlinkages can be organized into some limited sets of policy actions. This paper aims to critically review the diverse mapping approaches towards the SDGs interlinkages and interdependencies as well as the related clustering frameworks and explore whether the interactions are synergistic or trade-offs. It can provide ideas of how to move from the generic form of SDGs to the critical policy action nodes to advance SDGs implementation.

To do so, a combined approach was adopted including (i) a critical review of the existing scientific literature as well as grey literature (e.g. sustainability reports and the international guidelines); and (ii) snowballing of relevant references considering the most cited and recent publications as well as the most innovative approaches and frameworks on the reports. Then a qualitative content analysis was applied based on a set of criteria such as the type of target audiences, context and characteristics of each framework, credibility, innovation, collaboration, and implementation.

The findings showed that the analytical clustering frameworks adopt a rather technical approach towards conceptualizing SDGs. The main focus of the clustering was more based on their systemic functions of the SDGs and the network of their targets since various SDGs targets address similar themes but within a different context. Also, the results demonstrated the cross-cutting role of SDG 17 and in some cases SDG 16, since they are partly transversal to the other clusters and considered as underlying goals for means of implementation and the governance-related issues.

By identifying the nodes of interaction between SDGs, the synergies and trade-offs can be made more apparent to policymakers and influence their option-taking and policy coherence. Selecting such focus areas will be also required for reasons of communication and can be framed to tackle the sustainable development challenges in the future.

Keywords: Sustainable Development Goals, Clustering framework, Interlinkages and interdependencies

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Sustainability-oriented labs: Towards implementing a transformative learning space at a Portuguese Higher Education Institution

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Abstract

Sustainability is inherently linked to questions of relationship: How do we relate to ourselves and to the world around us, and how can we enhance our transformative capacity to thrive within the planetary boundaries? In the current times of multiples crises, e.g. the climate crisis, the pandemic due to COVID19, as well a global crisis of trust, the aspects of intertwined inner and outer care are highly relevant: The personal care for ourselves (physical, emotional and mental care) will impact and reflect the care for our communities and environment and draws on the social-ecological system perspective (Fischer et al. 2015). With the aim to focus on the links between care and sustainability, an inter- and transdisciplinary learning space shall be created at a Portuguese higher education institution (HEI) as a space for transformative capacity building, combining in particular aspects of inner and outer sustainability (Pereira et al, 2018; Ives et al., 2020).

This initiative, envisioned as a “care-lab for people and planet”, seeks to integrate participatory action research, experiential learning and co-creation in order provide meaningful training opportunities and reflections on personal development as cornerstones for capacity building. The overall concept of a caring mindset shall serve as an umbrella to inspire the activities to unfold in such a space. This paper presents an integrative literature review on sustainability-oriented labs and transformative approaches relevant for the design of the care-lab, as well as the first methodological steps for implementing such a space. While the overall idea of the presented initiative strives for general awareness for the SDGs, this

research relates in particular to SDG 4, target 4.7, and SDG 12, target 12.8. The outcomes of this research can contribute to a better integration of the holistic perspective on sustainability at different levels: By strengthening personal inner resources and competences for collaboration, people's capacities for their own agency of change can be enhanced, eventually multiplied, and accelerate also institutional transformation of HEIs.

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Social Innovation and Local Sustainable Development: A Systematic Literature Review

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Abstract

People and communities have always tried to find answers to their own problems, individually and collectively. The recent focus on the concept of social innovation and its appropriation by entrepreneurs and government officials, seems to encompass a set of new civil society abilities to address both old social problems, such as unemployment or quality education, as well as the most recent challenges related to digitalization, climate change and environmental sustainability. In this perspective, social innovation, as a development proposal based on intersectoral partnerships and entrepreneurial initiatives with social and environmental impact, can be considered an instrument for sustainable development, namely in the fulfillment of the Sustainable Development Goals contained in the 2030 Agenda published by the Organization of the United Nations in 2015. In the European context, Portugal played a pioneering role in the development and implementation of the concept through a public program to promote social innovation, mobilizing European Union funds for this purpose. Evidence suggests that this initiative had a significant impact at the local government level, mainly in investment strategies, with outcomes in local sustainable development, resulting from a new and dynamic relationship between the public sector and civil society.

Thus, social innovation constitutes a collaborative and co-creation model for sustainability. Nonetheless, there is still little research on how social innovation addresses the 2030 agenda, namely on the fulfilment of Sustainable Development Goals at a local level. This article proposes a systematic literature review on this relationship, focusing on collaborative and co-creation practices for sustainability at local governance. Furthermore, an analysis grid is proposed to identify the motivating factors for entrepreneurial social innovation initiatives and the motivating factors for municipality investment decisions in those initiatives, with reference to the 17 Sustainable Development Goals.

Social innovation projects address one or a set of social problems, and by doing so, they address a particular goal and target, although they can be generically referenced to SDG 8.3 (promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro, small and medium-sized enterprises, including through access to financial services) and 10.2. (by 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status). It is aimed to bring new clues on how community-based social innovation can contribute to local sustainable development.

Keywords: social innovation, local sustainable development, local governance.

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Sustainable for Whom?: Critical Assessment of Competing Priorities of Individuals and Sustainable Transport Goals

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Abstract

With promotion of sustainable transport, United Nations places “access” to transport at the core of all development – social well-being, economic development and environment (Bamwesigye & Hlavackova, 2019). However, by treating it as a global concept, local individual needs are compromised, which is incongruent with the ontology of sustainable development.

Like cultural imperialism coerces dominant viewpoints over minority groups with contentious realities (Gibson & Selinger, 2005), neglectful – and misinformed – imposition of 2030 agenda of transport does not cater to diverse national contexts. Top-down approach of many governance structures is inefficient to address the complex social issue of sustainable transport. Rothman and Grant (1987), through concepts of felt versus unfelt needs, posit that perceptions of facilitator (or policymakers) about problems and priorities (therefore solutions) do not necessarily concur with those experienced or envisioned by the community. Implementing well-intended solutions for urban development (macro-level goal) based on future sustainability without considering and/or supporting individual-level priorities of vulnerable populations, do little to advance sustainable development goals.

Particularly in countries grappling with large populations and poverty, human displacement, and displacement of in/formal economies individuals depend on, are by-products of transport planning. Transport development activities may not only induce displacement but also reinforce “patterns of social-spatial segregation” (HLRN-India, 2017; Hernández García et al., 2018). In this scenario, none or inadequate compensations or rehabilitation processes with ephemeral benefits aggravates the living conditions of such displaced individuals (Van der Ploeg & Vanclay, 2017). Also, discrimination against informal livelihoods, such as street vendors, for promoting transport infrastructures perpetuates unjust power relations (Recio et al., 2019) catapulting them further into a “vicious circle of poverty” (Nurkse, 1954). Thus, it is imperative to be cognizant about needs of transport “users” and “non-users” to ensure a holistic and multidimensional planning of sustainable transport.

Effectiveness of sustainable innovation depends on public attitudes paired with behavioral intentions, which in turn impact uptake. Escobar-Salazar and Wendorf Muhamad (2018) found that community members often resist innovation(s) when they feel excluded from design and implementation phases. Therefore, it is critical to examine the relationship between micro (individual), meso (community), and macro (societal) level needs and sustainability efforts, particularly among the most vulnerable where tension between priorities may exist. Using findings from primary survey, we delineate experiences related to (quality of life, satisfaction) and perceptions about [sustainable] transport of an inclusive and robust group – service

providers, general public (users and non-users) and other stakeholders. The study geography includes two cities with indispensable public transportation, Barranquilla (Colombia) and New Delhi (India). Informed by these findings, we propose recommendations for innovative transport planning that perpetuates democratic processes – widening the scope to include socioecological factors – thereby creating agency and access.

The abstract is related to SDG/Target 11.2. We establish that neglecting the needs of “non-users” can be an erroneous judgement during orchestration of transport activities, and with the onset of pandemic, may aggravate their hardships. The study includes those who are impacted by transport infrastructures but may not be directly using them. By undertaking holistic assessment of needs of both “non-users” and “users” of transport, it suggests ways to realize true sustainable transport system.

Full papers

THE WORLD IN THE POST-PANDEMIC

The need for governance for sustainability

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Abstract

Sustainable development permeates the intellectual production and the political agenda of the contemporary world, combining a balance point between economic growth, social equality and environmental protection, and should guide public and private conduct in order to create a network of partnerships in favour of quality of the environment. Hence, the importance of creating new solutions through governance with expanded participation. In this context, the Millennium Development Goal 8, of 21 Agenda, and Sustainable Development Goal 17, of 2030 Agenda, both from the United Nations, are extremely relevant in order to implement a sustainability support network, taking into account that it is necessary to reframe the SDGs to face the challenges of a complex, plural and post-pandemic Risk Society, that is, it is essential to rethink how to face the global challenges for the achievement of Human Rights with the pandemic of COVID-19, which led to a public, economic and social health crisis, which imposes the necessity of a joint effort, with the adoption of multidisciplinary measures provided by governance to create a more resilient, sustainable and inclusive future, with respect for the human rights of the future generations. Thus, it is necessary to resize the principle of intergenerational solidarity, in order to restructure the SDGs of 2030 Agenda for a post-pandemic world. In this line of reasoning, this article aims to address (through a critical analysis by dialectic-deductive method, with bibliographic reference), sustainable development from the point of view of its mandatory implementation. Then, it analyses MDG 8 and SDG 17 to demonstrate the need for partnerships for sustainability through cooperation mechanisms carried out by governance among all stakeholders, according to actors and subjects of International Law, as well as indicating examples of such systematic applied in Brazil, such as: a) partnerships of companies for health: from the distribution of basic food baskets to the concession of alcohol to enable thousands of sanitizers; b) around technology and health: with the creation of applications to guarantee the safety and health of people when returning from bars and restaurants; the "Day After Project" which promotes conversations related to mental and emotional health as well as

the relationship with alcohol during the pandemic; or, still, projects related to urban waste (such as the "Voluntary Delivery Point", which is concerned with the global goal of collecting more plastic, processing the waste with the acquisition and use of recycled resin, or, "Give the Hand to the Future", focused on personal hygiene and cleaning); c) training: of the national industry to reduce environmental impacts and maximize social values, focusing on the product life cycle, among other projects. Finally, this article indicates that cooperation is essential in the world pandemic scenario, for the creation of strong, effective and resilient institutions (according to SDG 16) with the objective of facing the current health crisis, with a view to enabling sustainability in a post-pandemic crisis context for future generations.

Keywords: Governance, Sustainability, 2030 Agenda, Sustainable Development Goals, Future Generations.

1. Introduction

In the face of the current scenario pandemic scenario promoted by the coronavirus, it is faced one of the greatest challenges in terms of granting Human Rights, in view of the numerous restrictions imposed by national governments in favour of health and collective well-being, but which have opened up space, also, for an economic, social and environmental crisis.

It is, for this reason, that in order to solve this complex crisis generated by COVID-19, it is necessary that States and non-states actors (such as: national States, subnational entities, transnational and multinational companies, international intergovernmental organizations, non-governmental organizations, media vehicles, mass communication, scientific and academic community, and individuals, among others) to cooperate internationally at the most different levels possible, in order to carry out a real (and necessary) reformulation of international governance for the creation of joint platforms outside the already established regional and well-known bases, for the adequate coping of this crisis, in order to respect the quality of life of future generations.

In this line of reasoning, this article aims, at first, to analyse the global challenges to be faced by Human Rights during and after the COVID-19 pandemic, which brought a crisis, not only of health, but also economic and social, in order to highlight the need to tackle this crisis no longer in an individual way considered by countries, but with the creation of new joint and coordinated structures, based on existing governance instruments, in order to create a more resilient future in a joint effort, sustainable and inclusive and that, above all, has respect for the rights of future generations to a healthy environment and to a quality of life essential to human dignity. Being certain that, to demonstrate this reality, the present article indicates examples applied in Brazil, such as: a) partnerships of companies for health: from the distribution of basic food baskets to the conception of alcohol to enable thousands of sanitizers;

b) around technology and health: creation of applications to guarantee the safety and health of people when returning from bars and restaurants; the Day After Project, which promotes conversations related to mental, emotional and alcohol-related health during the pandemic; or, still, projects related to urban waste (such as the Voluntary Delivery Point, which is concerned with the global goal of collecting more plastic, processing the waste with the acquisition and use of recycled resin, or, Give the Hand to the Future, focused on personal hygiene and cleaning); c) training: of the national industry to reduce environmental impacts and maximize social values, focusing on the life cycle of products, among other projects.

Thus, this paper finally demonstrates the need to reframe the Sustainable Development Goals (SDGs), formulated by the 2030 Agenda, of the United Nations (UN), to face the challenges of a complex, plural and Risk society in the post-pandemic, which respects the principle of intergenerational solidarity.

2. Methods

This paper is carried out through a dialectic-deductive methodology, made by means of a critical analysis of the current bibliographic reference on the subject, including international documents and news from the media.

3. Human Rights and Covid-19: Worldwide responses and challenges

The COVID-19 pandemic quickly became the biggest international crisis in generations (Guterres, 2020). This has been a public health emergency since its inception. Just look at the measures taken in an attempt to at least prevent and/or control the spread of the virus (in order to break the chain of infection), with support for social and collective well-being, in view of the need to prevent health services from becoming overwhelmed (without the possibility of effective and necessary assistance to all), such as border closings, imposition of control and travel restrictions, as well as measures to improve sanitary control involving the activation of surveillance mechanisms at points entry, training of health professionals (to define suspected and confirmed cases); management of prevention cases; training of laboratory teams; activation of rapid response and alert teams; distribution of educational materials, information and individual production equipment (PPE) (UN, 2020), stoppage of flights, suspension of public events (such as concerts, sports, theatres and cinemas), public meetings, closing of schools (Mosquera, 2020), among other factors.

In addition, the health sector was in short supply of tests, individual protective equipment for health workers and other resources, due to the long stay of patients in intensive care services (Grimm, 2020), as well as shortages of supplies, materials and logical support considered critical (such as bedding, food,

cleaning products, fans, among others, at points of service to the population), as well as problems in maintaining adequate levels of personnel in hospitals (Robertson, 2020).

For this very reason, an international emergency was declared on January 30, 2020 (World Health Organization, 2020), and the COVID-19 pandemic (an infectious disease that threatens many people simultaneously worldwide) on March 11, 2020 (BBC, 2020), both by the World Health Organization (WHO).

However, the current crisis is also much more than that, as it also encompasses an economic, social and human collapse, which quickly turns into a tension aimed at (granting or not) human rights, which calls into question the dignity of the human person and the realization of countless human and fundamental rights, but, in any case, universal (contained, even, in the Universal Declaration of Human Rights), considering that the measures taken to face the health crisis have an impact on jobs and livelihoods, in addition to the provision of other essential social services, including second-rate human rights, such as health, food, water, sanitation, education, leisure and security (elements that guarantee adequate standards of living).

It is enough to realize, for that, the disproportionate effects in certain communities, the increase of hate speech (mainly directed to those people who already suffered in some degree any kind of segregation, such as the homeless population, precarious housing or without distribution of drinking water) (MSF, 2020), the (sharper) segmentation in certain vulnerable groups and the risks that security responses have caused in territories, such as the imposition of different days in the week for men and women to leave home, which ended up leading to an increase in violence against the trans population (Unaids, 2020), with cases of abuse and violence, as is the case of: a) Panama, which decreed a rotation between the departures of men and women: women can go out to supermarkets, banks and pharmacies on Mondays, Wednesdays and Fridays, while men can go out on Tuesdays, Thursdays and Saturdays. The maximum period of stay on the street is two hours. On Sundays, the population cannot leave their homes (Mançano and Mello, 2020); b) Colombia, in which some cities had the imposition of "rotation" systems between people, based on the last digit of the national identification number (Uol Notícias, 2020); or, c) Ecuador, in which there are abandoned corpses scattered on the streets, houses and hospitals (Biernath, 2020), because, due to the restriction measures and the touches of shelter, the government presents difficulties in collect the bodies from the streets (IG Ultimo Segundo, 2020a), and, in addition, there is a lack of suitable coffins, forcing the country to use cardboard boxes to bury many of its dead (IG Ultimo Segundo, 2020b).

It is clear, therefore, that the health crisis has provided a pretext, in a world reality that is already quite needy, for the adoption of repressive measures. Many of them, not even directly related to the context of the pandemic.

However, the best answer will always be one in which threats are always dealt with protecting human rights, invoking responsibilities, promoting transparency and freedom of expression, in an internationally guaranteed rule of law, based on legal, proportionate, necessary and, mainly, measures, non-discriminatory. And that, in this way, aim at the legitimate and proportional purpose, based strictly on safety reasons and health-related emergencies, in addition to scientific evidence and strategic information, as well as, mandatorily, having to be "limited in time and space to the minimum. indispensable to the promotion and preservation of public health", as determined by article 3, paragraph 1, of Law 13.979/2020, of Brazil (Planalto, 2020).

This is also the determination of article 12 of the International Covenant on Civil and Political Rights:

> 1. Every person who is legally in the territory of a State shall have the right to move freely and choose his residence there.
> 2. Everyone has the right to leave any country freely, including his own.
> 3. The aforementioned rights shall not be permitted by law and in the interests of restrictions, unless provided for by law and in order to protect national security and public order, health or morals, as well as the rights and freedoms of other persons, and that are compatible with the other rights recognized in the present Covenant.
> 4. No one shall be arbitrarily deprived of the right to enter his own country. (Planalto, 1992)

Thus, such measures must have a specific duration (temporary) and that allow the least possible intrusion into other human and fundamental rights, in order to guarantee public health. In other words, the best responses are those that respond to the immediate threats caused by the pandemic, but that, proportionally, protect human rights and guarantees of the rule of law.

It is about strengthening health care networks through coordinated and joint initiatives to the pandemic (Ministério da Saúde, 2020). This is because COVID-19 made the vulnerability of existing global systems for protecting the environment, health and the economy very clear, indicating that it is necessary to create new joint solutions.

There are no individual solutions to a global crisis.

3.1. The post-pandemic world: The need for joint effort for a more resilient future

In this sense, the best solutions for the post-pandemic world are those that realize the need to define plans together, which are more sustainable.

After all, sustainability, in a critical and interdisciplinary perspective, is nothing more than the creation of a link of solidarity between humanity and the planet, with the creation of ethical values, equity and equal rights, in a search for justice (including in the environmental aspect), since the challenges brought about by globalization spread at different levels of multidimensional scale around the world, causing uncertainties, ambiguities and complexities, which, in turn, demand joint responses and interventions,

based on governance, but that reflect the need for profound changes in the socio-economic and environmental system that still exists in several areas, from production to consumption, such as, for example, energy, agriculture, transportation, housing, education and, of course, health.

It is, therefore, about the creation of a public governance policy carried out on a continuous basis that enables new long-term structural solutions, idealized in regional blocs (which, many times, escape the conventional standards already established), but, in any way, promote equality and social justice through integrated, articulated and coordinated policies among the most diverse sectors affected by the pandemic crisis.

It is the inclusion of a critical and innovative view on international cooperation (involving new power dynamics between State and non-State actors on the global stage) in times of health crisis, in a plural, complex, modern, globalized and at risk Society (as preaches Ulrich Beck) (Beck, 2011)[1], which endangers the advances already made in relation to development and poverty reduction achieved by the measures implemented as mechanisms for activating the Millennium Development Goals (MDGs), of the 21 Agenda, and, subsequently, by the Sustainable Development Goals (SDGs), of the 2030 Agenda.

Take, for example, the group of seven countries formed by Austria, Australia, Israel, Czech Republic, Denmark, Greece and New Zealand, all of them dependent on tourism to increase the Gross Domestic Product, which consolidated an alliance for the post-pandemic in order to reactivate national economies, with incentives to trade and tourism among the population of the countries mentioned (including with regard to the student exchange educational market, which, in the case of Australia and New Zealand, represents about 30% of the economy's revenue from foreigners) (Mendes, 2020). This initiative was put into practice even in the face of the various criticisms it received from parts of the European Union (EU), since four of the members of the new alliance are part of the EU, which has its own reopening agenda for the post-pandemic. Of course, in this model, the resumption will be gradual and in accordance with safety and hygiene standards, being "wearing masks, mass testing, maintaining social distance in bars and restaurants, as well as keeping borders closed to countries where the virus still circulates quickly is mandatory" (Mendes, 2020).

In addition to these examples, at the Brazilian level, it is possible to mention: a) partnerships of companies for health: from the distribution of basic food baskets to the conception of alcohol to enable thousands of sanitizers; b) around technology and health: creation of applications to ensure the safety and health of people when returning from bars and restaurants; the "Day After Project", which promotes conversations related to mental, emotional and alcohol-related health during the pandemic; or, still,

[1] An expression created by Ulrich Beck, arising from the post-industrial Era, which contrasts with the classic industrial society previously lived, and which gave rise to the development of various techniques and technologies that increased the living conditions and the needs of individuals, but which, however, brought significant changes in the way of living in the society and, mainly, of relating to the environment, which implied a deterioration of the environment to meet human needs. It is, therefore, an industrial production society that, in its evolution, gives rise to a society of industrial sequels reflecting itself, which produces inherent risks, which must be managed, under penalty of compromising the continuity of the global, plural, complex and complex society itself (Beck, 2011).

projects related to urban waste (such as the Voluntary Delivery Point, which is concerned with the global goal of collecting more plastic, processing the waste with the acquisition and use of recycled resin, or, Give the Hand to the Future, focused on personal hygiene and cleaning); c) training: of the national industry to reduce environmental impacts and maximize social values, focusing on the life cycle of products, among other projects.

In this way, the pandemic opened up space (legal, legislative and public opinion in general) to rethink the relationship between humanity and nature, providing the opportunity to reconstruct the planet, this time, in a sustainable way, with the access to the human rights as a focal point to the socio-environmental quality of present and future generations.

The process of reconstructing post-pandemic socio-environmental values must respect the rights of future generations to have a healthy quality of life, as the most elementary meaning of the word sustainability deals with the search for an economic and social development capable of addressing the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987).

It is clear, therefore, that for the effective implementation of measures to safeguard essential human rights for the population, the post-pandemic world will require a joint and intergenerational effort for a healthy, safer and more resilient future to global threats, and that above all, respect the rights of those who have not yet been born.

3.2 Principle of intergenerational solidarity

In this way, the adequate global recovery from the crisis caused by the COVID-19 involves respecting the rights of future generations, aiming at socio-environmental quality for those who have not yet been born, in a clear respect for the principle of intergenerational solidarity (prioritized by the Brazilian Federal Constitution of 1988), keeping in mind sustainable development in its three facets: economic, social and environmental.

The principle of intergenerational solidarity is contained in the article 225, of the Brazilian Federal Constitution, of 1988, which prescribes the duty to preserve the environment for both present and future generations.

It translates, therefore, a principle of ethics between generations, since currently existing resources must be used in order to guarantee a compatible quality standard for future generations. Thus, the principle of intergenerational solidarity aims to “compel present generations to include the interests of future generations as a measure of action and weighting” (Canotilho, 1993).

Such understanding is in line with Principle n. 1 of the Stockholm Declaration (of 1972), which recognizes that the right of future generations is closely linked to the responsibility of current ones with the balance of the environment (UN, 1972).

Thus, it presents transgenerational characteristics, since it extrapolates the subjective rights of the present generations to reach those who are yet to come. The duty of environmental protection creates, in this sense, a link of solidarity between present generations and future ones.

"It is a right that translates, for the first time, an intergenerational commitment, a pact of the current generation with the future, in the sense of respect and preservation of the environmental balance as a common good" (Padilha, 2010).

This is because, according to the Executive Director of the United Nations Environment Programme (UNEP), Inger Andersen: “not taking care of the planet means not taking care of ourselves” (UN Environmental Programme, 2020), but, mainly, it means giving up the human rights of future generations.

Because of this, it is essential to build cooperative relations between members of the community, including the public or private sector, through productive dialogue, in order to raise awareness about the rights and duties of each citizen, which, ultimately analysis, favours the conception of a positive transformation in society, what can (and should be done) resignifying the Sustainable Development Goals (SDGs), created by 2030 Agenda (UN, 2015), in this new post-pandemic world.

3.3 New sustainability: The resignification of the SDGs of 2030 Agenda for the post-pandemic with a focus on the rights of future generations

It is clear, therefore, that human rights can and should guide COVID-19's responses and recovery solutions, because the principle of human dignity needs to be at the front and center of any and all actions implemented in this regard.

Looking to the future, within this reality, it will be necessary to create new mechanisms for sustainable governance, based on the SDGs, of the 2030 Agenda, which already provide a viable support structure for more inclusive, resilient and environmentally appropriate societies. But, through a new meaning of them.

After all, “no one will be left behind” (UN, 2016), which is precisely the social ethical motto and the moral code of the 2030 Agenda, in a clear principle of universal coverage and solidarity of the fundamentals of each SDG, which, again, it is underlies the commitment to the quality of life of future generations.

In reality, it is both a magnifying glass in the implementation of human rights, placing the imperative focus on health for all, as prescribed in SDG 3: “Ensuring a healthy life and promoting well-being for all, at all ages” (UN, 2015), as well as an alert system, which essentially highlights those who suffer the most and have the least resources to face emergency situations such as the current pandemic.

> We have seen how the virus does not discriminate, but its impacts do — exposing deep weaknesses in the delivery of public services and structural

> inequalities that impede access to them. We must make sure they are properly addressed in the response. […] The virus threatens everyone. Human rights uplift everyone (Guterres, 2020).

Thus, it is concluded that, respecting the human rights of future generations, even in times of a pandemic crisis, it is possible to build more effective, inclusive and sustainable solutions (based on the guidelines already built by the Sustainable Development Goals) to remedy the health emergency today, but thinking about tomorrow's global recovery.

4. Conclusions

There are many shortcomings in a serious approach to the realization of human rights, whether on the part of national governments or communities. Several speeches, in rather somber tones, have led to non-significant human rights actions, but there are steps in the wrong direction and a marginalized attention to the topic by international debates.

Thus, although the horizon regarding Human Rights has been on the international and national agenda (of many countries) for more than a decade, the concern of most State and non-State actors (who could place intergovernmental and subnational measures, based on governance and paradiplomacy criteria and instruments) remains to be desired.

In this scenario, the COVID-19 pandemic and its devastating consequences represent an unprecedented emergency, imposing a panorama of insecurity, disease and death, which puts at risk the years of multilateral progress in terms of access to the right to development, global health and poverty reduction. However, at the same time, it requires the conception of creative, inclusive, resilient and more sustainable thinking on the part of the international community about human rights, in order to create fundamental changes to effect a radically more robust and coordinated approach, so that, jointly and with a focus on the effective realization of "The future we want" for all, can achieve the Sustainable Development Goals of the 2030 Agenda, bearing in mind, mainly, the rights of future generations to have a healthy and dignified life.

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Platform-based business model for sustainable last mile delivery

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Abstract

The parcel industry is facing serious challenges, exacerbated by the 2020 Covid-19 epidemic through increased e-commerce. The parcel industry is characterized by the fact that, in addition to the industry and the customer, it has an impact on ordinary people, traffic trends, pollution and urban management. In the interests of sustainability, it must take into account all the actors involved, in addition to its own cost-cutting interests. Despite its challenges, the industry has not been creating collaborative business models for decades.

Numerous solutions have been found to address the growing challenges of last mile logistics. Cooperation is one form of solution that the parties usually enter into with each other to gain some economic advantage. Numerous forms of collaboration are known in the logistics literature, yet providers rarely choose it to solve problems. To understand the solutions this paper presents known alternatives to support last mile delivery and examines the factors required for collaboration. This paper envisions a vision for a possible future virtual collaboration through the example of Urban City Centres (UCC). The virtual collaboration model is platform-based, in which the research examines the behavioural patterns of the parties involved in the collaboration to learn its characteristics. At this stage of the research, this paper, in addition to some findings, addresses network-related issues.

Keywords: last mile delivery, network theory, sustainability, platform based operation

1. Introduction

According to the World Commission on Environment and Development chronology report, the organization first met in October 1984. Its task was to unite countries to pursue sustainable development together. The meaning of sustainability is to meet our own needs without compromising the ability of future generations to meet their own needs. In addition to natural resources, the population also needs social and economic resources. Sustainability is not just environmentalism; it is also social and economic responsibility. In the nearly 40 years since 1984, sustainability and environmental protection have become almost intertwined concepts. Environmental problems are placing an increasing burden on organizations around the world as they make increasing efforts to meet expectations.

The sharing economy has been a research topic for decades, which has come to the fore in the context of the 2020 COVID-19 epidemic. The growth of e-commerce over the years has intensified even more

in 2020. With the growth of e-commerce, parcel delivery related to freight transport have also increased. Increased parcel delivery imposes additional freight traffic on the roads, generates even more traffic and at the same time further pollutes the environment. The logistics industry in the field of parcel delivery is characterized by alternative solutions rather than collaborations. Collaboration is a well-known concept in the supply chain, but for some reason it only happens in negligible cases in parcel delivery. The increased volume of packages and the changed expectations of customers are forcing the parties involved in parcel delivery to cooperate. In the spirit of the sharing economy, horizontal collaboration is gaining new meaning. Platform-based collaboration is effective among the public, therefore the platform could enable logistics providers to perform transportation tasks more efficiently. In the interests of sustainability, they must not only take into account cost reductions, but also participate in the implementation of environmental regulations. For parcel transport providers, reducing environmental challenges means reducing the number of vehicles, the mileage, achieve better capacity utilization, etc. In recent decades, several alternatives have been tried, in some cases even collaboration. The situation during the 2020 epidemic has highlighted that business models to date need to be rethought and ones that focus on optimization first and foremost.

To answer and analyse the above statements, the structure of this paper is as follows: The first chapter provides a comprehensive literature review of alternative solutions to last mile delivery problems, such as parcel lockers, alternative fuel vehicles, or involving ordinary people in delivery. The second chapter of the paper presents the factors known so far for possible collaboration, discusses the option of a platform-based service analogous to the Uber-type service, presents the benefits of UCCs, and finally provides further questions to the background and application of a network research theory to study virtual network-based service development

2. Literature review

In recent decades, the scientific world has also been increasingly concerned about the negative effects of human activity on our planet. As Seroka-Stolka (2014) emphasizes, world organizations, the press and civil organizations alike are putting pressure on companies to reduce their activities that have a negative impact on the environment. Kazancoglu et al. (2021) argue that dramatic population growth, higher levels of technological development, and increased purchasing power have resulted in significant production growth, which has been accompanied by a significant increase in consumption, leading to further environmental pollution. As a result of human activity, emissions of harmful substances and air pollution of toxic gases have increased. The transportation sector is one of the largest producers of pollutant emissions in terms of carbon monoxide (CO), sulfur dioxide (SO2), nitrogen oxides (NOx) and volatile organic compounds (VOC). According to the expectations adopted by the European Commission in 2011, emissions should be reduced to 80-95% by 2050 (European Commission 2011a,

2011b). In the transport sector, a reduction of at least 60% must be achieved in order to meet expectations (Halldórsson & Wehner, 2020).

E-commerce is on an upward trend and the Covid-19 situation in 2020 predicts even more intense growth for the coming years. According to Hagen and Scheel-Kopeinig (2021) the sector has increased from 15 % in 2010 to 35 % in 2020, and the consumers' expectations have become more demanding along with. Excess transport demand and changed customer expectations pose increasingly serious challenges for logistics providers as well as city residents. The increasing level of urbanization worldwide leads to higher levels of transport activity related to cargo distribution and service provision (Paddeu et al., 2016). This phenomenon generates social, environmental, and economic impacts, mainly related to traffic congestion and noise, pollutants, and greenhouse gas emissions, as well as a greater risk of traffic accidents (Oliveira et al., 2017). In addition to these challenges, Olsson et al. (2019) argue that last mile delivery consumes the largest share of the logistics cost and moreover, as Halldórsson and Wehner (2020) state it is the most energy consuming operations; therefore, suppliers and stakeholders are encouraged to minimize their transport cost while attempting to reduce the social, environmental, and economic impact of their operations.

The scientific literature has been dealing with the scope of the last mile delivery problem in terms of sustainability, environmentally, socially, economically for years to find the optimal solution to the growing problems. The first group of the proposed solutions focus on the use of innovative technologies and sustainable vehicles (Allen et al., 2017, Bandeira et al., 2019, Chiang et al., 2019, Dai & Chen, 2011, McLeod et al., Moroz & Polkowski, 2016, 2020, Pardo-Bosch et al., 2021, Oliveira et al., 2017) the second group offer optimization and optimized planning solutions to address the problems (Allen et al., 2017, Dahl & Derigs, 2011, Limoubpratum et al., 2015, Park et al., 2016). The third group of solutions deals with logistics structures including urban city models to transform supply chain operations (Hagen & Scheel-Kopeinig, 2021, Melkonyan et al., 2020, Montwill et al., 2021, Park et al., 2016, Pourrahmani & Jaller., 2021, Serrano-Hernandez et al., 2018) and the fourth type of articles focus on regulation where the studies refer to identifying the existing and missing regulations of the last mile logistics (Park et al., 2016).

The polluting stage of last mile delivery is the delivery itself, when trucks deliver the ordered goods from the depot to distribution points or directly to the end consumer. Tiwapat and Jomthong (2018) summarizes that there are four delivery options according to the customer's needs: 1) at collection point, 2) parcel locker, 3) post office, 4) home delivery. Of the four delivery methods, delivery to the post office and collection point is less common compared to parcel lockers and home delivery. Home delivery is the most convenient and most frequently used mode of transport. In the case of home delivery, the last mile service provider takes over the package to be delivered at the distribution centre and deliver it to the exact delivery address provided by the customer. The service provider (courier) searches for a parking space near the given address, then visits the customer's address and delivers the

package. The courier then goes back to the vehicle and heads to the next shipping address. The process is problematic from the point of view of urban logistics for the following steps: 1) approach to downtown street; 2) finding a parking space and 3) finding a customer at home. The biggest problem with home delivery is if the recipient cannot be found on site at the specified time. In this case, the delivery must be repeated the next day. Repetition further increases the already high costs of the service provider and inherently pollutes the environment, causing further traffic congestion. There are several last mile service providers in a given country or region, often operating in the same area with their own resources and very often serving the same customer. They all struggle with the same problems and are all responsible for environmental damage. To avoid the problems indicated above, service providers have invented several alternatives, one of which is the parcel locker machine.

Parcel lockers are vending machines that are placed at stations, in busy public places, and the customers have the opportunity to withdraw the parcel from the parcel locker in a wider time zone. The parcel locker is an optional delivery method, which according to Moroz and Polkowski (2016) is an environmentally friendly delivery option for Generation Y. The authors note that Generation Y is also willing to pay a surcharge for environmentally friendly modes of delivery. Although the parcel locker is popular with the younger generation, older people still prefer home delivery. As research suggests that home delivery will increase with the growth of e-commerce, an environmentally friendly home delivery method needs to be developed.

From the point of view of reducing pollution, the use of electric vehicles could be an obvious solution and alternative to traditional home delivery. Nevertheless, as Bandeira et al. (2019) explain, the literature on the analysis of the use of electric vehicles have been mainly developed in Europe (77%). There are no studies for underdeveloped countries and the number of cases for developing countries is also small. The use of electric vehicles is a really beneficial solution in terms of pollution. Though, as Hanula (2013) described it is important to examine the extent of emissions needed to produce electricity as well. However, although there is an increase of sales in electric vehicles, the adoption of electric vehicles is still extremely low compared to the traditional vehicles (Pardo-Bosch et al., 2021). In addition, the operation of electric vehicles requires the construction of charging stations throughout the city, which cities currently have only in part. Although the use of electric cars reduces emissions, it keeps traffic and congestion at the same level. The electric-powered bicycle and tricycle were made by analogy with electric vehicles. The use of these vehicles is widespread as they not only minimize emissions but also reduce the number of traffic jams and accidents. There are countless examples in the world of the use of electron bikes and tricycles. One example is that in the Hungarian courier, express and parcel (CEP) market, two market players have collaborated to optimally cover downtown deliveries. One player is the market-leading courier service (GLS) and the other is the market-leading bicycle courier service (Hajtás Pajtás). The motivation for the cooperation was on the one hand the

environmental commitment of the courier service (GLS), on the other hand economic interests, cost-based considerations in order to cover the increased downtown parcel demand.

The advent of Uber and Airbnb and the success of their digital resource sharing has also piqued the interest of scientists researching the development of the logistics industry (Qin et al., 2020). In the United States, England, and the Netherlands, more and more services have emerged that offer resource sharing based on an IT platform typically developed by start-up companies. Accommodation, personal transport service, boat rental, food or cooking location sharing services are based on an unprecedented trust among the population. The question is whether the new service model developed in the C2C market can be transformed into the B2B and B2C world. Examples of deliveries involving ordinary people have intensified in recent years. The opportunity came from Uber and Airbnb's platform-based service, which industry, including logistics, sought to embrace. According to Pourrahmani and Jaller (2021), this type of delivery is crowdsourcing/crowdshipping, whose original purpose was to benefit society by reducing the number of delivery vehicles and to help service providers reduce their costs while maintaining the quality of service. In fact, service providers can indeed reduce costs by involving ordinary people, but ordinary people use their own vehicle for delivery, with which they themselves become the sources of pollution and traffic. In addition, some crowdshipping services operate in similar ways to other couriers or transport services, where the crowdshippers exclusively conduct transport delivery activities, and not as part of their regular travel needs.

One way of making last mile deliveries more efficient, innovative and sustainable is establishment of UCC and central micro depots (CMD). Allen et al. (2017) describe that UCCs are logistics facilities that are situated in relatively close proximity to the geographic area they serve. CMDs are a type of UCC that are located within the urban areas which the goods are consolidated before the final delivery to the customer (Hagen & Scheel-Kopeinig, 2021). One such initiative is the UCC in Bristol, presented by Paddeu et al. (2018). Bristol is the largest coastal city in the South West of England, making it the most congested city by 2016 due to daily car and truck traffic. The city administration has been determined to transform Bristol into a sustainable city and build a city consolidation centre. The city has introduced various regulations that have resulted in non-food last mile deliveries being delivered through UCC, where collaboration is based on the use of shared resources and deliveries. As a result of the initiative, emissions have been significantly reduced while maintaining customer satisfaction. According to the authors more than 200 similar experiments have been conducted in Europe, but only 15 UCCs are operational 5 years after their establishment.

Over the past few decades, countless models have been developed by the scientific community to reduce traffic and emissions as well as to optimize the last mile costs of services. Models have been substantiated by the introduction of alternative vehicles, through the optimization of deliveries to the establishment of service centres. In the vast majority of cases, scientists have supported the environmental and cost impacts of each method with calculations. However, there have been few studies

written on developing collaborations, which might be a solution of last mile problem solving. Collaboration is a known form in the supply chain management literature, but last mile delivery lacks this solution. There are some examples, especially in Western Europe, that demonstrate successful collaborations, however, Oliviera et al. (2017) state that only few examples survive the pilot phase.

Solutions in the scientific literature that support sustainability and efficiency are alternatives that can help providers solve problems by adapting alternatives. Examining the options and recommendations, the obvious solution would be collaboration between service providers. However, collaborations do not take place for a number of reasons. The present study takes stock of the factors needed for collaboration and examines the possibility of creating a form of collaboration that is both effective for providers and sustainable for all actors and the environment.

3. Results and Discussion

Environmental directives, and with them rules dictated by city governments, are placing an increasing burden on last mile providers. At the same time, e-commerce is following an increasing trend and, as a result of the still popular home delivery, service providers are being forced to use alternative solutions. Cooperation in other areas of logistics can provide an optimal solution if its rules are laid out optimally for the parties. According to the literature, there are two types of cooperation in the logistics industry: 1) vertical and 2) horizontal. In a vertical relationship, the parties are subordinate to each other in a relationship of subordination, while in a horizontal relationship, the parties are on the same level with each other. Because last mile providers often ship parcels to the same area, possibly to the same customer, they increase transportation traffic, pollute the environment, and hinder traffic. The obvious solution is to work together between these providers by sharing their resources to reduce environmental damage.

The conditions for the development of cooperation are the following: 1) economic interest; 2) coercive factor and 3) trust. An economic interest develops between the parties when they work together to the benefit of both parties. A typical example of this is the collaboration between the Hungarian GLS and the Hungarian bicycle courier service in order to serve the downtown areas of the capital. GLS opted for collaboration instead of building a missing competency, during which it was also able to meet the company's environmental standards. Environmental regulations by city management can cause closed roads, further reduced and expensive parking lots, and other restrictions on package delivery. However, some city administrations, entering as a third party, offer an option that benefits both city residents and package delivery providers. In this case, delivery takes place through UCCs set up by the city administration, using common resources. City leadership uses coercive force, but in addition to regulation, it also offers service providers the opportunity to achieve a win-win situation. The

emergence of UCCs is a new type of business model in which a previously known horizontal relationship is complemented by an outside third party. Service providers choose any form of cooperation, the trust factor must be present in order for the cooperation to be successful.

The advent of Uber has launched a new kind of collaboration among ordinary people. A service provider who offered the IT platform entered into the mediation of the cooperation, and through the platform the customer requesting the delivery and the service provider arranging the delivery contacted each other. Although the employment background of the Uber-type service is still being settled, the network based on the model can also offer an interesting alternative for logistics last mile delivery. Uber's IT platform offers an opportunity for demand and solution, but is not intended to regulate the services provided. In addition to mediation, the platform to be used in the last mile service must also play a coordinating role. In the case of Uber, the goal is to connect passenger transport players, but environmental regulations are not important. In the case of last mile delivery, the environmental regulations as well as the regulations applied by the city management must be taken into account when organizing the deliveries. In order to achieve this, the role of the operator of the platform to be used changes, from an intermediary to an organizing role.

It was found that any cooperation required an economic interest or coercive force, supplemented by trust. For a platform-based business model, what is the economic advantage that makes joining the platform attractive to service providers. The platform-based resource allocation model, which is widespread among the population, could only work in parcel delivery if it provides additional benefits to the service provider in addition to the platform-based service. Moving along this line of argument, further complementing the collaboration model developed in UCCs and platform-based could together create an opportunity that is appropriately attractive to individual providers. The platform provider must therefore also provide additional services in order for the parcel delivery company to have an interest in joining. The strengthening of environmental regulations and city protection rules will create a situation where there will be no other way for service providers than cooperation.

Effective cities will build UCCs and offer a new service model to service providers that benefits both parties equally. Providers will have no choice but to join UCC if they want a service. They will work together to achieve the goals. During the development of the cooperation, both the vertical and the horizontal relationship system will be present, at the same time the third party enters the picture, thus creating a hitherto unknown organizational model.

This section of the research contains a plethora of questions that need to be answered in order for the new model to be developed. In addition to examining the factors required for collaboration, it is worthwhile to find out what kind of model is created by connecting service providers to the platform making a virtual collaboration. The previous knowledge of network theory is applied to the research. To apply network research theory, it is necessary to identify the actors involved in the network. Who

do we consider a member of the network? In what respect do we need to examine each element of the network? Is it important to consider customers as part of a network? In connection with the collaborations, the literature has descriptions and samples. The virtual collaboration model outlined in this paper does not necessarily carry the features of already known models. Is it worth starting to study the virtual network model by comparing existing and known models? How much does the motivation to connect to the network change in the virtual world? How much does trust change in cyberspace? It is important to prove whether the established connection system bears the characteristics of scale-independent networks. The most important feature of scale independence is the lack of a central element, as each node decides for itself what it is connected to and what it does (Barabási, A. L., 2003). However, this contradicts what has been said before that the platform is controlled by a third party and its connection to the platform creates a package delivery network for service providers. In this case, however, scale independence needs to be re-evaluated, as the essence of the model is precisely to have a central managing party that can control a more efficient and environmentally friendly solution of resources. An examination of network-based collaboration will bring to the fore the interests of joining the network, the importance and necessity of constraints, and determine whether the UCC-type model will be the delivery organization of the future last mile. The platform only provides IT support for data management, not the structure of the model is decided based on the platform.

4. Conclusions

Parcel delivery logistics faces serious challenges these days. Environmental requirements, the regulations of city management in order to make cities more liveable, place an additional burden on service providers, for whom the last stage of parcel delivery is the most problematic and at the same time the costliest. In the current situation, parcel delivery service providers are almost forced to work together to achieve more efficient operation. However, collaborations occur in very few cases. Based on the above the main objective of this article has been to assess what factors lead to the development of cooperation.

The first part of the document provided a comprehensive literature review of alternative solutions available in the scientific and professional literature. Alternative solutions to support parcel delivery offer tools such as parcel lockers, alternative fuel-powered vehicles, or more recently, the involvement of ordinary people in the delivery of the service. The solutions help a service provider to some extent, but as the demand for home delivery increases, the alternatives outlined do not meet their expectations. Environmental regulations and possible steps by city leaders point to directions that can provide a solution for cooperation.

However, the development of cooperation takes place in very few cases. The primary goal of the platform-based virtual business model is to optimally reduce the growing burden on last mile providers by increasing efficiency. At the same time, the model also aims to make the reduction of pollution,

traffic and congestion measurable and visible. Understanding the network formed on the basis of the cooperation of the service providers is essential for the development of the new platform-based business model, therefore it is necessary to know the characteristics of the service provider network. Questions have arisen at this stage of the research that need to be answered, both in terms of collaboration and the characteristics of the model. The study concludes that, to the best of our knowledge, UCCs are proving to be resource efficient, effectively collaborate, and comply with environmental standards. However, a UCC is a central-element network that cannot bear the characteristics of a scale-independent network, so it must continue on the path that can provide a more efficient and affordable model for last mile providers than even a UCC.

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9. Governance, Power and Institutions and Weakness of SDGs

9c. Public participation and the role of stakeholders

Abstracts

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Towards sustainable regions: Stakeholders' engagement in environmental assessment

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Abstract

Global challenges, such as climate change, biodiversity loss and social inequity, urges the need for a paradigm shift. This shift is necessarily linked with the understanding of the challenges, decision-making processes, and governance issues, in urban systems. Scholars have pointed out that some instruments and techniques applied in this domain, such as Environmental Assessment (EA), have the potential to deliver a shift towards sustainability. EA is an environmental policy integration tool that promotes and integrates sustainability into decision-making processes. It analyses the decision-making effects on the environment and the communities. It is a systematic, strategic, and participated approach. Previous work showed that EA advances sustainability in context-specific territories through governance and community empowerment. Even though the dominant EA scholarship focuses on rationality and process effectiveness to achieve sustainability, the empirical reality is that EA processes have a strong political, institutional, and cultural dimension that is affected by different stakeholders. This research aims at understanding how the stakeholders affect EA towards sustainability through the analysis of the public participation component of the EA process. The empirical studies explored a form of impact assessment commonly known as Strategic Environmental Assessment (SEA) which deals with the ex-ante appraisal of policies, plans and programmes (PPP). It was used a case-study research design using the Portuguese Regional Operational Programmes (2014-2020). In particular, the SEA processes were scrutinised through qualitative content analysis to the SEA report. The analytical framework entailed the type of public participation using Arnstein's ladder of citizen participation, the number of participations, typology of actors, and the type of contribution (process or substantive). Preliminary results show that public participation is still developed through tokenism instead of stakeholder empowerment, there is overall low participation and is mainly done by entities with environmental responsibilities. It is necessary to improve mechanisms to strengthen cooperation between stakeholders, and empowerment of practitioners and local stakeholders. Overall, this research contributes to the enhancement of knowledge of environmental policies, planning and sustainability within SEA processes. This research is closely aligned with the Agenda 2030, and may help achieve SDG 11.a (Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning), SDG 16.6 (Develop effective, accountable and transparent institutions at all levels) and SGD 16.7 (Ensure responsive, inclusive, participatory and representative decision-making at all levels). Also, proposes a contribution to understanding the state and perspectives of the integration of environmental, social and economic issues in decision-making and their interrelations with stakeholders.

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Promotion and partnership for SDGs - Catholic Church engagement project example

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Abstract

In the time of crisis, the role of close participation and cooperation of different stakeholders and its deep understanding what SDGs really mean and how important for society transformation they are, is even more important than it time of prosperity.

There are several groups of stakeholders, that even if officially support the concept of sustainable development, their representatives at local level have very different (or even lack of understanding) perspective and attitude.

One of such, which is very influential in many countries, including Poland, is Catholic Church. Their representatives (priests, bishops, etc) have a huge impact on local communities and even state policy. Their very conservative and distrustful attitude towards Agenda 2030 significantly reduces the interest in this topic in the conservative societies.

At the Cardinal Stefan Wyszynski University in Warsaw I invited and coordinated the group of 55 researchers from seven different research discipline and coordinated project, which result was the book "Sustainable Development Goals and the Catholic Church

Catholic Social Teaching and the UN's Agenda 2030" published by
Routledge (link: https://www.taylorfrancis.com/books/sustainable-development-goals-catholic-church-katarzyna-cichos-jaros%C5%82aw-sobkowiak-rados%C5%82aw-zenderowski-ryszard-sadowski-beata-zbarachewicz-stanis%C5%82aw-dzieko%C5%84ski/e/10.4324/9781003053620).

The aim of this monograph was to identify both the common points and differences between the *2030 Agenda*, with its contemporary sociopolitical concepts, and Catholic social teaching in terms of achieving SDGs, and to indicate the complementarity of cognitive perspectives and paradigms in the content of the 17 SDGs. Individual SDGs were discussed in the 17 chapters of the monograph in order consistent with the *2030 Agenda*.

In each from 17 teams was the representative from catholic church (researcher specialised in Catholic doctrine or philosophy) and from two or three fields related to certain SDG. Its' aim was to find the bridge between the Agenda 2030 and Catholic Social Teaching and answer the question if cooperation in certain areas is possible. Eventually each group found the space for cooperation and dialog.

The paper will present the methodology, main assumption, research questions and the process of our work, including obstacles and difficulties, and final results that were delivered in the book. The project and its results might be helpful to other leaders and organisations working on SDGs implementation and

give some examples how to work with other societies, religious, philosophical or cultural groups, which are stakeholders that still have a huge impact on decision making process and societies (and in general its role increase in the of crisis). It will also help to deal with SDGs 16b and 17.17

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End-of-life Vehicle (ELV): Links and Impacts on SDGs

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Abstract

The increasing number of abandoned end-of-life vehicles (ELV) causes persistent challenges in countries that have not strictly regulated the ELV. These vehicles become total losses or written off, and create tones of waste, which require proper disposal regulation to avoid hazards to public health and the environmental. ELV abandoned by the streets is also a perfect place for vandalism and sometimes linked to crime. Taking stock of these issues, this article aims at examining the link and impacts of ELV on sustainable development goals (SDG). Doctrinal analysis are made on relevant documents and articles on ELV and SDG. This article found that ELV is connected to SDG 1, 2 and 3 as its waste is a source of wealth for the poor that are needed to sustain their health and livelihood. A proper vocational training on ELV handling is a technical knowledge beneficial to the community (SDG 4) and will be able to close gender gap (SDG 5) when woman is capable to learn and handle technical matters of ELV. On the chemical sides, ELV waste produces leachate that seeps into and harm underground water (SDG 6). A proper regulated ELV industry will require more technicians and increase innovation while reducing inequality. Cleaner city from ELV will also create safe city, while promotes sustainable production and consumption patterns that reduce, reuse or recycle waste. With all benefits towards achieving SDGs that can be achieve through a regulated ELV industry, strong partnership is needed between government, the industry and the community to support the proposal for regulating ELV.

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Corporate allies or guardians of public interests? Examining the counter-hegemonic role of civil society in the Albanian oil industry

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Abstract

Several critical management scholars have emphasised that a heterogenous civil society with the ability to represent and guard public interests is of vital importance as a counter-hegemonic force to corporate definitions of sustainability (Whelan, 2013; Rhodes, Iain and Pullen, 2020; Barthold and Bloom, 2020). This is line with the theoretical framework of political discourse theory (Laclau and Mouffe, 1985/2014) and the political concept of pluralistic agonism (Mouffe, 2013) where hegemony is conceptualized as a never-ending struggle to define what society is and should be. However, critical management scholars have also emphasised that civil society actors are at risk of being cooptated through corporate-civil society collaborations and thus included in hegemonic formulations of sustainability dominated by corporate agendas (Burchell and Cook, 2013; Fooks et al., 2013; Dawkins, 2015). Accordingly, this study examines the role of local civil society actors when sustainability agendas are formulated by foreign investors in the Albanian oil industry. The question is whether Albanian civil society actors take on a counter-hegemonic role in such contexts, where corporate agendas and sustainability regimes tend to dominate, or if they rather become aligned with corporate interests through corporate – civil society collaborations. The study is based on empirical material from an autoethnographic exploration of the Albanian oil industry and include interviews, autobiographic accounts, social media and news agency material. This context shows that formal civil society organisations who collaborated with the dominant oil company in the region tended to align their programs with corporate agendas and lost their trust among local communities. At the same time self-organised local protests played an important counter-hegemonic role to raise community concerns and protests corporate activities. These results show that the debate regarding the role of civil society as a counter-hegemonic force to corporate domination and exploitation needs to consider both formal and informal civic action. The results confirm previous studies of civil society action in Central and Eastern Europe (CEE), which emphasise self-organised civic action as a core feature of the CEE context (Jacobsson & Korolczuk, 2019; Císar, 2013). In addition, the results also point to the need for further explorations of how such civic action function to mobilise counter-hegemonic definitions of sustainability that take local needs into account.

This abstract is related to SDG 9, target 9.2, to promote inclusive and sustainable industrialisation. Extractive industries have often been developed in non-inclusive and unsustainable ways and the role of civil society as a counter force to such developments is key to reach this target. In addition, the abstract relates to the overall conference theme of “accelerating progress towards SDG’s in times of crisis” by emphasising the key role of local stakeholders in industrialisation processes, especially since extractive industry contexts often entail localized crises for communities directly impacted by industry development.

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Sustaining society with less markets and State

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Abstract

A vision for sustaining society with less markets and State is an outcome of the 2018 statement by BlackRock, the biggest investor in the world, wanting, “A new model for corporate governance” and that “companies must benefit all their stakeholders”. The idea of firms delivering value to all stakeholders was reinforced in 2019 by 180 other CEOs of the US Business Roundtable. Corporations who delivered benefits for all stakeholders become what Ostrom describes as Common Pool Resource (CPR). Ostrom described how competing interest for shared life sustaining resources become self-regulating by adopting a polycentric form of governance. Polycentric governance is illustrated by the bottom-up stakeholder-governed firms in the US, UK & Europe and also in sporting and civic organisations including two designed by the author. These examples are used, with the insights of system science, to reformat the Ostrom design principles for incorporated organisations. Self-funding tax incentives and other rewards are suggested to encourage corporations to introduce self-governance to best suit their specific operations while maintaining shareholder primacy. This new way to govern corporations reshapes and spreads their ownership and so democracy by providing citizens with benefits and voice from the bottom-up. These can provide contributions to a universal wellbeing income while enriching the quality of democracy. In addition, the size, cost and involvement of government can be reduced while enhancing the protection and promotion of a sustainable world.

The tax incentive would provide investors with a bigger profit, sooner with less risk in return for them transferring their equity to a stakeholder class of shares over say the life of a patent. Fiduciary investors with a duty to maximise profits would obtain a duty to approve changes in corporate constitutions to endow stakeholders to become shareholders. This allows welfare to be privatised from democratising corporate ownership and control that also enriches democracy. Shareholders fading out with a profit would require all profits to be distributed as dividends and obtain rights to re-invest in “offspring” corporations used to expand the businesses. This process would also keep corporations to human scale. Such “endowment” corporations avoid shareholders being excessively overpaid with “surplus profits” in a way that accounting doctrines cannot report.

Democratising the wealth of nations in this way funds the universal wellbeing income to directly contribute to SDGs 1, 2, 3, 4 and 10. Converting corporations into CPRs promotes global common goods like reducing pollution of land, sea and atmosphere to directly contribute to SDGs 6, 13, 14 and 15. Stakeholder voice and governance promotes SDGs 5, 8, 12, 16 and 17. Indirect contributions are made to the four remaining SDGs 5, 7, 9 and 11.

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How delebrative spaces strengthens peoples participation in governance and contributes to SDG

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Abstract

Rural India is characterized by diverse and multiple developmental challenges. The situation has especially exacerbated for the rural community with the onset of COVID-19. Besides livelihood loss , food insecurity , reverse migration and increasing pressure on natural resources ; there exists an institutional vacuum and resultant governance deficiency at the grassroot level that needs to be addressed effectively. This governance deficiency is the absence of deliberative spaces , lack of cooperation between actors and formal/informal institutions located horizontally and vertically that are operating in silos at multiple scales and levels. This gap of democratic/deliberative engagement impacts the socio-economic and environment progress in the rural hinterlands and prevents the ability of local communities to leverage benefits of favorable policy measures. Over the years , FES has played a significant role in highlighting the value of nesting local action within the larger scales of landscapes in the context of natural resource management through cooperation with local institutions , government departments , CSOs to improve governance challenges . It involved capacity building , crafting structural spaces to enable effective community participation including women and marginalised and placed rural citizens as active agents of sustainable development through Multi Actor Platforms(MAPs). MAP aids in collective action by bringing together diverse stakeholder groups who represent the 'whole system' while ensuring equity and social justice. Such informal deliberative spaces have proved efficient in mobilising the community to adapt to external shocks induced by the pandemic.In this case study , we present 6 stories from Rajasthan and Odisha, to understand how communities across different spatial locations leveraged MAPs to secure livelihood ,ensure the sustainability of natural resources and contributed to SDG in response to COVID. Due to FESs earlier intervention to promote collaborative interaction between various stakeholders , the community members and leaders were able to effectively respond to the looming livelihood crisis by enrolling the incoming migrant workers in MGNREGA job scheme , providing Community Forest Rights titles under FRA , undertaking work on common lands for NRM asset creation by mobilising women. Efforts were made by the local community to harness technology to bridge the information asymmetry , access social security schemes by the vulnerable groups and migrant families, circulation of public health information , undertake campaigns to fight food and water insecurity and raise awareness and take measures in response to resource depletion. We unpack the theory of change using MAP as an institutional approach that helped in mobilising the community by taking up local stewardship initiatives to reach the intended outcomes.

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Involving Africa's Youth into Africa Union Agenda 2063 and Sustainable Development Goals

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Abstract

Introduction: Outside the international development sector and the government sector, few youths are aware that world leaders have come to a historic, far-reaching agreement to improve the lives of people and the planet by 2030 as well as aspiring for a better continent by 2063. If both Agenda 2063 and SDGs are adequately disseminated to African young people in their languages and without the international development jargonistic terms, surely African young people can be partners in communicating the development agenda to their communities at the local level, as well as across countries and regions.

Method: The research study encompasses related previously published peer-reviewed and blog articles. The literature search was conducted on Google Scholar, SDGs sites, Researchgate, and semantic scholar for articles published from 2017 to 2020, and the search result showed 12 articles respectively. Search keywords are Africa, Africa Union, SDGs, and Agenda 2063.

Discussion/Conclusion: The research should be a reminder to African governments, the private sector, international development agencies, and youth development stakeholders that Africa is abundantly blessed with a youthful population that can leapfrog Africa’s development. Extensive work is needed now to make African youth the engine that drives Africa’s development. More actions, as opposed to policy pronouncements, is needed. The current political commitment from all actors regarding youth development needs to be supported by funding and improved follow up actions and reporting. Youth

development stakeholders should be reminded that youth contributions to SDGs and Agenda 2063 present an opportunity for Africa.

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The National Green Tribunal Model to Ensure Access to Justice and Public Participation

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Abstract

Environmental courts and tribunals (ECTs) have been established by many countries because of the development of international and national environmental laws and principles, the threat of climate change, and public dissatisfaction with the existing general judicial forums. Among the functioning ECTs, India's National Green Tribunal established in 2011 is highly celebrated because of its comprehensive nature and innovative features. This paper explores NGT's innovative features to see how far those have ensured two very important SDGs, access to justice (SDG+Target: 16.3) and public participation (SDG+Target: 16.7 & 16.10). This paper though acknowledges and examines the challenges faced and controversies created by the NGT argues that NGT model can be used as an example by other countries who are struggling to ensure environmental justice.

In examining NGT's initiatives to ensure access to justice the adoption of various measures will be analyzed. Such measures include Circuit procedure of courts going to people rather than asking people to come to the courts; Expansive interpretation of the term 'aggrieved person' adopted by the NGT allowing any person (citizen and foreigner) directly or indirectly affected or even interested to ventilate grievance in an application or appeal. However, the exercise of *suo moto* power e.g., taking cognizance of environmental matters based on newspaper reports by the NGT will be critically examined because it has created controversies. The latest NGT initiative to ensure access to justice by introducing e-filling will be evaluated to see how far it is helping to accelerate progress towards SDG's during the Covid-19 pandemic.

This paper explores NGT's innovative features i.e. stakeholder consultative adjudicatory process, investigative procedure, and collaborative approach to see how far NGT has been able to ensure public participation. In the stakeholder consultative procedure, both internal and external experts along with the stakeholders are consulted to reach to a solution in cases of wider ramification involving major issues such as river cleaning or air pollution or environmental issues which have a public impact. In the investigative procedure, the experts visit the vicinity and collect information to reach a solution.

This paper argues that in addition to the initiatives adopted in ensuring access to justice and public participation the NGT has certain features which have elevated its credibility as a model for other countries. Such features include the unique composition of having permanent expert members along with judicial members, widespread jurisdiction, independence, the power to order relief and compensation to victims of pollution and other environmental damage, pragmatic problem-solving approach by going beyond the 'courtroom door' and application of international legal principles. However, the paper critically examines the major challenges regarding the NGT with an aim to improve the NGT model for ensuring environmental justice. The challenges include criticisms that the NGT is overstepping its jurisdiction by adopting judicial review power, indulging itself in policy formulation,

trespassing into the domain of other organs, misusing the polluter pays principle, non-implementation of orders and judgments and establishment of monitoring committees.

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Systemic Transformation and Further Improvement of Environmental Public Participation since the Implementation of China's Civil Code

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Abstract

The long-standing China's civil code of China was officially promulgated in 2020, which is a milestone in legal system history and has the epoch-making significance. In the field of environmental protection, the civil code established the green principle as the basic principle for the first time. Moreover, compared with the previous scattered civil laws, the civil code has made a series of improvements in many fields, such as environmental torts.

The traditional mode of environmental protection is led by the government, but the government management is limited by the public financial investment, and there are some deficiencies in information sources, regulatory effectiveness, regulatory initiative and so on. Therefore, in addition to the way of government management, we should pay attention to absorb other social groups and play the role of other governance forces. So the public participation system in environmental protection is particularly important.

For the public participation in environmental protection, the civil code establishes the public interest litigation system, and stipulates that relevant organizations can file public interest litigation. This is conducive to the promotion of public participation in environmental and ecological protection, and in line with the trend of diversification of governance subjects in the field of environmental and ecological protection. "Relevant Organizations regulated by law" is a powerful supplement to the environmental protection led by the government, and also a concrete embodiment of the principle of public participation in the civil code.

This paper will discuss the systemic transformation and further improvement of Environmental public participation in China, especially the changes since the implementation of China's civil code. Mainly from four aspects:

First, why public participation? I will discuss its role from the view of Chinese regional government and the GDP. Second, I plan to talk about the status quo of public participation in China from the relevant laws and regulations, environmental NGOs and public interest litigation. Third, to discuss the changes of environmental public participation before and after China's Civil Code. Fourth, I prefer to talk about further improvement of environmental public participation in China.

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Stakeholder perspectives of the Social Licence to Operate: exploring the governance of shale gas development in England

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Ms Charlotte Mummery

Abstract

Energy security, the economic crisis, dwindling North Sea gas supplies are some of the drivers for the development of on-shore gas exploration in England. Shale Gas Development (SGD) has become a divisive issue in recent times; some claim it will bring revenue, jobs and claim it will help us to reach CO_2 reduction targets by acting as a bridging fuel as we transition to renewable energy. Others are concerned about the potential harm to the environment and to human health. Government ministers and industry claim the UK has a 'Gold standard' regulatory regime, however these regulations were not designed for this technology and appear fragmented. Some claim the regulations are inadequate, flawed and difficult to enforce. The aim of this research is to investigate the Governance of SDG in England to determine how stakeholders perceive the regulatory regime, regulators and how they understand the associated risks and benefits. In addition to regulatory concerns, the industry does not appear to have gained a Social Licence to Operate (SLO); an implicit contract between the operator and other stakeholders which may reduce socio-political conflict and challenges to the activities of the SGD company. This research examines which are the important factors regarding the issuance of SLO from a community perspective; this includes perceptions of regulators and governmental organisations.

Using comparative case study methods, this research investigates the SLO and governance in two key SGD areas of England, Yorkshire and Lancashire. Methods include semi-structured interviews with stakeholders such as regulators, operators, Members of Parliament and residents near potential development sites. Participants draw on a multitude of factors when forming perceptions of the risks

and benefits associated with SGD, pro-SGD participants frame their perceptions based on quantitative risk assessment methodologies, whereas anti-SGD participants use their personal experience of the industry, including experiences with conventional gas development. Resident participants consider governance and regulation, in addition to the operator, when considering granting a SLO. Lack of credibility, legitimacy and trust in the regulators is a key factor, not traditionally considered within the SLO framework. For SLO to be a useful tool for industry, and indeed academia, it should be considered from the community perspective, this includes investigating governance in addition to the company seeking to gain a SLO. An additional barrier is that industry and government actors characterise the resident stakeholders as incapable of understanding the discourse, this research found this perception to erroneous; resident stakeholders are perfectly capable of understanding the discourse, furthermore networks are created to pool skills and knowledge.

9. Governance, Power and Institutions and Weakness of SDGs

9d. Legal aspects of sustainable development

Abstracts

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Renewable Energy and International Law: Can a Global Regulatory Framework be Established?

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Dr. Imad Antoine Ibrahim

Abstract

Much has been said about the importance of renewable energy in fighting climate change and ensuring the existence of a clean environment. This has sparked the interests of multiple stakeholders including nations, international organizations, civil society organizations, as well as a wide range of actors looking into the possibility, that an entire energy shift may occur the coming years or decades. Moreover, in recent years, scholars and practitioners have started exploring the way the international community can support the development of this sector, as well as fostering cooperation among the different nations. International lawyers have begun assessing the possibility of establishing a global regulatory framework that tackles the problems with renewable energy. Lawyers and scholars attempted to use already existing international regulations addressing either conventional energy or other issues to figure out whether a similar model can be established. While many aspects have been widely discussed and agreements and disagreements have been noticed, one main topic always constituted the principal subject of arguments: whether the establishment of a global regulatory framework, applicable to renewables is needed in the first place. Answering this question is of utmost importance. Therefore, the authors will proceed to examine the different stages of energy utilization, which are relevant to ensure a smooth energy shift from fossil fuels to renewables. The objective is to examine three main different stages through two various lenses. These three stages are energy production, transfer and trade (including aspects of consumption). It is important to examine whether the framework at each of these three stages is capable to ensure a global shift towards renewables. The assessment will go beyond simply making an analysis of the current reality. Rather the objective is to compare the current situation to what it ought to be at each of the three stages. The first of the two lenses is the “Fairytale” describing an ideal scenario, through which renewables would be used globally and the importance of global rules. The second is the “Reality” that describes the current state of things, the obstacles and challenges that need to be dealt with to ensure that a global energy shift toward renewables occurs, and the role of a global regulatory framework to ensure such transition. The authors will conclude with arguing towards

the importance of such a wider regulatory system on a worldwide scale. This paper relates to Sustainable Development Goal 7: Affordable and Clean Energy and its targets 7.1 (by 2030, ensure universal access to affordable, reliable and modern energy services) and 7.2 (by 2030, increase substantially the share of renewable energy in the global energy mix). The proposed contribution suits perfectly the topic of the conference given its focus on accelerating progress toward SDG 7 related to affordable and clean energy.

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The legal implication of carbon dioxide removal for the 2060 carbon neutrality goal in China

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Abstract

In September 2020, President Xi Jinping announced at the UN General Assembly that China will aim to achieve carbon neutrality by 2060. The IPCC has already concluded that it is impossible to reach the goal of net zero emissions without negative emission technologies. In the discussion on various methods to achieve the 2060 goal, Chinese scholars and practitioners have been focusing on the transition to renewable energy and the decrease of carbon emissions and energy consumption from fossil fuels, while the development and application of carbon dioxide removal (CDR) technologies to remove CO_2 from the atmosphere has not yet received sufficient attention in China.

CDR, or carbon geoengineering, refers to a series of technologies that artificially increase carbon sink on land or in water, or remove existing CO_2 from the atmosphere by physical or chemical engineering methods. Main CDR methods are BECCS, biochar, enhanced weathering, direct air capture, ocean fertilisation and large-scale afforestation and reforestation.

This article aims to explore the legal and policy status of CDR in China and its potential role in contributing to achieving the 2060 carbon neutrality goal. First, this article will examine how Chinese laws and rule-based policies regulate CDR. One of the main legal issues is the balancing between the encouragement of developing CDR for achieving the 2060 goal and the control of negative environmental impacts arising from the application of CDR technologies. Another legal issue is the mechanisms on technological innovation and transfer of CDR technologies.

Second, this article examines six CDR methods one by one regarding their legal status in China and the main legal constraints. The examination of applicable laws include four parts: climate conventions and treaties to which China is a contracting party, Chinese constitution, Chinese laws and regulations on climate change, Chinese environmental and energy laws and regulations which have relevant provisions on regulating environmental impacts of CDR technologies.

Third, this article will analyse the possible development of CDR in future for achieving the 2060 goal, including the legal principles (prevention principle, precautionary principle, etc.), legal institutions and mechanisms (EIA, ecological compensation, etc.), and the likely relationship between different methods for achieving carbon neutrality goal confirmed by law.

This article concludes that CDR will not play the leading role but still indispensable in achieving the 2060 goal in China. Laws and regulations need to adapt to the requirement for regulating disruptive technologies for climate mitigation.

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Can MEAs contribute to the SDGs? On the need for legal indicators to measure MEAs' effectiveness

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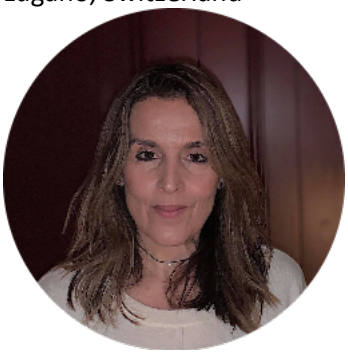

Professor Emmanuella Doussis

Abstract

In recent decades, international treaties concerning directly or indirectly the environment have proliferated extensively. These instruments have set new standards and innovations in their topic fields, which range from environmentally-targeted domains (e.g. forestry, wildlife, freshwater and oceans protection instruments) to areas that are at first glance peripheral to the environment but still have important environmental impacts (e.g. trade and investment agreements).

Despite the growing number of such agreements, and multilateral environmental agreements (MEAs) especially, we still know very little of their actual contribution to sustainable development. The existing literature provides little information on the effectiveness of these instruments and scholars even disagree on what effectiveness actually means so that how to measure effectiveness becomes a rather obscure exercise. This state of things leads to having this wide array of instruments not integrated in the state of the environment and/or sustainable development scorecards published regularly by states and international organizations, which report almost exclusively on scientific, economic and social data. Even when MEAs are taken into consideration in formal state-of-the-environment reports, they are not the subject of in-depth evaluations. Therefore, the weight of international environmental law and its usefulness seems to be underestimated.

This paper examines why it is important to integrate effectiveness issues of MEAs in assessing furtherance of sustainable development, in general, and implementation of SDGs, in particular, and how this could practically be achieved. It explores the methodological challenges inherent to designing a set of legal indicators (i.e. quantitative measures of the performance of legal systems) that could be

meaningful for multiple agreements and discusses the pros and cons of tailoring the choice of suitable legal indicators for clusters of agreements, either on a natural resources basis (e.g. the agreements on the protection of watercourses) and/or on a treaty-basis (e.g. the Paris Agreement). It goes into considering the feasibility of formulating and testing various types of legal indicators (i.e. structural, process and outcome indicators) based on the envisageable difficulties into collecting data from events-based, socioeconomic and administrative sources, and/or opinion surveys. It argues that, by defining such a common methodological framework, which could serve as a "bridge" between various (clusters of) agreements, legal indicators may serve as operational tools to further contribute towards implementation of SDGs via measuring, and simply communicating information on, progress or regression of international environmental law.

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Re-evaluate water governance: A cross model between law and management

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Abstract

Freshwater is source of life for human beings and, in the meantime, is characterized by scarcity, vulnerability and - sometimes - a non-equitable distribution. Water is also an important resource, useful for different human activities, interests and purposes. Firstly, water is used in different production processes as fundamental production input in the primary sector (i.e. agriculture, fishing) but also in manufacturing (for instance, textile and paper production) and the third sector (tourism activities and hospitality sector). Furthermore, thanks to hydropower installations water is an important primary source of renewable energy too. In doing so, it contributes to decarbonize the energy sector by reducing greenhouse gases emissions (in particular, carbon dioxide) during the energy production phase. Due to climate change, however, freshwater is becoming scarcer, and a suitable water governance can play a fundamental role for managing its different uses, which may be in competition among each other.

Starting from these premises, this contribution aims to reflect on the three environmental governance pillars - participatory rights for nature: access to information, access to participation, access to justice, through critical legal analysis and the ecological ethics of empathy (ability to enter in communion with the others' emotions), compassion (ability to feel together), and care (ability to take restoring actions). The objectives of the research are to i) redesign the legal response to the ecological challenges concerning water, with a focus on our obligations towards water (rights of water), ii) explore on the role of the different freshwater uses as key components of an improved water resources management.

In the long term, the study is expected to contribute to the scientific progress towards the achievement of the Agenda 2030 Sustainable Development Goals (SDGs), in times of environmental and health crisis, by reflecting upon water governance model that bridges legal and management issues. More specifically, the study scope is linked to SDG 6: *Ensure availability and sustainable management of water and sanitation for all*", targets 6.1, 6.4 and 6.5.

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Entrenching the intergenerational equity through climate litigation

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Abstract

Intergenerational equity sits at the intersection between sustainable development and environmental law. It is at once constructed on recognizing the needs and concerns of existing generations while also valuing and protecting the needs and concerns of future generations. In this way, it is arguably an encapsulation of sustainable development at the theoretical level. While the concept of intergenerational equity has become an accepted element of international law, at least in the soft law and aspirational context, it has gathered increasing momentum in the context of climate litigation and climate justice campaigns.

This paper discusses the growing momentum in climate litigation at the national and international level as a method of combining legal parameters of sustainable development law, environmental law and intergenerational equity in order to craft successful arguments regarding natural resources and environmental protection. Building on the findings of, among others, the Supreme Constitutional Court of Colombia in the *Atrato River* case, the Supreme Court of the Netherlands in *Urgenda*, and the Inter-American Court of Human Rights in the Advisory Opinion on the *Environment and Human Rights*, regarding the vitality of intergenerational equity, the paper examines the new spate of cases filed from 2019 onward in jurisdictions across the globe. Some of these cases have already yielded decisions with critical implications for establishing intergenerational equity as binding element of national law, such as the *Friends of the Irish Environment* case. Meanwhile, many others are pending before courts yet contain arguments pertaining to intergenerational equity and its entrenchment in law.

The paper relates to the following SDGs: 13 (Targets 13.1, 13.2, 13.3), 14 (Targets 14.1, 14.2) 15 (Targets 15.1, 15.2, 15.3, 15.4, 15.5, 15.9) and 16 (Targets 16.3, 16.6, 16.7). It connects to the conference theme by presenting the emerging use of climate litigation and climate justice as tools for sustainable development implementation and entrenchment of intergenerational equity as a legal tenet. At a time when the international community is focused on addressing the global pandemic crisis, the paper emphasizes the ways in which intergenerational equity can bridge sustainable development and environmental law to ensure that future generations are not left behind, thus connecting to the SDGs as well.

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Equality among the Community for Participation in the Efforts to Prevent Bribery in Indonesia

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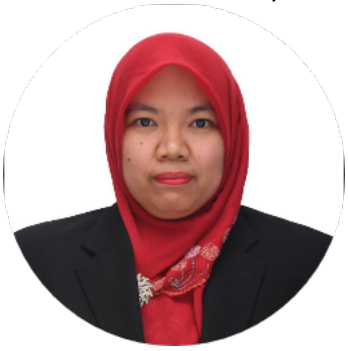

Mrs Tinuk Dwi Cahyani

Abstract

This study aims to examine the fundamental issues regarding the importance of public participation in efforts to prevent corruption in Indonesia which has its own character in the form of bribery. This study uses a normative legal research approach that is: a conceptual approach, statute approach, case approach. The research results can be concluded, namely: first, on the report in the form of information, suggestions, and opinions as public participation, the community has the right and responsibility in obtaining services and answers from law enforcers. Second, in carrying out participation in the prevention and eradication of corruption, the public has rights and responsibilities whose implementation adheres to the principles or provisions stipulated in the prevailing laws and regulations and by obeying religious norms and other social norms. Third, in order to guarantee protection for whistleblowers for their participation in the eradication of corruption, confidentiality is also stipulated for the reporter. In order to be an effective control, people must be smart, know and understand their rights and obligations as citizens, who have a nature of the concern for the future of their nation and country. This research is expected to be able to contribute to anti-corruption activists as required by Sustainable Development Goal 2030.

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Innovative environmental governance of rivers: comparison of the legal personhood governance structures of three rivers in New Zealand, India and Bangladesh, and the underlying motivation.

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prof tineke lambooy

Abstract

Purpose: Recently, three important rivers in Asia and Oceania were acknowledged as legal persons. In 2019, the Bangladesh Supreme Court declared that the Turag River be regarded as a legal person. The High Court in the Northern Indian state of Uttarakhand ordered in 2017 that the Ganges and its main tributary, the Yamuna, be accorded the status of living human entities (which has been disputed by the Uttarakhand government before the Supreme Court of India). In 2017, the New Zealand government granted legal personhood to the Whanganui River. This paper explores the motivation behind these innovative ways of environmental governance. Next, the paper analyses and compares the new governance systems as outlined in the legal documents that created these Rights of Nature in the three jurisdictions.

Methodology: Employing doctrinal research, thereby examining original legal documents, academic papers and grey literature concerning these Rivers. The authors also have contacted scholars from the three jurisdictions to contribute to this project.

Results: The analyses reveal different reasons for proposing these innovative legal structures. They include: providing people access to clean rivers for drinking water, sanitation, transportation and agricultural purposes; preventing that the river disappears; addressing the issue of pollution and toxicity of river water; acknowledging the divine status of the river; and honouring indigenous rights to the area of the river. Also, different ways of governance have been chosen by the New Zealand legislator and the two High Courts of Uttarakhand and Bangladesh for establishing legal personhood of the three Rivers and their representation. Each of them is discussed in the paper in a comparative analysis.

Conclusion: The findings need to be evaluated in the larger context of the UN Harmony with Nature programme (http://www.harmonywithnatureun.org/), which contains an overview of cases in which

Rights to Nature were granted as well as initiatives to that end. It is important and necessary to carefully and systematically examine each of these cases and initiatives in order to reveal and understand the different ways in which Rights of Nature are being established and how each of such ways functions.

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Conservation litigation could remedy biodiversity loss

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Abstract

(We hope to please be considered for both track 9d and 3a.)

Anthropogenic biodiversity loss, driven by actions such as illegal wildlife trade, deforestation, pollution, emissions and mining, is responsible for cascading ecological, social, and economic harm. These impacts place growing demands on legal systems to tighten regulations, improve safeguards and standards, and hold relevant parties responsible. Importantly, these impacts increase the need for additional legal pathways to remedy harms to biodiversity.

Laws in many countries allow lawsuits to hold parties liable for harming the environment, typically through civil and administrative law—including in Brazil, Indonesia, the United States, France and other European Union members, the Democratic Republic of Congo, Mexico, India, China and the Philippines. Landmark cases, such as the Exxon Valdez and Deepwater Horizon oil spills, held responsible parties liable for undertaking clean-up, restoration costs and compensatory payments to victims. Similar lawsuits could help address widespread harm to biodiversity, including threatened species. We propose that such conservation litigation could provide new remedies, creating avenues for justice, and financial support for conservation. However, the body of precedent cases, expert guidance, and necessary experience to expand lawsuits to address a broader range of harms is nascent.

We explain conservation litigation from a multidisciplinary perspective, in terms of three key dimensions: 1) defining the harm that occurred, 2) identifying appropriate remedies to that harm, and 3) understanding what remedies the law and courts will allow via lawsuits. The aim is to create an accessible understanding of what lawsuits seeking remedies for harm to threatened species could look like. We do this by drawing on legal principles and comparative international law, while focusing on the specific example of civil lawsuits in Indonesia. We draw on a hypothetical case involving the illegal trade of one Bornean Orangutan, and explain how litigation in a civil lawsuit is possible.

We lever this example to create a generic framework for developing lawsuits that seek to provide remedies for threatened species. We argue that these types of cases merit greater cross-disciplinary cooperation and attention, as an important response to contemporary biodiversity loss.

Relationship to Conference topic: The abstract links to accelerating progress towards SDGs in a time of crisis by proposing legal approaches that can help with environmental restoration and justice, and providing guidance on implementation. The framework we outline is applicable across jurisdictions. It is designed to simplify the complex interdisciplinary topics of creating damage claims into something achievable, to promote greater legal action.

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A Global Environment Trust to Combat the Ecological Crisis

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Abstract

I present a case for the global environment trust which imposes fiduciary duties on States in managing the global commons. My argument is two-fold. First, to ascertain the existence and content of the principle of trust as a general principle within the meaning of Article 38(1)(c) of the *ICJ Statute*. Second, to apply the said principle to the global environment. I thus introduce the 'general principle of trust' and 'global environment trust' as innovative approaches for the sustainability law. I mainly employ doctrinal and comparative methodologies, while also canvassing a potential impact of the said principles on accelerating the progress towards the Sustainable Development Goals ('SDGs'). Specifically, these principles can inspire the creation of global and domestic institutions to protect the environment and inform international and national policies on the matter.

My findings illustrate that the general principle of trust is ascertainable from national legal systems representing diverse legal families and regions of the world. These include the civil law, common law, customary law, mixed legal systems and Muslim law legal families as present in the regions of Africa, Asia, Europe, Latin America and the Caribbean, Northern America and Oceania. Additionally, I show that the principle of trust is transposed to the international level through its embodiment in various forms such as Global Environment Facility, International Seabed Authority, United Nations' Trusteeship system, etc. The common principle shared by the diverse legal system provides that trust arises where one person (trustee) holds, possesses or controls property or rights (trust assets) and administers them for the benefit of another (trust beneficiary), or with a view to achieving a specific purpose.

Consequently, the general principle of trust binds States as an unwritten source of law and applies to various fields including the global environment. In the latter case, the said principle gives rise to the global environment trust which: (i) imposes fiduciary obligations on States as trustees to act in the sole interest of humankind as trust beneficiaries, (ii) renders States accountable for their administration of the global environment as trust asset, and (iii) gives the trust beneficiaries a legal interest in the trust assets, substantial and procedural rights, as well remedies for the breach of trust. This illustrates the value of the global environment trust in the potential long-term legal protection of the global commons for present and future generations.

This Abstract specifically relates to (i) SDG 12 + Targets 12.5, 12.6, 12.8, (ii) SDG 13 + Targets 13.1, 13.2, 13.3; (iii) SDG 14 + Targets 14.1, 14.2, 14.C; and (iv) SDG 15 + Targets 15.3, 15.4, 15.5. Although my paper primary focuses on the environmental protection, it potentially impacts the interconnected economic and social dimensions of sustainable development. This abstract is also directly relevant to the topic of the Conference because my paper proposes a legal pathway to clarify and heighten the responsibility of States with respect to the global environment.

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The legal identity of social enterprises in the Netherlands: what determines the choice of the legal form

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Abstract

Purpose: This study aims to examine the way social enterprises are organized in the Netherlands in terms of legal form, while using the Dutch legal system that does not provide supportive legal forms to social enterprises. Furthermore, legal developments concerning new legal forms for social enterprises in the Netherlands are provided and explained. In that context, the study identifies the factors that drive social entrepreneurs in the Netherlands to choose for a specific legal from.

Theoretical framework(s): Economic, organizational and sociological theories are considered to indicate in which way legal aspects of entrepreneurial organizing interact with economic and organizational aspects.

Method: This study employs desk research and an empirical mixed method research design which comprises the use of qualitative and survey methods for the collection and analysis of data. The examined sample includes social enterprises which operate in different sectors, with different sizes, legal characteristics, social objectives and organizational activities.

Findings: The findings demonstrate the variety of legal forms, structures, and ways of organizing that Dutch social enterprises currently undertake. The prevalent preferences of social entrepreneurs in the Netherlands for certain legal forms as well as the dominant way of legal structuring and organizing of Dutch social enterprises is provided. The factors that determine the social entrepreneurs' choice of legal form are identified.

Conclusion: This study contributes to the discussion concerning the development of regulatory environments and formal institutions that facilitate and/or inhibit the activities of social enterprises.

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MONITORING INSTITUTIONAL CAPACITY ON THE ELVs DEREGISTRATION POLICY FOR SUSTAINABLE ENVIRONMENTAL EFFECTIVENESS

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Abstract

A proper deregistration policy for ELVs is essential in ensuring the proper implementation of sustainable waste and recycling processes. Besides policy, the comprehensive design of the monitoring system for local authorities and governmental agencies should also be created according to the specific procedure for environmental effectiveness. Considering such environmental problems arise from improper deregistration of ELVs, the study aims to examine the federal government's task to monitor the institutional capacity as provided by Rules in section 66 of the Road Transport Act. ELV deregistration policy can be designed most effectively and efficiently in line with the Sustainable Development Plan 2030 on SDG 12 (sustainable consumption and production) for three reasons: to empower the local authorities and governmental agencies to execute such a task; to improve the monitoring system on the institutional capacity, and to ensure the improvement of sustainable environmental effectiveness. The study reviewed the designed Rules using content legal analysis, literature reviews, and comparative case study. In order to control ELV generation and its recycling process, the discussion emphasised that (1) the amendment of law seeks to explain the provision that empowers the Minister to set a procedure for deregistration of the vehicle and to improve the process of vehicle deregistration for any practical purpose; (2) the deregistration requirement should be strictly regulated to achieve specific targets under SDG 12 which includes: environmentally sound management of all wastes throughout their life cycle (Target 12.4); substantially reduce waste generation (Target 12.5); and compliance with the national policies and priorities (Target 12.7). Upon compliance, both deregistration certificate and institutional authorisation have significantly improved the capacity control of ELVs flow, ending up with proper recycling process; and (3) a monitoring system that requires interoperable data related to deregistration, statistics of scrapped ELVs, and steps to improve the environmental performance of ATF dismantlers or recycling facilities for proper adherence to the designed Rules and Agenda 2030.

Keywords: ELVs Deregistration Policy, Environmental Sustainability, Monitoring Effectiveness.

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Sports Dispute Resolution: Is Malaysia serious towards achieving Sustainable Development Goals by 2030?

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Abstract

As the internationalisation and development of sports continue to evolve, disputes in sports are also rising globally, and Malaysia is not an exception to this trend. This article addresses the urgent need for a comprehensive study of the relationship between sport dispute and the Goal No 16 Sustainable Development Goals enshrined in the 2030 Plan for Sustainable Development, the global development platform of the United Nations. Therefore, the question arose as to whether the current Sports Dispute Resolution in Malaysia is in line with the Sustainable Development Goals 2030 to ensure justice in support of effective, responsible, and inclusive institutions, transparent and fair practices are essential for ensuring people's trust in the administrative body and government. However, due to conflict, insecurity, weak institutions and limited access to justice remain threats to sustainable development. In 2019, the number of people fleeing war, persecution and conflict exceeded 79.5 million, the highest level recorded since these statistics have been systematically collected. The COVID-19 pandemic threatens to expand and exploit instabilities across the globe. The article aim is to examine the legal position under the Malaysian Sports Development Act 1997 to what extent it protects Malaysian athlete's interest. The legal study conducted by using content legal analysis, literature reviews and comparative case study. The results indicated a need to amend the sport resolution dispute for better protection to Malaysian athletes. This article will benefit the Malaysian Ministry of Youth and Sport to formulate a policy, guidelines, and legislature in realising its Kementerian Belia dan Sukan (KBS) Strategic Plan and to all stakeholders in sports industry. Recommendation for improvement is proposed as it is not only timely needed but also to advocates good governance for the sport structure industry and improves its ecosystem. Upon improvement as this article proposed, it is expected that it will bring huge relief to all stakeholders in sports industry for proper adherence of SGD 2030 and will also offer the sustainability law for institutional change and government policy towards future generations. The paper concludes that the legislation in force seems ineffective for ensuring a proper level of protection. In order to achieve SGD 2030 goals, the discussion emphasised(1) the need to amend the current Malaysian Sports Development Act, and (2) the demand to harmonise the Act with the National Governing Bodies constitution in order to ensure justice for all (Target 16.3).

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Assessing the effects of the Directive 2014/95/EU on Nonfinancial Information Reporting: Evidence from Italy and Spain

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Abstract

This paper explored the effects of the Directive 2014/95/EU on the disclosure of nonfinancial information (NFI) in two European countries, Italy and Spain. Content analysis was performed to verify the sustainability indicators disclosed by Italian and Spanish companies before and after the Directive's publication, and its implementation into the two national legislations. The level of NFI disclosure was scored using a disclosure index. The comparative analysis found a progressive reduction in the Italian companies' disclosure levels differently from the Spanish ones for which an expansion of the disclosure was detected. The Italian response to the new requirements can be interpreted in different ways. It might result from a process of rationalisation supporting more effective communication; from a prudent approach to disclosure induced by the provision of mandatory assurance of NFI (Raucci and Tarquinio, 2020; Tarquinio et al., 2020); from a "tick-box" mentality under which companies exhibit an apparently responsible behaviour (Caputo et al., 2020). The increase in Spanish disclosure levels, on the one side, could be the expression of the positive attitude toward compliance that generally drives companies operating in countries with prior regulation (Venturelli et al., 2019). On the other side, given the ineffectiveness of the previous regulation (Luque-Vílchez and Larrinaga, 2016), it might represent an attempt to fill the information gap still existing in Spanish reports. Findings also reveal a reduced gap between the quantity of NFI reported in the two countries, supporting the hypothesis that regulation can produce harmonisation (Caputo et al., 2020).

SDG 12.6 encourages companies "to adopt sustainable practices and to integrate sustainability information into their reporting cycle". By measuring and disclosing their social and environmental impacts, companies can assess their contribution to sustainable development and establish new strategies in this direction. The EU Directive has significantly contributed to fostering corporate transparency and accountability on several SDGs topics (Pizzi et al. 2019). Consequently, evaluating the impact of the new requirements on NFI can help understand the European path towards the achievement of SDG 12.6.

(SDG + Target: 12.6)

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“Sustainable” financing in times of crisis: the role of securitisation in advancing SDGs

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Abstract

The Sustainable Development Goals and the Paris agreement have paved the way for the progressive integration of “sustainability” considerations in financial regulation and investment practices. They have highlighted the pressing need for private cash flows to meet the global objectives in the environmental, social, and governance sphere. Besides, they have also prompted a vivid discussion about the financial risks derived from climate-related events and about the losses and opportunities associated with the transition to a low-carbon economy.

This has triggered a multitude of regulatory initiatives at the national, international, and market level, seeking to steer capital flows in a sustainable direction.

At the same time, investors’ demand for bonds, loans, and other financial instruments which pursue ESG (environmental, social and governance) objectives has skyrocketed: the amount of global financial assets with these characteristics has more than tripled over the last 8 years, leading to $40.5 trillion in 2020. [1] There is preliminary evidence that the COVID-19 crisis has not halted this trend, but that it has strengthened investors’ confidence in investments in the “social” sphere of sustainability.[2]

In spite of the boom of “green” bonds and loans, which finance environmentally-friendly projects, policy-makers and literature seem to have paid only marginal attention to the potentials of securitisation. It is a financing technique, especially used by larger institutions like banks, which converts credit claims, like leases and mortgages, into tradable financial instruments. Since 2014, there have been only seminal examples of deals embedded with “green” credentials and various practical and regulatory constraints seem to curb the development of the sector.

Against this background, my paper will situate securitisation within the “sustainable finance” debate. It will describe its potential for the political agenda on sustainability. It will also shed light on the need for a robust legal framework to support the growth of the sector. In particular, soft law instruments like standard clauses are needed to establish uniform conditions for such operations.

It is argued that securitisation has an added value compared to other financing mechanisms in advancing the sustainable finance agenda. Wider use of this technique could be a step forward in bridging the SDGs investment gap, a persisting concern in the recovery from the COVID-19 crisis.[3] Pooling together different credit claims allows originating entities to mitigate their default risk. Therefore, securitising “green” and “brown” assets could protect companies against the severe losses caused by climate-related events (13.1). Besides, the issuance of capital market instruments could facilitate access to finance for energy-efficient improvements (7,3, 9.4). It could also mobilise investors in support of climate activities (13.1) and innovative projects which step up renewable energies (7.2).

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CONSTITUTIONAL CLIMATE LITIGATION IN COMMON LAW (Working Title)

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Abstract

In 2009 Rockström and his colleagues introduced the theory of planetary boundaries. They affirmed that, anthropogenic pressures on the Earth System have reached a scale where abrupt global environmental change can no longer be excluded. These planetary boundaries are interdependent and, transgressing one or more of them may be deleterious or even catastrophic due to the risk of crossing thresholds that will trigger non-linear, abrupt environmental change within continental- to planetary-scale systems. Furthermore, the social impacts of transgressing boundaries will be a function of the social–ecological resilience of the affected societies.

This theory provides a helpful concretisation of the ecological limits within which economic development must be allowed to occur. Furthermore, it helps put into focus the moral need to establish and enforce the right of a healthy environment; since Earth's natural resources constitute the sustenance, shelter and energy of human civilisation and must be preserved for future generations. The paper analyses the recent phenomenon of grassroots constitutional climate litigation to limit and to redress the ecological disasters and the socio-ecological harm caused by climate change.

It first provides a theoretical overview of how nonviolent civil resistance, specifically youth-led movements, use adversarial legal tools to attain the articulation of new rights [New rights for communities in the form of a climate change recovery fund, and new rights for the environment in the form of a recognition of juridical personhood]. It does so by using the history of the NAACP as a paradigmatic example of using constitutional litigation to achieve social and political change.

Then, it provides an in-depth analysis, using the case study of *Juliana v. United States,* of constitutional legal actions from grassroot youth-led organisations protesting governments' inaction on climate change and their support for fossil fuel industries.

The paper concludes highlighting the difficult debate of who own the Earth natural capital and it poses that at the very heart of these lawsuits stands the question of who owns the Earth resources and, to what extent the general public can claim the services that the Earth provides as common property. Finally, it provides some ideas on how these new types of litigation could establish important precedents for any future constitutional climate litigation.

The contribution relates to the topic of the conference because it analyses from a legal point of view how the use of legal tools by grassroots organisations could be a useful method to achieve the recognition of a right of intergenerational justice, and to establish new legal principles for a more sustainable use of the Earth resources. For this reason this abstract relates to SDG **Goal 13: Take urgent action to combat climate change and its impacts, and it especially relates to target** 13.2.1.

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River Pollution: Issues in Securing Water for All in Malaysia

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Abstract

Malaysia has developed many policies and laws ensure water resources sustainability under le Sustainable Development Goals (SDG) 6 and 16. However, river pollution remain a problem and has caused water disruption and discomfort to city dweller. In 2020, four major pollution incidents in Selangor has caused water supply disruption for over one million consumers, while pollution from pig farming in Penang and chicken farming in Johore have caused bad odor and discomfort. This paper employs a doctrinal research to review related laws policies and laws in Malaysia, as well as articles and commentaries on the subject. This analysis reveals that water resources are matters under the state government jurisdiction; hence, each state should review and enforce pollution related offence under their respective state enactments. The sources of pollution also varies and the licensing authorities must monitor the activities to avoid continuous pollution, and not leave this duty to the state water resources authorities. Attempts have been made to impose higher fines to deter the polluters, including using The Security Offences (Special Measures) Act 2012 (SOSMA. Based on the reviews, legal measures against water pollution are adequate, but lack of coordinated.

Keywords: SDG 6, SDG 16, river, pollution, laws, Malaysia.

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SAVING THE FOREST: LEGAL ISSUES IN CATCHMENT PROTECTION IN MALAYSIA

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Abstract

Demand for water is rising due to population growth, urbanization and industrialization. However, the availability of water resources decreases because of deforestation and destruction of water catchment. This, together with illegal logging, has increased sedimentation and caused river pollution. There is no specific laws on water catchment in Malaysia and leads to inadequate protection of water catchment. Doctrinal analysis on the laws and policies on forest and catchment protection reveals overlapping jurisdiction between the State and Federal government in this matter, hence resulted in inconsistent catchment management. A comparative analysis on other jurisdiction demonstrate that the law and regulations on catchment protection are needed to ensure strict enforcement and protection. This paper recommends the importance of the role of government and stakeholder in protecting water catchment and provide better information to authorities for creating a more sustainable forest and catchment development in the future. This will also enhance sustainable development goals no. 6 on water security, whilst ensuring sustainable life below water (SDG 14) and life on land (SDG 15). Forests are also the green lung for the earth and will reduce the impact of global warming and climate change (SDG 13).

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The Human Right of Migrants As An Accused Person in Malaysian Syariah Court: A Critical Analysis

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Miss Multazimah Rafie

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Abstract

Abstract

The rights of an accused in a criminal proceeding is a fundamental human right for everyone regardless of whether he is a citizen or a migrant. This protection is provided in several legal instruments as a guarantee of fair justice for all. Despite the rising number of migrants accused of Syariah criminal offences in Malaysia, there are neither specific standard operation nor specific provisions in any Syariah Criminal Procedure regarding this matter for migrants. This may expose migrant accuseds to harmful acts and may affect his rights during proceedings. This paper aims to investigate how Syariah Court protects a migrants' right as an accused in criminal proceedings. On top of that, this paper identifies migrant offender rights in Syariah Criminal Procedure Enactment, constitutional provision of Malaysia and the manual procedure of Syariah court. In doing so, it will analyse the respective manual for investigation, and procedure for pre-trial, trial and post-trial used by Syariah Courts in Malaysia. This is a qualitative study which utilises documents analysis approach in its data collection. The study found only general protection provided in the respective Syariah Criminal Procedure Enactment and Standard of Operation regarding migrant offender rights. This study will recommend an amendment of syariah law in this regard, and an improvement for standard of operation for Syariah Courts in Malaysia . This

study is to ensure rights of migrant accused in Syariah Court and to improve application of Syariah law from human right perspective.

Keyword :

migrant rights, Syariah criminal procedure, right of accused

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Health, Human Rights and the SDGs: Inter-Linkages in Times of Crisis

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Abstract

The global Covid-19 pandemic has impacted implementation and achievement of many Sustainable Development Goals (SDGs) and will doubtless result in changes to the ability of States to fully implement their commitments under the SDGs by 2030. This paper will examine the inter-linkages between health and human rights law as reflected in the SDGs and the ways in which these inter-linkages have been and will continue to be tested by governmental and international community responses to the Covid-19 pandemic.

The paper will begin with a discussion of the way in which human rights and health were related under the Millennium Development Goals in order to provide an understanding of the relationship that transferred between the MDGs and the SDGs in 2015. It will then review the SDGs which reflect the inter-linkages between human rights and the SDGs. This review will necessarily focus on SDG 3, but will also address more nuanced areas of connection, such as the nutrition and food security aspects of SDG 2, and the clean water and sanitation elements of SDG 6. Following this, the paper will address the impacts of the Covid-19 pandemic on State implementation of the SDGs as reported in the Voluntary National Reviews filed in 2020 and 2021. While knowledge of the pandemic and associated impacts changes on a near-daily basis, even the VNRs filed at the outset of the pandemic provide insights into the impacts felt on SDG implementation and the shifting in priorities. For example, although the VNRs often demonstrate an increase in funding for health systems, this funding is limited to the Covid-19 context and frequently comes from the reallocation of funds meant for other critical healthcare programs, resulting in a crisis of health and human rights concerns. Finally, the paper highlights the challenges for and gaps in the implementation of the SDGs in the context of health and human rights due to Covid-19.

The paper relates to the following SDGs: 2 (Targets 2.1, 2.2, 2.4), 3 generally, and 6 (Targets 6.1, 6.2). It connects to the conference theme by discussing the ways in which health and human rights concerns are connected to the SDGs and the potential issues for the achievement of SDGs associated with health and human rights due to the Covid-19 pandemic, in order to create dialogue around the processes needed to accelerate the implementation of these SDGs in a time of crisis.

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Should We Call It Moral Money?: Institutional Ownership and Board Diversity

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Abstract

The debate around the merit of stakeholder capitalism partly ignited by the Study on Directors' Duties and Sustainable Corporate Governance prepared by Ernst Young for the European Commission Directorate-General for Justice and Consumers in 2020 has motivated a deeper reflection on corporate purpose and the transformative power of corporate governance. Corporate governance can afford practical value to stakeholder capitalism if corporate governance rules are based on appropriate standards such as the ones provided by the Sustainable Development Goals (SDGs). To that end, some potential measures afford themselves to empirical inquiry. Some of those measures are creating a regulatory framework that enables the representation of stakeholders such as non-governmental organizations and other pressure groups through the attribution of voting and veto rights and their members' nomination to the management board. The latter measure is similar to German co-determination by which stakeholders like employees are appointed to the supervisory board. Another step could be to expand fiduciary duties to include the protection of stakeholders' interests, accountability of corporate managers, consultation rights, and additional disclosure requirements. Additionally, the role that institutional investors can play to overcome externalities such as climate change and income inequality, for example, should not be understated. In their study *Corporate Purpose in Public and Private Firms*, Claudine Gartenberg and George Serafeim utilize Rebecca Henderson's and Eric Van den Steen's definition of corporate purpose, that is, "a concrete goal or objective for the firm that reaches beyond profit maximization." In their paper, Gartenberg and Serafeim analyzed data from approximately 1.5 million employees across 1,108 established public and private companies in the US. In their words: "we find that employee beliefs about their firm's purpose is weaker in public companies. This difference is most pronounced within the salaried middle and hourly ranks, rather than senior executives. Among private firms, purpose is lower in private equity owned firms. Among public companies, purpose is lower for firms with high hedge fund ownership and higher for firms with long-term investors. We interpret our findings as evidence that higher owner commitment is associated with a stronger sense of purpose among employees within the firm." With institutional investors on the rise, these findings are important because they redirect our attention to shareholders' nature, composition, ownership, and long-term commitment. This paper asks the following questions. Do firm ownership and investor commitment matter for aligning corporate governance with the SDGs? Should investors' money be "moral" money? This piece especially relates to SDG 8, Target 8.3, and SDG 10, Targets 10.4 and 10.5. This paper provides guidelines to surmount the tension between prioritizing shareholders' wealth maximization and corporate purpose. Corporate purpose should consider shareholders' and stakeholders' interests by taking into account the company's governance structure and how it relates to its ownership structure and board diversity as critical dimensions to develop new policies in corporate law and corporate governance. Ultimately, this paper sheds light on the role of sustainability law for institutional change.

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Households' food waste - A Participatory Methodological Approach

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Abstract

Citizens are increasingly concerned about food waste. It is a transversal theme to the whole society. Food waste is receiving growing attention from the scientific community, due to its economic, environmental, and social implications. The EU- Directive on Waste establishes that member states should seek to achieve an indicative target for reducing food waste at the EU level of 30 % by 2025 and 50 % by 2030. At the EU level, household food waste accounts for over 50% of the food wasted along the value chain.

This paper aims to discuss the measures and actions focused on reducing households' food waste and their contribution to sustainable development. Towards this end, at first, a systematic review of measures and actions is used to understand what has been implemented across the world to incentivize food waste reduction with a focus on households, as they are responsible for a significant amount of waste. This inventory will allow for a better understanding of the types of measures and actions that have been experimented with and that could be articulated and incorporated within integrated food waste management strategies at the local, national, and even the international level. Reference will also be made to the framework of European Legislation (Directive 2007/98 / EC of the European Parliament and of the Council of 19 November 2008) and Portuguese National Legislation on waste and food waste. Secondly, our purpose is, from those previously selected measures and using a participatory methodological approach analyze the choices that the 6 focus groups from the municipalities of Porto and Maia, two cities located in the second largest metropolitan area in Portugal made regarding the most effective in combating food waste in their households. An in-depth content of the focus groups carried out analysis is used to understand whether the Portuguese households are in fact in tune with the measures that resulted from the previous review. The paper will also address the role currently played by legal instruments in fighting food waste and how these could be enhanced, built on the Portuguese case.

The findings indicate that the measures should be applied in a holistic way, that the measures are different depending on the municipality that applies them, and that urban gardens could effectively be a way to reduce food waste by households, at a local level Finally a general concerned about the environment and food comes out of this study people want to live in green and sustainable cities.

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A Deluge of Standards: On the Influence of Abundance.

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Abstract

This contribution concerns the question how private regulatory norms concerning sustainable supply chain management can contribute to closing the gap between legal and political goals concerning sustainable development and the practice of Western-based brands operating in international supply chain of ready-made garments?

The RMG industry is a complex, globalised, and unsustainable industry. Profound change is necessary for the RMG industry to become sustainable. However, the fact that the ready-made garment (RMG) industry -together with many other industries- operates at a global level, implies that there is not one state that can regulate the impacts of the supply chain of this industry. Since there is no such unambiguous national legislative authority, combined with the fact that a solution based on formal international legislation is not realistic soon, other alternatives to the formal judicial order of the old governance are necessary to achieve the essential change. The lack of international regulation and the challenges to the traditional regulatory options fuels the need to examine new regulatory options.

In order to answer to an increasingly compelling call for more sustainability from various stakeholders, Western-based RMG brands selling their garments in the EU adopted quality certificates and private regulation. However, this private regulation in the RMG industry has led to a deluge of quality standards and supplier agreements. The question is whether this abundance of regulatory options has a beneficiary influence on the goal of making the RMG industry operate in a more sustainable manner.

Firstly, this contribution develops a theoretical understanding of the complex effects of private regulation in supply chain relations set against the background of a buyer driven RMG industry. Secondly, the sphere of influence of private regulation in comparison to formal law is scrutinised. The paper then describes the effect private regulation can instigate, based on the information gained from two qualitative case studies in the RMG-industry. In the discussion section the effects of implementation of private regulatory norms in the RMG-industry supply chain are discussed.

The influence of regulation regarding sustainable behaviour is examined through the lens of Lawrence Lessig's social-legal theory, which constitutes the so-called 'New Chicago School' (1998), This theory describes a possibility for formal law (rules) to directly influence informal norms (i.e. self-regulation) which can then indirectly influence human conduct. A critical hermeneutic model is employed to analyse and interpret the findings.

Accordingly, this paper contributes to an understanding of the regulatory and normative challenges of a globalised industry trying to make a transition towards sustainable value chains.

SDG 12.6 and 17.16

Relates to 'accelerating progress toward SDGs in times of crisis' through analysing the interconnectedness and influence of formal and private regulation to sustain new regulatory drivers for change.

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Sustainability and Market Efficiency: Are They in Conflict?

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Abstract

The proposed abstract is related to “SDG+Target: 8.10”

The proposed analysis is framed within the perimeter of the financial market. In fact, the progress to SGD goals needs, inter alia, a financial regulation able to reconcile the public interest of sustainability (environmental, economic and social) with the private interest of market efficiency. In this perspective, the paper will focus on the legal incentives for sustainable financial investments, as well as on their impact on the financial stability regulation, on the one hand, and investor protection regulation, on the other.

Specifically, the analysis will aim to investigate:

(a) with respect to Financial Intermediaries (especially their prudential regulation):

- whether amendments to bank and insurance companies' capital requirements for sustainable investments (inclusion of sustainability - environmental, social and governance risks - in prudential requirements for banks and insurance companies; see Directive 2019/2034 and Regulation 2019/2033) could compromise the objective of ensuring financial stability, especially if their portfolio includes non-performing loans;

b) in relation to Financial Investors:

- whether and when the integration of sustainability factors, risks and preferences in the legal framework on financial investors’ protection (see the proposal of the European Commission amending Delegated Regulation (EU) 2017/565 as regards the integration of sustainability factors, risks and preferences into certain organisational requirements and operating conditions for investment firms) could compromise financial intermediaries’ duty to act in the best interest of their clients;

c) with regard to Financial Products:

- with reference to ‘product governance’ regulation , whether and to what extent public intervention encouraging ‘green’ financial products (‘green bonds’*, i.e.* securities that comply with environmental or low-carbon criteria on the basis of the standard proposed by the European Commission's Expert Group on Sustainable Finance, to which any bond issuer or other debt instruments can voluntarily adhere: see Report "EU Green Bond Standard", June 2019) is compatible with market efficiency.

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Tort liability for unsustainable development

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Abstract

Since the principle of sustainable development was initially formulated in 1992 much has been said about its legal implications in general. However very little attention has been paid to how, if at all, sustainable development may impact a specific area of law, which is liability law. Recent developments have brought the importance of such principal to the fore in light of the undergoing litigation against certain states for not having done enough to fight climate change. More recently, some municipalities have started suing private companies for contributing to the same. The paper analyzes the role of sustainability within this context.

The purpose of the paper is thus to highlight the huge potential of the sustainability principle to overthrow many existing paradigms of current liability law and to make it evolve into something different and still unknown.

The paper draws upon the theoretical framework surrounding the sustainability principle, from its inception and formulation in the Brundtlandt Report (Our Common Future, 1992) to the Sustainable Development Goals (SGDs) presented in September 2015 at the UN General Assembly and beyond. After having explored the legal implications of sustainable development (on which see Mauerhofer, 2015), the paper focuses on its specific implications for tort liability law, both as regards the states or public administrations and private actors (like oil companies). To that regard, the recommendations by the Expert Group on Global Climate Obligations (2015) and the Principles on Climate Obligations of Enterprises (2018) are examined and critically reviewed.

Liability law has for the most part remained foreign to the legal developments concerning sustainable development. Whereas a whole and powerful discourse was eventually elaborated mostly with regard to the technical or economic sides of the principle at stake, while it slowly kept opening its way with regard to international environmental law, among other areas, liability law managed to keep itself apart as if it was some sort of isolated compartment, with the result that it did not receive any significant relevant influence of the sustainable development principle as such. Yet its implications for liability rule are profound.

Theoretical elaborations on the sustainability principle have not yet had an impact on liability law as such, both including the liability of states from an international perspective and liability of the public administrations or private actors from the point of view of (private) tort law.

By focusing on the plethora of new cases revolving climate change liability litigation, of which the Urgenda case is probably the best known example, the potential of the sustainability principle to revolutionise liability law is explored.

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An assessment of Environment Language in International Investment Agreements

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Abstract

A network of over 3 000 treaties form part of the international investment legal framework. These investment treaties grant international legal protection to foreign investors including direct access to enforce these legal protections through investor-state dispute settlement (ISDS). ISDS is currently facing a legitimacy crisis where States criticize, inter alia, the outcomes of arbitral decision-making as being unbalanced and favoring investors over States. Against this backdrop, States have undertaken various actions aiming at reforming and rebalancing the international investment system. States have started to recalibrate their IIAs by, for instance, redefining investment protections, restricting investor-state dispute settlement provisions or, by incorporating other objectives than investors' protections, such as the protection of the environment and responsible business conduct. The United Nations Conference on Trade and Development (UNCTAD) highlights that 'modern treaty making include a sustainable development orientation, preservation of regulatory space and improvements to or omissions of ISDS.'[1]

In light of these developments, one question is whether the newly incorporated wording of environmental provisions in IIAs can make a difference ? The paper discusses the different types of environmental provisions found in IIAs and analyzes the relevant Investor-State arbitration case law. This study is relevant in order to assess the potential of the international investment system to assist in the achievements of the Sustainable Development Goals (more specifically SDG 17). Foreign investment, as regulated under IIAs, is an important source of finance for development, especially for low-income countries. If carefully tailored, foreign investment can be conducive to sustainable development. The paper also offers further suggestions for enhancing the synergies between the protection of the environment and the protection of investors in investment treaty making with a focus on State regulatory capacity in times of crisis.

[1] UNCTAD, "Recent Developments in the International Investment Regime," IIA Issues Note, May 2018.

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The Dutch Programmatic Approach to Nitrogen: Article 6 of the EU Habitats Directive as a unsuspected catalyst for a strong sustainability approach in the European Union

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Abstract

During the past decades, the concept of sustainable development has also become an increasingly popular buzzword. As is widely known, sustainable development has three main pillars: economic, environmental, and social, often informally referred to as People, Planet and Profits. Part of its attractiveness is linked to the fact that sustainable development allows politicians to justify policies which often do little more than minimizing continued environmental decline. This has only intensified after the adoption of the UN's 2030 Agenda, which represents the new global sustainable development framework and sets 17 Sustainable Development Goalds (SDGs).

In the wake of this global reassertion of the concept of the sustainable development, also the EU has further committed itself to the concrete implementation of the SDGs. With an increasing rapidity, many scholars have criticized the concept for being overly vague and because of the lack of concrete hierarchy between its constitutive pillars. At its inception, sustainability was interpreted as a requirement to preserve, intact, the environment as we find today in all its forms. However, in practice the concept of sustainable development has often given rise to weak sustainability, which assumes the full substitutability of natural capital. In contrast, the strong sustainability concept highlights the non-substitutability and prioritizes the ecological boundaries which are prone to constrain any type of harmful economic development.

For now, the legal status of sustainable development, remains debatable. The lack of over-arching definition substantially affects its binding nature, limiting its enforceability in court. However, in the context of the EU, several environmental directives can serve as a complementary catalyst for enforcing a more ecological understanding of sustainable development. One recent textbook example is offered by the decision of the Court of Justice of the EU on the compatibility of the Dutch Programmatic Approach to Nitrogen (in Dutch: Programmatische Aanpak Stikstof) with Article 6 of the EU Habitats Directive (Case C-293/17).

Against the backdrop of an overload of nitrogen deposition in the majority of its EU protected sites, the Dutch government came forward with an integral, programmatic approach with a two-fold objective. On the one hand, the programmatic approach set forward additional reduction efforts, especially in the context of livestock farming, and the implementation of future restorative actions in degraded EU protected site. These actions were needed to comply with the EU Habitats Directive. On the other hand, the programmatic approach wanted to create more legal certainty for future economic growth, by facilitating the permitting procedures. While proponents hailed this approach as a progressive illustration of sustainable development, some environmental NGOs claimed the programme merely justified unchecked livestock expansion for uncertain reduction and restoration actions.

Ultimately, both the EU judges as well as the Dutch national courts agreed with the latter criticism. This paper will analyse this jurisprudence and highlight the legal potentialities of Article 6 of the Habitats Directive as an unexpected precursor for strong sustainability within the EU. Amongst others, it reveals that Article 6 requires Member States to prioritize ecological integrity of short-term economic growth.

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Challenging the Public/Private Divide in the Sustainable Development Goals

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Abstract

The Sustainable Development Goals (SDGs) have attracted significant attention in legal scholarship in their three dimensions (environmental, social, economic). The SDGs have become a focal point for comprehensive thinking about the future of the world. This is so at least in the area of public international law. With regard to private law, by contrast, there has been less attention, although the SDGs are directed not only to governments, the UN and other international institutions, but also to local authorities, indigenous peoples, civil society, business and the private sector, the scientific and academic community – and all people. Certainly, public action and public law will not be enough if the goals are to be achieved. In particular, in pursing the SDGs, MNEs' codes of conduct and international supply agreements are relevant where these goals become contractual clauses or declarations that may or may not have a binding effect for the parties. In fact, the topic is still underdeveloped in legal scholarship. Our stance is that the analysis on how to pursue SGDs in private law should not be advanced in isolation from the other legal 'arm' of public law and vice versa. Initiatives and tools must be comprehensively driven to the same achievement, i.e. sustainable development. A hybrid mechanism is necessary, hence an analysis of such combination of soft law, binding and non-binding public and private instruments. In conclusion, our interdisciplinary paper examines whether and how a relationship may be seen between PIL and contract law in pursuing SDGs, questions its goals and pitfalls and its impact over liability issues. Thus, we discuss the interplay of PIL and contract law with the aim of contributing in enhancing our mutual, and comprehensive, understanding of such hybrid mechanism in pursuing the SDGs.

SGDs 12 Responsible production and consumption

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Just sustainabilities and SDGs: Towards new opportunities

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Abstract

Covid-19 has exposed the vulnerability of our fractured societies, being ill-equipped under-prepared nations. The impact of the virus is global, multi-various, and multi-dimensional. The common prognosis recognises a dynamic and fundamental change in our ways of seeing, experiencing, thinking, planning, organising, and living. It is already established that its negative effect upon the poor and the vulnerable is disproportionate. Post- COVID-19 offers a progressive opportunity to question and change our thinking and relationships with each other and with our planet. The terms 'equity' and 'justice' attract significant attention during the reconstruction processes. This form of thinking and planning is essential for the understanding and effective implementation of the SDGs.

A changing society, not by choice but by necessity, simultaneously creates the space to broadcast a fresh message that allows 'equity and justice' to be moved to centre-stage. Agyeman's theory of 'Just Sustainabilities' (JS) is a bridge, 'joined-up' thinking of environmental justice and sustainability discourses directing society radically into a more sustainable trajectory. JS is as 'an overarching societal value' with an equity-based agenda. In this broader context, sustainability and sustainable development are not simply about the environment. Social and economic dimensions must be recognised as equal partners alongside the environment to implement the SDGs. The SDGs provide a framework of sustainability agenda to 'heal and secure our planet and shift the world on a sustainable and resilient path'.

This paper locates JS alongside SDGs through an 'embedded lens' approach. JS is a paradigm while SDGs offer an international, operational framework. The 'embedded lens' envisions a fairer and inclusive society and provides a plural and comprehensive understanding of sustainability trajectories. The basic message and resolve for 'a just, equitable, tolerant, open, and socially inclusive world' evidence SDGs and JS are integrated to drive a sustainable future. Appreciating JS embedded within the SDGs framework helps re- orientate and clarify thinking, both during and in post- Covid-19 'new normal' times.

Aspects of environmental sustainability within the 'embedded lens' are sited in the context of environmental sustainability, as JS and SDGs are synergetic and complementary. Goals 6 (Targets 6.1-6.3), 7 (Target 7.1) , 12 (Targets 12.1 and 12.2), 13 (Targets 13.1-13.3), 14 (Targets 14.1 and 14.2), and 15 (Target 15.1) specifically and directly focus on environmental sustainability. Core elements and the relationship between JS and the SDGs are identified by common key terminology and implied meaning. The 'embedded lens' offers an accelerated pathway to sustained, inclusive, and sustainable economic growth within a transformed world.

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Towards land degradation neutrality in Finland

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Abstract

Land degradation neutrality (LDN) is a relatively new concept globally and almost unknown in Finland. It is, however, an important part of SDG 15 and it should get more emphasis in environmental discussions in Finland, and elsewhere, too. In Finland the information gathering related to LDN has started but there is no political discussion on it yet.

Sub-goal 15.3 reads "*By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.*" According to UNCCD, LDN means "a state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security *remain stable or increase* within specified temporal and spatial scales and ecosystems".

On the political level in Finland LDN seems to be misunderstood as a desertification problem where as land use change, land sealing, soil pollution and shrinking or deteriorating CO^2 sinks are equally important aspects of LDN. Land pollution is fairly well regulated in Finland. Most other issues, such as land use change and land sealing are not yet being regulated.

Achieving or even striving to achieve LDN would require reversing past and on-going land degradation, as there will evidently be land lost to construction, mining, etc. also in the future. Reversing can mean better management methods in e.g. agriculture and forestry, or reforestation or de-sealing of land. Reaction hierarchy, avoid - reduce - reverse, means that an offset mechanism for land sealing projects should take place.

Some countries, such as Germany, have already integrated e.g. ecological offsets into land use planning law. Yet, in most countries the obligation to offset applies only to specific species or habitats, which does not lead neither to no net loss of biodiversity nor to LDN. Germany is probably the best example of a country that has implemented offsetting widely into land use planning. Germany has the highest levels of land fragmentation in the EU, but Germany has managed to slow down the annual land cover change rate to 0,11 %. In Finland the annual change rate is still 0,35 %.

The speed of urban sprawl in Finland remains stable, with an annual artificial land take rate about 0.4%, which is slightly above the European average. Sprawl is driven by the extension of mines and quarrying areas, as well as dump, construction and industrial or commercial sites. On the other hand, the extensions of residential and sport and leisure areas, which were major sprawl drivers in the period 2000-2006 show significant decline. In my presentation I want to discuss the main challenges and how Finland is tackling land use change issues currently - mainly focusing on land use planning - what could be improved. Since there are not much legislation about this issue yet, I would be very interested in getting comments and insights from other countries.

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Addressing Solid Waste Pollution in Sierra Leone: Lessons from Singapore

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Abstract

To ensure the protection of the environment and the people's wellbeing is the responsibility of every government. The issues of waste, especially solid waste, have been challenging for many developing countries, including Sierra Leone. While other countries and their citizens are luxuriously enjoying a green, healthy and clean environment such as Singapore, that has not been the case in Sierra leone. Sierra Leone has been marred with solid waste due to many factors such as weakness in the existing laws, social issues, regulations, and poor policy implementation. On the other hand, Singapore has been notably known for its stringent rules and policies, with adequate and effective performance. In light of these, this paper examines Singapore's laws or measures to reach such a goal, analyses the current waste and legal issues in Sierra Leone, and taps from Singapore's experience. Thereafter, the researcher founds that, by ensuring good waste management, Sierra Leone will achieve greater protection of life below water (SDG14) and life on land (SDG15).

Keywords: Pollution, Solid Waste, Regulations, SDG14, SDG15.

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The Medicolegal Conundrums of Employing Medical Robots

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Abstract

The sustainability of a nation's healthcare system is dependant on its resources. In the wake of the Covid-19 pandemic, human resources have become particularly invaluable as healthcare workers are battling the pandemic at the forefront. The importance of human resource management became apparent so as to avoid depletion. In this regard, medical robots are seen as a convenient and effective solution. The adoption of robotics in healthcare has been gradual whereby semi-autonomous robots are being used, mainly for minimally invasive surgery, care, rehabilitation and training. Nevertheless, the employment of robotics has been increasingly promoted with the intent of facilitating the healthcare system in this time of crisis. That said, in the face of potential risks particularly to patient safety, underlying medicolegal issues exist which needs to be addressed. The advancement of artificial intelligence and the prospect of autonomous medical robots further create intricate loops on the existing thread of problems. Hence, through literature review of past studies and case laws, this paper aims to examine the medicolegal issues arise from employing medical robots and identify the corresponding legal principles under the common law.

This paper attempts to provide comprehensive overview of the legal accountability and liability of the various stakeholders involved; the doctor, hospital, and manufacturer of the robot, and may as well extend to involve the instructor and telecommunication provider. Despite the progress of robotics in healthcare, the development in law to cater it seems to be stagnant, hence it calls for lawmaker's proactive measures to fill the lacuna.

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Assessing Latin American climate change laws under a Sustainable Development Goals' approach

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Abstract

Climate change legislation has developed extensively since the Paris Agreement, emerging new instruments to address this global threat. However, many have fallen short in ambition and establishing

proper conditions to enable climate governance and binding instruments to measure and promote progress, undermining the possibilities of meaningful outcomes.

Often, climate action led by governments has left aside key aspects of sustainability, with a blurry or undetermined role of civil society and the private sector, overlooking the importance of social and economic dimensions, essential to achieve success over time.

In this context, the purpose of our paper is to examine the most common shortcomings and pitfalls in Latin American climate change legislation, offering proposals to overcome identified gaps and achieve related Sustainable Development Goals (SDGs) by surveying comparative law research and pondering on Chile's Climate Change Bill as a case-study.

As the analysis will show, the main gaps identified in such laws are the lack of binding long-term objectives, inadequate instruments to manage climate change, institutional deficiencies, and weak involvement of non-environmental authorities.

Considering comparative law research, we have identified key aspects that should be taken into consideration to overcome those shortcomings, including: a) binding national goals linked to, and updated with, international commitments; b) regulatory instruments to enable climate action, subject to periodic monitoring, reporting, and verification; c) a strengthened climate governance that allows for crosschecking and science-based decision making; d) integrate climate change as a crosscutting issue within all governmental authorities statutory mandates; and, e) involve all relevant stakeholders, with clearly defined instances for public participation in the process of drafting instruments and policies.

Our work concludes that for effective climate change legislation, it is paramount to decentralize climate policy from sectorial agencies and make it part of the agenda of all governmental institutions, with special focus on those sectors that represent a fair share of greenhouse gases emissions (e.g., energy, transport, mining, among others) or are more vulnerable to climate change adverse effects (e.g., biodiversity, water resources, coastal lands, among others). Finally, the involvement of civil society and the private sector will be essential to find both legitimacy and the financial means to accomplish proposed targets, as well as allowing an approach based on sustainability criteria.

In doing so, this paper relates to several SDG's, but primarily to SDG 13 "Take urgent action to combat climate change and its impacts", particularly, to its target of integrating climate change measures into national policies, strategies, and planning (target 13.2). Additionally, it closely relates to the conference theme "Accelerating progress towards SDG's in times of crisis" as many legislative procedures are underway, and timely analysis and consideration of the key elements presented in this work could contribute to strengthen regulation, integrate legal aspects of sustainability, and provide alternatives that could help fast-tracking decision making in climate action.

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The Role of Net Gain Law for Governance of a Sustainable Development

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Abstract

Governance and Law are intrinsically intertwined in addressing the endeavour to achieve a sustainable development. Latest environmental agendas of the UN and the EU imply global environmental and biodiversity net gains as the ultimate goal for a sustainable development even already till 2030. This chapter strives to assess the role which law can play within the implementation of these latest worldwide and regional policy directions. It does so through outlining as proposed research agenda. Hermeneutic methods are applied such as comparative legal analyses and different types of text interpretation (e.g. historic, wording, rational). The findings identify for this research agenda three major parts, namely

1. the assessment of the interpretation of net gain in connection with law related to the new UN and EU biodiversity and environment net-gain agendas.
2. The analysis how existing and future law can contribute to environmental and biodiversity net-gains by enabling voluntary behaviour (sufficiency), prescribing and implementing binding behaviour (effectiveness), increasing current and future biodiversity's representation (ecological equity) and/or enabling efficiency while ending rebound effects (eco-efficiency)
3. The elaboration of the legal integration among these four criteria assessed in terms of interrelation, decision-making, instrument-and policy mixes as well as geopolitical legal interplay towards environmental and biodiversity net-gains.

The proposed research agenda with these three parts is capable to provide a common basic understanding for environmental and biodiversity net-gains in relation to law as well as a starting point for steering the regional and global implementation of this new international policy objective enabling a sustainable development. The presentation has its focus on SDG 16 as it particular guides SDG 16.3. “16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all” as well as 15.5 “Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species”.

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The transition toward mandatory non-financial disclosure: a systematic literature review

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Abstract

In the current socio-economic context, an increasing number of companies are paying attention to the repercussions that their production activity has on the community and the environment. In the wake of this global trend, the non-financial information that companies disclose to their stakeholders has assumed and is assuming a pivotal importance. For many years, non-financial information disclosure has been conducted on the basis of voluntary initiatives carried out autonomously by various companies; this has led to the spread of different reporting practices and standards, which make the comparison of the different approaches adopted and the related results. Furthermore, this kind of voluntary reporting has not always succeeded in preventing information asymmetries and opportunistic behaviors by the companies' top management. The reasons are mainly related to the fact that, being not mandatory some companies may have decided to report exclusively economic and financial information or, in other cases, they may have omitted information regarding the negative impacts of the organization on the environment and the society. Non-financial disclosure, however, should be aimed to make social and environmental performance easily accessible to investors and consumers, harmonizing it with the economic and financial one. In this context, the European directive 2014/95 / EU, of 22 October 2014, imposes to the company a key novelty, i.e., making non-financial reporting mandatory by law. It is evident that the transition from voluntary to mandatory non-financial disclosure is greatly fueling this line of research. On this point, academics and policy makers have started to discuss the difficulty for companies to adopt a business model based on a mandatory sustainable paradigm.

According to this evidence, this paper aims to analyze the scientific debate which has characterized the recent years. Using co-citation bibliometrics analysis, co-occurrence keywords, chronological keywords analysis this study explores answers to the following research questions:

RQ1. Which channels (authors, journals, and articles) are the most influential in the research of voluntary and mandatory non-financial disclosure?

RQ2. How are articles clustered, and which research streams are likely to emerge in voluntary and mandatory non-financial disclosure? And what has been the evolution over time of non-financial disclosure?

Bibliometrics analysis has been conducted on 323 items (articles, preceding papers, early access, reviews, book chapter, editorial materials about non-financial disclosure published during the period 1996-2021. For this analysis, we used co-occurrence of keywords, co-citation and bibliographic coupling as indicators. Co-occurrence of all keyword's analysis provided keywords to investigate the conceptual structure of the field. Co-citation analysis allows us to investigate when two articles are both

independently cited by one or more articles, while bibliographic coupling takes place when two articles both cite a third article, indicating a probability that the two articles discuss a common topic.

This study offers valuable results both from the academic and business perspective. The bibliometrics analysis clearly illustrates the different stages of this field of study, as well as the emerging lines of research, which can be studied in greater depth.

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The Implementation Progress of the Biodiversity Protocol to the Carpathian Convention. Achievements and Challenges in Ukraine

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Bsc. Larisa Semernya

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Abstract

The Carpathian Mountains are Europe's largest mountain system crossing the frontiers of seven countries, namely the Czech Republic, Hungary, Poland, Romania, Serbia, Slovakia and Ukraine. Owing to its high geological diversity and historical climatic fluctuations, the Carpathian region has evolved to one of the most important biodiversity hotspots in Europe. The rapid political, economic and social developments in the region and the associated intensification of human activity over the last decades have been exerting massive pressure on already fragile mountain ecosystems (e.g. due to climate change). To counteract this pressure, and to ensure sustainable use and development in the Carpathians, the biodiversity conservation issues of the region have been addressed by an international agreement and its respective protocol. In this context, a Protocol on the Conservation and Sustainable Use of Biological and Landscape Diversity was adopted within the Framework Convention on the Protection and Sustainable Development of the Carpathians. In this document Parties to the Convention affirmed to "undertake appropriate legal and administrative measures for ensuring implementation of the provisions of this Protocol, and monitor the effectiveness of these measures". Since then, the Protocol has been signed and ratified by all Member States. The ratification by Ukraine was accomplished in September 2009 and came into force in April 2010.

In this context, this study aims to shed light on the extent to which the Biodiversity Protocol has been implemented by Ukraine. It seeks to identify legislation related to the Biodiversity Protocol, specific actions taken towards its implementation, as well as the players involved at both, the local and the national levels. Additionally, the research will help to uncover implementation gaps and thus the resulting need for action, providing a basis for a minimum implementation of the Protocol. Furthermore, the study analyses the challenges and the determinants affecting the implementation of the Protocol. For this purpose, data will be collected through semi-structured interviews/questionnaires with experts/relevant players. Finally, the study will result in the formulation of possible recommendations for an optimum implementation of the Biodiversity Protocol, based on the comparative analysis with other Parties to the Convention, as well as provide guidance for further research in this field.

The results of the study will contribute to a better understanding of the functioning and implementation mechanisms of the Carpathian Convention and its Biodiversity Protocol at the national level. The knowledge gained will further support and improve the implementation of the Protocol not only in Ukraine, but also in other Member States. The proposed abstract relates to SDG 15 / Targets 15.1 and 15.4 in particular. Furthermore it adds to the implementation of SDG 16.

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The Implementation of the Convention on Biological Diversity in Land Use Planning and Zoning Law: a quantitative and qualitative literature review

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Abstract

The mutual relationship between the Convention on Biological Diversity (CBD) and land use, zoning and planning law is quite apparent. “Positive” interactions, namely win-win situations are of particular interest in this context. Less apparent is what the implementation of the CBD concretely contributes – unidirectionally – to enhancing land use, zoning and planning law. Particularly, issues of causality of such a potential influence regarding goal and target setting in connection with the implementation of the CBD are hardly taken into consideration.

This presentation assesses how the implementation of the CBD contributes to enhanced land use, zoning and planning law (de lege lata) and how far could it contribute (de lege ferenda). One hypothesis in this context would be that in countries/regions with well-established conservation legislation, the impact of the CBD on land use, planning & zoning law is low or even negligible. While in other countries/regions it is high/considerable (and these are usually the countries with a higher rate of biodiversity).

The methodology applied is implemented twofold and consecutively interconnected. First, in order to receive a rough overview in qualitative and quantitative terms of UN-documents, the UN-online search tool InforMEA was used by inserting different combinations of the relevant terms in connection with the CBD. A similar keyword search in the two internationally leading data bases - Web of Science and Scopus - was carried out to get the scientific perspective on the influence of the CBD on national implementation, and to identify best practice examples.

The current analysis indicates mixed conclusions. The quantitative analysis by means of the InforMEA database leaves the impression that the search tool in connection with the Adobe Reader DC is only able to bring approximate and unreliable results. The quantitative assessment by means of the CBD database of national reports and NBSAPs also arrives at similar results. The overall results from the literature review indicate that the CBD impacts developing countries and certain “overdeveloped” countries, particularly when other international commitments are widely lacking.

Overall, the findings indicate that the implementation of the CBD contributes to enhanced land use, zoning and planning law (de lege lata) and there are many proposals in the literature on how this contribution could be enhanced (de lege ferenda). More research could be put into the quantitative side of the implementation of the CBD towards improved land use laws, zoning law and planning law. Additionally, more evidence of the causality between actions taken at the national level and the goals, targets and actions required under the CBD.

The presentation has its focus on SDG 15.5 “Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species”.

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Can Sustainable Development Goals (SDGs) aid in the implementation of the UNCLOS regarding the protection of the sea environment?

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Abstract

As the title question already indicates, the presentation will try to answer whether the Sustainable Development Goals (SDGs) can in any way aid in the implementation of the obligations regarding the protection of the sea environment. The oceans produce more than half of the oxygen in our atmosphere and act as sinks for dangerous CO_2 emissions.

Additionally, around half of the Earth's population leaves in the close proximity of the seas and the industries connected to the oceans contribute to more than 500 billion USD to the world economy. Hence, the prevention of ocean pollution and over-exploitation of the oceans is necessary for the long-term existence of the humankind and the conservation of the Earth's ecosystem. Unfortunately, the awareness of the ocean's importance is lacking, as well as is the implementation of the basic rules on prevention of pollution and over-exploitation defined in the United Nations Law of the Sea Convention (UNCLOS). This presentation will hence contribute to the debate on the relationship between the SDGs (more particularly SDG goal 14) and existing international law norms.

There are different opinions in the academic community on the relationship between SDG 14 and UNCLOS. Some authors believe, that UNCLOS itself limits the fulfilment of the SDG 14, while others believe that SDG 14 may aid in the implementation of the UNCLOS measures.

Therefore, the focus of the presentation will be mainly on the question whether SGD 14 (and if applicable in special circumstances also other goals) are only a mean of current interpretation of the existing UNCLOS measures or whether more legal weight should be given to them in this particular relationship between UNCLOS and SDG 14? While trying to answer this question the presentation will also concentrate on whether SDG 14 and its targets could be regarded as a toolbox for states to implement the UNCLOS obligations?

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Rule-based and principle-based compliance in Non-Financial Reporting: a possible convergence path?

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Abstract

In response to the growing stakeholders' pressure towards sustainable development, non-financial reporting continues to gain attention among companies, accounting standard boards, and professionals in Europe and the world.

The urgency to translate ethical and academic stance into real action is remarked by the current crisis: the recovery of the economy requires a deep change in models for pursuing, measuring, and representing the value creation.

Over time, thanks to specific standard-setters (IIRC, GRI, and others), the adoption of sustainable and integrated reports have become widespread among larger companies in Europe [1]. The law is playing a crucial role in boosting the change in production and consumption models (SDG 12], and establishing specific provisions on non-financial information (NFI), which today stand as rules for public interest entities (2014/95/EU Directive on Non-financial Reporting).

In this scenario, in a complex competitive game, the standard-setters, which are mostly nongovernment organizations, are committed to ensuring the diffusion of their guidelines, also through the aid of the lobbying parties [2], and powerful coalitions of actors who can influence the policymakers to allow the adoption [3, 4]. Scholars are focused on clarifying the differences between various standards, in terms of quality, relevance, transparency, verifiability.

In light of the above, we intends to explore how, in conjunction with the transposition of the Directive by each country in local law [5,6] companies are selecting different models for non-financial reporting.

To this aim, the research will collect and analyse data on the adoption of standards suitable to comply with the EU Directive on NFI [7], through statistical analysis, within Europe.

The results of the empirical study, in the frame of the literature background, have many practical and theoretical implications. Possible paths of evolution of guidance and framework for NFR, and of the overlay between the main standards (namely, GRI and <IR> Framework) and others, that ask for armonization and convergence of principles, and also further evolution in legal rules will be envisaged.

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Negative Emission Technologies in the Asia Pacific Region: Legal Principles and Barriers

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Abstract

In 2015, countries adopted the 2030 Agenda for Sustainable Development and its seventeen Sustainable Development Goals, the so called 'SDGs'. Climate change action is the key driver for the SDGs to be achieved globally. The Paris Agreement also sets a goal of restricting warming to within 2°C of pre-industrial levels, and pursues efforts to limit the temperature increase to 1.5°C. Most emission pathways that are compatible with these goals are heavily reliant on Negative Emissions Technologies (NETs), at a global scale to mitigate CO_2 from the atmosphere such as: Afforestation and reforestation, Land management to increase and fix carbon in soils, Bioenergy production with carbon capture and storage (BECCS), Enhanced weathering, Direct capture of CO_2 from ambient air with CO_2 storage (DACCS), and Ocean fertilisation to increase CO_2. Therefore, NETs seem necessary in order to reach the Paris targets.

Climate change is a global problem, and thus reducing the Greenhouse Gas (GHG) emissions driving this process is a global challenge. There has been wide discussion on the use of NETs, especially in the EU and the U.S. However, there has been little discussion on the technology in the Asia Pacific Region (APR) where there is an urgent need for a substantial reduction in the GHG emissions to achieve the global target.

This study aims at examining and identifying any relevant legal principles and barriers to developing the future opportunities for NETs in the APR. Concerning this, firstly, this study comprises an analytical framework by using any relevant literature to legal study. Secondly, it applies the framework for the situation in the APR. It then discusses the past, current and future issues with regard to barriers to the legal barriers within the APR. Throughout this study, we have addressed the lack of manageable evidence and guidelines provided by the Inter-governmental Panel of Climate Change (IPCC) for technical and regulatory measures of NETs, as well as a clear mitigation pathway with associated efforts and rapid deployment of renewable energies, land management, and reducing emissions of other GHGs. We have also identified a number of key legal issues in relation to the current political, policy and legal frameworks within the region. This study then concludes with a range of legal principles and barriers to developing NETs in the APR.

This study outcome is strongly related to SDG targets '7. Affordable and Clean Energy', '8. Decent Work and Economic Growth', '9. Industry, Innovation and Infrastructure', '11. Sustainable Cities and Communities', '12. Responsible Consumption and Production''13. Climate Action', '15. Life and Land' and '17. Partnerships for the Goals'. Furthermore, this study will not only contribute to overcoming future barriers to legal approaches to the NETs development in the region, but can also be applied in other technological development to take urgent action to combat climate change and its impacts

relevant to the Paris targets and SDGs. The study outcome is thus highly appropriate to the topic of the ISDRS Conference (“Accelerating progress towards the 2030 SDGs in times of crisis”).

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Constructing a Legal Framework for Carbon Capture and Storage (CCS) in Japan: Towards a Comprehensive Legislative Design

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Abstract

The Paris Agreement came into force on 4 November 2016. To achieve the target of keeping a global temperature rise this century of well below 2°C above pre-industrial levels, it is essential to realise a low/zero carbon society both at the regional and global levels. The Intergovernmental Panel on Climate Change (IPCC)'s latest report on 8th Oct 2018 also announced that the agreed Paris targets on reducing emissions would not be enough without setting larger and more ambitious targets after 2030 and maximising the capacity of a best mix approach including renewable energy, nuclear and carbon capture and storage (CCS). There has been wide discussion about CCS considered as one of the significant approaches to meeting the Paris target.

Japan, as a developed country, is now facing a challenge for meeting its mid and long-term goals for reducing Greenhouse Gas (GHG) emissions, due to the limited energy sources (e.g. nuclear and renewable energy) after the Great Tohoku Earthquake in 2011 and a trend of relying on fossil fuel energy sources (coal and gas). On 4 October 2020, Japan's new Prime Minister, Yoshihide Suga, announced that Japan is aiming to cut GHG emissions to zero by 2050 and become a carbon-neutral society. Currently, approximately 40% of Japan's carbon emissions come from power companies, and the new target is expected to be achieved by using more renewable sources of energy, while developing emerging technologies using hydrogen, ammonia and other carbon-free resources. The Prime Minister has also acknowledged that CCS technology will play a significant role in achieving the target. However, there has yet to be a comprehensive legal framework in Japan. In this regard, there is an urgent need for designing a legal framework for CCS deployment in this country.

This study aims at identifying a number of the existing legal issues and constructing a potential CCS legal framework in Japan. Our study has addressed a number of legal barriers and options in response to each criterion addressed above, relevant to the context of Japan. This study then constructs various regulatory requirements in order for the existing legal framework to be comprehensive and commercially viable for the state. The suggested key requirements are: a licence system for site-selection; a financial system to cover all the development phases (i.e. injection/storage, monitoring cost for post-closure, and costs for long-term liability and corrective measures and remediation measures); a system for transfer of responsibility; long-term liability; and monitoring potential CO2 leakage and unforeseen incidents. This study outcome is strongly related to SDG targets' 7. Affordable and Clean Energy', '9. Industry, Innovation and Infrastructure', '11. Sustainable Cities and Communities', and '13. Climate Action'. The study outcome is thus appropriate to the topic of the ISDRS Conference ("Accelerating progress towards the 2030 SDGs in times of crisis").

Full papers

Public Procurement and Sustainable Development

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Abstract

Public procurement has been evolving from an economic instrument into a mixed one with the inclusion of horizontal policies (both environmental and social ones). The latest Directives regarding public procurement have turned some of the previous "suggested" instruments into binding law, namely the sustainability principle, mandatory procedure dematerialization, ecolabels, life-cycle costing as a factor within the most economically advantageous tender criterion, social protection of persons with disabilities, specific procedure rules concerning certain social contracts, and innovation as an instrument to achieve sustainability. This legal instrument has been recognised as a strong legal mechanism to achieve the 12th SGD goal for promoting sustainable public procurement practices, in line with national policies and priorities (target 12.7). This is why public procurement actors must consider EU determinations such as The New Green Deal, which intends to make EU economy sustainable: "public authorities, including the EU institutions, should lead by example and ensure that their procurement is green"(European Commission, 2019a, §2.1.3). Since public procurement appears to be an interesting instrument for transitioning from a linear economy to a circular (sustainable) one, the EU has also published the Circular Economy Action Plan, the latest dating from March 2020 (European Commission, 2020a) and including a "sustainable products policy" to help public procurers design procurement and economic operators adapt their business models thereto. Both documents focus on "reducing and reusing materials before recycling", particularly in resource-intensive sectors such as textiles, construction, electronics, and plastics. While many Member States have been implementing green public procurement (hereinafter: GPP) in several economic fields, studies have shown that procedures still lack common methodologies, among other difficulties regarding the Life Cycle Costing (hereinafter: LCC) factor implementation. In this paper, we will therefore go through several of these national legal solutions and practices to understand how far GPP has been implemented and which methodologies are being applied (GPP Good Practice), dwelling particularly on the latest Portuguese guides concerning GPP, and analyse how far the present implementation meets the requirements of circular economy (Portuguese National Strategy of Green Public Buy 2020: hereinafter: ENCPE 2020a). This is the first step towards building guidelines for both public procurers and economic operators: as regards the first, in order to help them design adequate sustainable public procurement procedures; as for the latter, to help them adapt their business models accordingly. Sustainable development within public procurement can only be achieved that way.

Keywords: Public Procurement, Sustainability, 12th UN SDG goal, Circular Procurement

1. Introduction

Public Procurement Procedure has evolved from a typical economic tool to a complex one that embodies and pursues several dimensions of sustainable development, a "multiple-objective instrument" nowadays (Lundberg and Marklund, 2018, p. 44). The 12th UN SGD goal, *Ensure sustainable consumption and production patterns*, expressively includes Public Procurement as the 7th Target (Sönnichsen and Clement, 2020). As an instrument that serves both public entities and economic operators in their business of buying and selling goods and services, the topics of consumption and production are key factors in public procurement. Although sustainable development and sustainability should not be confused (Montini, 2020; Montini and Volpe, 2017), the ecological core of the concepts is present in the concept of sustainable public procurement. Besides the hard law of the Directives, Member States (MS) have now several soft law documents to guide them into implementing sustainability in public procurement and help public procurement to become a tool to implement circular economy. Even though circular economy (CE) is not yet a certain concept within the law - not even in economics (Kirchherr, Reike and Hekkert, 2017), although it has "a strong intuitive appeal" (Zink and Geyer, 2017, p. 600), we will try to demonstrate the adequacy of the public procurement process based upon the EU documents on the circular action plan by comparing the GPP experiences with soft law goals and tools foreseen in the two most recent EU Documents: The New Green Deal (European Commission, 2019a), which intends to make EU economy sustainable, and the Circular Economy Action Plan, the latest dating from March 2020 (European Commission, 2020a). For that purpose, we have chosen the four products targeted by those EU documents: textiles, construction, electronics, and plastics. The particular tool that 2014 Directives and the two abovementioned EU documents use is Life-Cycle Costing (LCC). The study on the use, the challenges, and the opportunities related to the use of LCC methodologies has been drawing the attention of researchers (Andhov, Caranta and Wiesbrock 2019; Caranta, 2015; Carvalho, 2019; Dragos and Neamtu, 2016; Estevan and Schaefer, 2017; Schebesta, 2014; Swarr, et al., 2011). The particular purpose is to analyse whether the path already travelled is useful to go further and embody circularity.

2. Methods

We intend to compare the circular economy concept enshrined in the Circular Economy Action Plan (CEAP), the latest dating from March 2020 (European Commission, 2020a) with The New Green Deal, which addresses the economic sustainability linked to environmental dimension as "one of [its] main building blocks" (European Commission, 2019a). For that purpose and bearing in mind that this paper is, essentially, an academic reflection in the law field, we will use, as foundations, the latest literature specifically devoted to CE related to Public Procurement. Finally, we will try to ascertain whether the GPP criteria already applied in some Member States include some of the concerns regarding circularity, using textiles, construction, electronics, and plastics as examples.

3. Results and Discussion

3.1. The construction of the European framework on Circular Economy (CE) and Public Procurement

The traditional economy process is a linear one, and the transition to a circular one is seen as an opportunity to overcome some of the most challenging problems the world and humankind are currently facing, such as climate changes and natural resources scarcity, to name the most serious ones (Popa and Popa, 2021; European Commission, 2017). Even though waste was initially the main concern (European Commission, 2014), by 2015 the EU acknowledged that waste targets were not enough. The Circular Era began (Popa and Popa, 2021) and, by December 2015, a wide range of tools were displayed, such as the European Circular Economy Stakeholder Platform and the European Cluster Collaboration Platform (Witjes and Lozano, 2016).

The first Circular Economy Action Plan – *Closing the loop – An EU action plan for the Circular Economy* – contained the definition of circular economy: an "economy in which the value of products, materials and resources is maintained in the economy as long as possible and the generation of waste is minimised" (European Commission, 2015, p. 2). The EU Communication recognises that public procurement can be helpful in pursuing the transition, namely though GPP. The Commission embraces a set of commitments: "the Commission will make sure that in future, special emphasis is placed on aspects relevant to the circular economy, such as durability and reparability, when setting out or revising criteria. Secondly, it will support a greater uptake of these criteria by public authorities and reflect on how GPP could be used more widely across the EU, in particular for products or markets that have high relevance for the circular economy. Finally, the Commission will lead by example, by making sure that Green Public Procurement is used as widely as possible in its own procurement, and by reinforcing the use of GPP in EU funding" (European Commission, 2015, p. 8). In 2017, the European Commission defined circular procurement as "the process by which public authorities purchase works, goods or services that seek to contribute to closed energy and material loops within supply chains, whilst minimising, and in the best case avoiding, negative environmental impacts and waste creation across their whole life-cycle" (European Commission, 2017b, p. 5). By 2018, the Commission proposed a monitoring system to gather up a set of indicators "covering each stage of the product life cycle". This tool allowed a site construction with "tools for monitoring progress and documents, methodologies for indicators, data sources, definitions and publication standards" particularly related to GPP (Popa and Popa, 2021, p. 25).

To better understand the transition, the Report on the implementation of the 2019 circular action plan (European Commission 2019) defined "circularity process" and related it to an adaptation of industrial processes. Design became a key factor in circularity process' implementation: "Products and services

designed in a circular way can minimise resource use and foster materials' reuse, recovery and recyclability down the road" (European Commission 2019, p. 2).

In 2020, the Commission's Communication *A new circular economy action plan for a cleaner and more competitive economy* went further and into CE implementation (European Commission, 2020a) and, in October 2020, the European Committee of the Regions presented a plan to strengthen the CE concept both locally and regionally.

Through all these EU documents and with ever-increasing visibility, the Commission has shown to be perfectly aware of the need to address the voluntary use of GPP criteria within the goal of transitioning to circularity using the public procurement tool.

Although most of the literature is uncertain about the rigour of the concept of CE and many of the papers address the waste topic, we believe we can establish that, as regards public procurement in particular, the concept must work with (a be related to) some already existing tools such as the LCC factor, which is currently of voluntary use, but will surely become mandatory in a near future (European Commission, 2020) . This tool is particularly useful and adequate to address products' design and lifespan (use, reuse, recovery, remanufacturing, recyclability, secondary raw materials, and so on). These concepts are at the heart of CE and can already be found in some GPP experiences, in soft EU law and in some of the national guidelines, such as Portugal has. Niero et al. criticize "the lack of emphasis on social contexts" (Niero et al., 2021, p. 2) and Michaux and Gruyters also highlight that the LCC is "solely focused on the inclusion of environmental parameters" (Michaux and Gruyters, 2020, p. 65).

3.2. Public Procurement rules, the path already crossed, and the one yet to be crossed

According to the Circular Economy Action Plan, "Global consumption of materials such as biomass, fossil fuels, metals and minerals is expected to double in the next forty years [OECD (2018), Global Material Resources Outlook to 2060], while annual waste generation is projected to increase by 70% by 2050 [World Bank (2018), What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050]" (§1) (European Commission, 2020a, p. 2).

The Circular Economy Action Plan focuses on the products "where the potential for circularity is high": electronics and Information and Communication Technologies (hereinafter: ICT), batteries and vehicles, packaging, plastics, textiles, construction and buildings, food, water and nutrients. It is a tool to implement *The Green Deal.* Therefore, a "sustainable framework" is set out, which includes: (i) the design phase (do note the existence of the Eco-Design Directive); (ii) the empowerment of both consumers and public buyers; and (iii) circularity in production processes (European Commission,

2020a).The design phase is responsible for up to 80% of products' environmental impacts (European Commission, 2014a). Therefore, the Action Plan dedicates some relevant reflection upon this life phase.

It is important to recall that the 2014 Directives (and the 2014/24/EU Directive, in particular) establish life-cycling costing (LCC) as a relevant factor to include in award criteria and as a tool to implement sustainable (ecological) public procurement. Sustainable public procurement can be achieved both by technical specifications (recitals 74 and ff.) and award criteria (recitals 92 and ff.) (Brammer and Walker, 2011; Witjes and Lozano, 2016). Public procurement is recognised as a tool to "support of sustainable growth" (recital 95), precisely through LCC, which includes: "all costs over the life cycle of works, supplies or services"; "internal costs, such as research to be carried out, development, production, transport, use, maintenance and end-of-life disposal costs"; it "can also include costs imputed to environmental externalities, such as pollution caused by extraction of the raw materials used in the product or caused by the product itself or its manufacturing, provided they can be monetised and monitored" (recital 96). Article 2 (20) defines life cycle as "all consecutive and/or interlinked stages, including research and development to be carried out, production, trading and its conditions, transport, use and maintenance, throughout the existence of the product or the works or the provision of the service, from raw material acquisition or generation of resources to disposal, clearance and end of service or utilisation". Article 67, no. 2, refers to LCC as a useful factor to be considered in the award criteria. Article 68 describes several aspects of the LCC factor, including the legal requirements set by EUCJ: costs relating to acquisition, use, consumption of energy and other resources, maintenance costs, and end of life costs, such as collection and recycling costs. All these costs have a straightforward link to the design stage, in the sense that most of them can be anticipated and addressed. Not all of them will have the same costs and the same relevance, but it is certain that the design phase is crucial to the life of products, goods and services.

Within the design factor, the Action Plan for Circular Economy lists a wide range of concepts that can be found in some GPP criteria: "durability, reusability, upgradability and reparability, addressing the presence of hazardous chemicals in products, and increasing their energy and resource efficiency", "remanufacturing and high-quality recycling", "restricting single-use and countering premature obsolescence", "ban on the destruction of unsold durable goods"; "product-as-a-service or other models where producers keep the ownership of the product or the responsibility for its performance throughout its lifecycle"; "mobilising the potential of digitalisation of product information, including solutions such as digital passports, tagging and watermarks"; "rewarding products based on their different sustainability performance, including by linking high performance levels to incentives" (European Commission, 2020a, p. 4). Design is therefore the key to implement circularity.

As stated before, we will focus particularly on textiles, construction, electronics, and plastics. The timeline for the implementation of the circular economy action plan is very ambitious: the latest date is 2023. The "Mandatory Green Public Procurement criteria and targets in sectoral legislation and

phasing-in mandatory reporting on GPP" is due until the end of 2021 (European Commission, s.d.) and has been supported by some of the most relevant researchers in this field of law (Pouikli, 2021; Andhov, M. et al., 2020; Melón, 2020, p. 1; Pantzar et. al., 2018).

Some examples of good practices regarding GPP criteria implementation:

Textiles: the Barcelona Sports Institute (IBE – Spain) intended to reduce plastic waste to diminish the environmental impacts of sports events, namely the "La Mercè Race". It wanted to "reduce the waste generated when athletes collect their t-shirts". Additionally, it wanted to "buy t-shirts which met the standards of MADE IN GREEN by OEKO TEX, to ensure t-shirts were free from harmful chemicals and made under safe working conditions". A procurement process was built for the 2019-2020-2021 race, implementing sustainable measures regarding transport (vehicles' environmental impact certification, use of eco-vehicles, etc.), waste (packing requirements and calculation of waste reduction), fibres (use of green fibres), design (comfort and breathability), and the reduction of the production period. Such requirements were useful: "the new race t-shirts are certified by MADE IN GREEN OEKO TEX, and are delivered using ECO vehicles, which leads to less CO2 emissions and reduces air pollution in the city. The packaging used to deliver the t-shirts has been reduced by over 75%, through the delivery of the t-shirts in reusable crates that the company takes back, after the t-shirts have been distributed to the runners' packs prepared for the race" (GPP In Practice, issue no. 99, September 2020, pp. 1-3). In 2015, the Municipality of Odense, Denmark, "published a call for tender which sought to include all elements of clothing provision to health professionals within one contract: leasing, collection, washing, and return of clothes to various points in the Odense Municipality. In addition, the supplier was to become responsible for the logistics of the service". Some of the abovementioned features of circularity can be traced here, such as leasing instead of buying, and the outsourcing of the logistics. Sustainability concerns were enshrined in both technical specifications and award criteria. As regards technical specifications, "purchase and use of low-toxicity textile products, preferably products and fibres with limited environmental impact during manufacture and made from fibres grown with minimal use of pesticides, and minimi[zation of] the environmental impact of use, maintenance and disposal of textile products"; environmental management certification was required "in order to support Odense Municipality's compliance with the POGI targets". Within the award criteria, service and sustainability weighted 45%, in line with the implementation of the LCC factor. Tenderers had to describe the production process and the measures taken to reduce environmental impacts: the measures taken to reduce the consumption of water, oil, pesticides, fertilizers, energy and CO2 emissions, and those regarding the recycling of disposals. Circularity features such as sourcing, manufacturing, use and end-of-life are particularly relevant within textile production: "an environmental improvement offered by the successful bidder was related to the recycling of discarded work clothes for new products. Textiles which are no longer suitable for clothing are now being recycled to produce 'OdensePoser' textile shopping bags, made by people employed on social clauses, to

promote sustainability within Odense" (GPP In Practice, issue no. 87, April 2019, pp. 1-3). Another example regarding textiles made from recycled fibres is found in the Netherlands, related to the procurement of towels and overalls, which had to contain "at least 10% recycled post-consumer cellulose fibres, [which] had to come from post-consumer textile material, as opposed to production waste or other alternative sources" (technical specifications)" (GPP In Practice, issue no. 77, December 2017, p. 2). Again, recycling is used as a way to implement circularity in public procurement.

These three examples are illustrative of the possibility to enshrine circular requirements into public procurement. *The EU Green Public Procurement (GPP) Criteria for Textile Products and Services Report* gives a set of examples of how to draw the procurement process and underlines the importance and benefits of the use of LCC as an analytic tool. It recognises the complexity and variation of the process, which depends on the nature, origin, use and end-of-life of the final product.

The European Commission has established five key aspects regarding the impact of textiles during their life, addressing fibre sourcing, chemical restrictions, durability and lifespan extension, energy conservation during use; and design for reuse and recycling:

Table 1

European Commission, 2017a, p. 8

Key environmental aspects	GPP approach
• Hazardous effects on the aquatic environment due to the use of hazardous fertilisers and pesticides during the cultivation of natural fibres. • Hazardous effects on the aquatic environment due to substances used during the processing of intermediate and final textile products. • The use of biotic and abiotic resources from forestry, petroleum and natural gas to manufacture fertilisers and fibres. • Greenhouse gas emissions, acidification and smog resulting from the production and use of electricity and natural gas used to manufacture synthetic fibres and to wash, dry and iron textiles. • Early product failure which can result in the consequent waste of biotic and abiotic resources, and their landfilling or burning with potential for hazardous emissions to air and water.	• Purchase textiles made from fibres which are produced using fewer fertilisers, hazardous pesticides and production chemicals. • Purchase textiles that contain recycled materials and fibres. • Purchase textiles with a reduced use of environmentally harmful and hazardous substances in their production. • Purchase textiles that require less energy for drying and ironing. • Purchase colour-fast fabrics that do not shrink during use, that are constructed to be more durable in use and which have longer-lasting functional coatings. • Contract services that minimise the energy used to wash, dry and iron textiles. • Contract services that maintain textiles in order to extend their lifetime. • Contract services that reuse maximise the potential for reuse and recycling of textiles at the end of their service life.

The document addresses the LCC methodology and underlines its importance of reducing "the life cycle costs associated with their laundering, maintenance and end of life: (…) energy associated with washing, drying and ironing textile products"; lifespan, and disposal (European Commission, 2017a, p. 32). Since December 2020, Portugal has adopted some GPP criteria regarding textiles which are very similar to EU GPP criteria. The main concerns regard fibres' origin; chemical restrictions; durability and prolonged service life; energy conservation during use conservation of water consumption and quality; and design with a view to reuse and recycling. Life-cycle analysis is a key tool in the Portuguese Manual and is centred in cotton, wool, synthetic fibres, man-made fibres, "energy consumed in the

processes and ecotoxicity associated to the production phases", and "release of microfibres in the washing process during use phase". The use of mixed contracts including services regarding maintenance, recovery, and recycled raw materials is one of the possibilities (ENCPE 2020a, pp. 9 and ff).

Road design, construction, and maintenance: The municipality of Frederiksberg, Denmark, has a particular environmental constrain regarding heavy rainfall combined with old sewage network. Therefore, urban flooding is a reality that has the danger of becoming more regular due to climate changes. Thus, the municipality launched "a number of projects to improve rainwater management. By improving the city's 'green' and 'blue' infrastructure (such as vegetation and water features), rainwater can be captured, and its flow can be diverted from sewers or slowed down". An innovative partnership was the chosen tool. The municipality sought for solutions to withhold rainwater from sewages and roadways and allowed both the use of existing road structure and the building of other structures. The award criteria foresaw a 20% deployability rate for the implementation of the solution presented (flexibility and modularity). The solutions proposed used the existing trees for retained rainwater, "saving time, water, and CO2 in terms of the trucks used for these maintenance operations), and reduc[ing] pressure on existing drainage networks by diverting water through transpiration (evaporation from trees)". This example demonstrates the contribution to climate changes fight and water circularity within a road problem (GPP In Practice, issue no. 97, June 2020, p. 2).

In 2016, the European Commission published some GPP criteria regarding road construction and identified the "most significant environmental impacts of roads": rolling resistance; congestion; "resources used and the emissions and ecosystem impacts associated with materials production, including extraction and transportation"; maintenance and rehabilitation; environmental noise emissions; and storm-water drainage. The tools to address the impacts of road construction are life-cycle assessment (hereinafter: LCA) and carbon footprint (hereinafter: CF). Portugal has issued a Manual with criteria that are very similar to those of the EU concerning design, construction and major repair, use, rehabilitation, maintenance, operation, and end of life. The particular features regarding use, for instance, are "rolling resistance associated with the texture of the road surface", traffic jams, extraction, processing and transport of construction materials, traffic flow, environmental noise emissions, and storm water drainage. LCC, carbon footprint, recycled, reused and reusable materials, and CO2 emission reduction are also tools inserted therein (ENCPE 2020, p. 13).

Electronics: computers, monitors, tablets and smartphones: there are several good practices regarding Information Technology (hereinafter: IT). In Sweden, in the Region Stockholm, there is a programme is being applied to reduce greenhouse gas emissions with relevant success. Even though the focus had initially been on transport and energy, IT procurement was also considered in the environmental requirements: "the Region Stockholm has identified ICT as a priority area to be addressed in their procurement, due to the high risk of human rights, labour rights, and child labour violations within the

supply chain". Therefore, the public body intends to procure products that are free of "substances hazardous to the environment and human health, have a low environmental impact from a life cycle perspective, and stimulate sustainable product development, while reinforcing social responsibility in the supply chain for goods and services". Thus, the technical specifications are focused on energy savings, and products to be halogen free, mercury free (documentation to confirm this is required for the last two requirements), and PVC free in the package, while "cellulose in packaging must be of recycled pulp, unbleached pulp, or pulp bleached without chlorine gas". Environmental factors weighed 15%, in the award criteria and environmental impact from a life cycle perspective and durability were among the factors taken into account in the process. Sustainable supply chains were required as contract performance clauses as well. Thus, some of the circularity issues are already addressed therein: energy savings, LCC perspective, durability, and supply chain sustainability (GPP In Practice, issue no. 89, July 2019, p. 2). Just about the same concerns, earlier, in 2016, the United Kingdom and Scotland sought for supply of ITC devices. Technical specifications focused on energy efficiency, product lifecycle, management of delivery fleet ("All deliveries should be managed in order to minimise emissions, including use of efficient logistics, full loads and driver training"), mandatory continuous monitoring duties, innovative packaging (to reduce waste and in line with "a more circular approach, innovative packaging solutions were sought that included take-back pallets or crate systems and alternative packaging materials"; these solutions sought waste minimisation, re-use, package recycling, and sustainable sourced materials), devices' end of life management, and circular economy (WEEE Directive: "emphasis was placed on repair, refurbishment and re-use of devices and the frameworks sought to embed this as a key requirement and encourage the market to go further"). I believe the example speaks for itself regarding the connection of public procurement and circularity within the technical specifications. In what regards the award criteria, these concerns weighed 50% altogether (GPP In Practice, issue no. 69, March 2017, p. 1). Portugal also has an example of IT procurement where energy efficiency was a deep concern. A municipality association (LIPOR) wanted to rent multifunction printers with high energy efficiency and, therefore, defined the technical requirements and "organised informal meetings with potential service providers in order to assess their ability to meet the tender criteria and communicate its benefits". In terms of energy efficiency, it received a "significantly better offer than the minimum required in the tender" (European Commission, 2016a).

This year, the European Commission published the GPP criteria regarding computers, monitors, tablets, and smartphones (European Commission, 2021). The Report addresses (i) product lifetime extension (reparability, reusability and upgradeability; rechargeable battery life and endurance; mobile equipment durability testing; Interoperability and reusability of components); (ii) energy consumption; (iii) hazardous substances; (iv) end-of-life management; and (v) refurbished/remanufactured equipment (supply of refurbished/remanufactured ICT equipment; service agreement associated with the supply of refurbished/remanufactured ICT equipment). The LCC tool is also considered to be suitable to

calculate costs related to acquisition costs, delivery and installation costs, maintenance/service costs, operation costs (energy consumption), fees, taxes and other costs, and externalities (CO2 emissions linked to energy consumption). Portugal has a Manual regarding ITC, but health related. Still, energy efficiency and life span are again the main concerns (ENCPE, 2019, pp. 5, 8 and 17).

Plastics: this issue is normally addressed in waste management or embodied in other issues that involve plastics as packages, as we have seen in previous examples.

Even though there are many examples of voluntary use of GPP criteria, the trend of turning them into mandatory GPP criteria has been growing: "given the size of public procurement in the EU economy" ("Public procurement is worth an estimated 14% of GDP in the EU, according to the CEAP"), GPP "can be an effective instrument in bringing about a wider change in the market by creating demand and acceptability for more circular products, and business models, which, at scale, may contribute to reducing the EU's material consumption" (Pantzar and Suljada, 2020, p. 14); (Testa et al., 2016). The fastest way into mandatory GPP criteria is to take advantage of the existence of guidelines and move "from voluntary guideless to mandatory criteria" (Pantzar and Suljada, 2020, p. 14). This option is not free from challenges, as we have already pointed regarding LCC implementation (Carvalho, 2019) (Testa et al., 2016; Testa et al., 2012): the lack of expertise in contracting authorities, the absence of reliable database, the absence of standardization, citizens' mistrust regarding costs (Lundberg and Marklund, 2018; Brammer and Walker, 2011), and the lack of methodologies capable of demonstrating the economic gain within the green concerns embodied in technical specifications and award criteria. Halonen further highlights that the economic discussion regarding GPP is made in a very outlined perspective, only considering transition costs, and not taking into account the societal effects, that remain unknown (Halonen, 2021, p. 7-8).

Furthermore, it will be necessary to address the differences among the several goods and products, and to reflect upon how this process can be adapted to services. Pantzar and Suljada (2020, p. 14) also underline the need to address the issues concerning prioritisation and include "more than energy use" . In parallel with the adoption of mandatory GPP criteria within the sustainable product framework, we can find in the description of the legislative proposal many of the sub concepts related to circular economy: durability, repairability and recyclability of products; value retention and reuse; digitalisation; energy efficiency; and right to repair (Pantzar and Suljada, 2020). The authors propose a "centralised system for environmental product information in the EU to support industry and regional initiatives in the transition towards circularity" (Pantzar and Suljada, 2020, p. 10); (Pantzar et. al., 2018). One of the tools is the widening the Eco-Design Directive – Directive 2009/125/EC, 21st October (energy-related products). There is also a directly related public procurement Directive regarding energy efficiency – Directive 2012/27/EC, 25th October. However, Pantzar and Suljada recognise the potential issue related to this tool: "it needs to be accompanied by the development of standards and testing methods to support harmonised verification of new requirements" (Pantzar and Suljada, 2020,

p. 11). Another tool is proposed, this time regarding citizens: to legislatively create a procedure of "substantiating green claims", replacing the different procedures already in force that are creating "confusion and possibly eroding consumer confidence in the legitimacy of the claims" (Pantzar and Suljada, 2020, p. 12). Finally, the authors claim the transparency and reliability of the information addressed to both consumers and economic operators. This kind of information may potentiate citizens' awareness to the topic and change behaviours. As for economic operators, this awareness may drive them to apply both the concept and the sub concepts into their business models (Witjes and Lozano, 2016). Both situations will benefit the public procurement procedure by meeting the requirements within the technical specifications, terms and conditions, and award criteria. Pantzar and Suljada are sceptic regarding this societal effect: "there is limited evidence to suggest that improved information about products' environmental impacts, such as eco-labels, result in real-life changes in purchasing behaviour because of various rebound effects, subconscious routines and habits, etc.; let alone at the scale required. Our choices as consumers (be them household, private sector or public) remain largely driven by price and convenience" (Pantzar and Suljada, 2020, p. 13).

Once mandatory GPP criteria are established, and the European Commission "will propose minimum mandatory green criteria or targets for public procurements in sectorial initiatives, EU funding or product-specific legislation" (European Commission, 2020, p. 12), it would be important to monitor their implementation (Cheng, et. al., 2018). So far, voluntary GPP criteria implementation has been a disappointment. For instance, in Portugal, the latest Report assessing green public buy, by the Court of Auditors, precisely expresses no monitoring, whereas environmental criteria/factors are given little relevance (Court of Auditors, 2020). The perception of this implementation may be very useful to endorse and support public policies and try to change citizens' behaviour in this matter, even though Pantzar and Suljada's recommend to "avoid a sole focus on citizens' role in changing consumption behaviour" and focus on public and private operators' responsibility (Pantzar and Suljada, 2020, p. 24). Furthermore, monitorization will also allow to assess whether products, goods, and services are effectively "circular" and "green", as declared. Having the label of circular or environmental conformity should not be enough to "automatically [assume the good or the product] to benefit the environment" (Pantzar and Suljada, 2020, p. 16). Sometimes, remanufactured products are "resulting in environmental impacts of both the primary and secondary production" (Pantzar and Suljada, 2020, p. 16), (Zink and Geyer, 2017).

Circular public procurement is already being implemented whenever technical specifications and/or criteria award embody factors such as reuse, recycled materials, remanufactured materials, repair, services rent, and so on. We have described some examples of effective procedures and Manuals that enshrine those concepts. Although there are several possible concepts of CE, as Kirchherr, Reike and Hekkert (2017, p. 229) refer, CE is "an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and

consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations". This economic perspective is capable of being "translated" into law requirements.

We believe that one of the most relevant hindrances for the transition to circularity within public procurement is Member States' economic development. Asymmetries in development persist, which will slow down the transition from linear to circular processes, also in what regards public procurement (Sönnichsen and Clement (2020) . These asymmetries are relevant to the existence of the barriers identified by Gasfström and Aasma (2021).This transition to a circular procurement will not be possible without the commitment of procurers, economic operators, and civil society. The law is only a small input (Testa et. al., 2016), and it seems rather settled that, as Sönnichsen and Clement (2020, p. 15) underline, there are three dimensions of circular procurement: "organisational aspects, individual behaviour and operational tools". The barriers rely, as Gasfström and Aasma state, "on very particular contextual conditions, including jurisdictions, consumer preferences and the presence or absence of various other institutional settings". Therefore, the national context analysis must be the starting point to address those barriers (Gasfström and Aasma, 2021, p. 11). Furthermore, from the standpoint of economy, the public policy makers must ensure "that products are good substitutes for benchmark alternatives and [focus] where buyer price sensitivity is low" (Zink and Geyer, 2017, p. 600).

4. Conclusions

The legal (both hard and soft EU Law) framework is clearly converging into linking sustainability to the transition to a circular economy. Joining in the SDG goals – the urgence of climate change –, the public procurement process, initially a fully economic instrument, is perceived as an important instrument to help that transition. Both the aforementioned examples and the existing guidelines regarding IT, textiles and road design, and construction and maintenance, clearly show that the public procurement process can be very relevant in the effort to transit to a circular economy. Several key circularity features are therefore being included in both technical specifications and award criteria, fomenting recycled raw materials, reuse, remanufacturing, refurbishment, repair, etc. The LCC methodology is being increasingly used in these procedures to assess the fulfilment of the requirements. Member States' efforts to implement GPP criteria (not mandatory yet), is a step further for Public Procurement to become an instrument of Circular Economy implementation.

There are still challenges ahead, though. The transition to a full circular public procurement must be holistic, and it must rely not only on the main actors within public procurement, but on the awareness of civil society as well (Niero et al., 2021, p. 8). Nevertheless, some public procurement procedures

already include some circular concepts in technical specifications and award criteria. However, one must remain open to the possibility that public procurement may not be the most appropriate instrument for pursuing the objectives of sustainability, from the perspective of "Law and Economics". Halonen uses the Tinberger rule, "applied in economic research on GPP, to demonstrate the tool's limitation to "drive such green transformation" and the "ambuiguity regarding which environmental targets the use of certain GPP criteria aims for" (Halonen, 2021, p. 17). Nevertheless, as Gasfström and Aasma state, "despite high gains of circular economy implementation, progress on the macro, meso and micro level is sluggish" (Gasfström and Aasma, 2021, p.1). There are some barriers, some of them similar to LCC implementation: technical barriers related to design stage and waste separation; market barriers regarding business models; institutional barriers concerning inconsistent public policies and infrastructures and social barriers related to "lack consumer awareness" (Gasfström and Aasma, 2021, pp. 6-7). On the other hand, Zink and Geyer highlight that, due the overlook of the economy part, "circular activities can lead to rebound by either failing to compete effectively with primary production or by lowering prices and therefore increasing and shifting consumption" (Zink and Geyer, 2017, p. 600).

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Direct Tax laws for sustained growth: A study of legislative and administrative steps in India

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Abstract:

The sudden occurrence of Covid-19 pandemic affected millions of lives in India. The Indian government took immediate steps to give relief to the taxpayers under Direct Tax laws to sustain their livelihood and stabilize the economic growth. These steps provided immediate support to the dwindling economic growth due to the imposition of a nationwide lockdown in the last week of March 2020, viz. retaining more money in the hands of the taxpayer rather than remitting to the Government. Post-lockdown, further measures were undertaken to address the genuine concerns and hardships of the taxpayers. The Indian Union Budget 2021 laid down in the Indian Parliament in February 2021 brought about more direct tax law reforms for rapid recovery and sustained economic growth for all sectors of the economy.

The focal point of the research is to study these steps and understand the effect of these steps on the sustenance of economic growth in India. The paper aims to study the suggestions of international organisations, namely UNCTAD, IMF, and OECD, on post-Covid handling of the economic growth. This paper proposes to relate to Goal no. 8 of the Sustainable Development Goals (SDG), i.e., promoting sustained and inclusive economic growth, full and productive employment, and decent work for all.

Keywords: direct tax, sustained growth, public policy, direct taxation, covid pandemic

1. Introduction

With the advent of the concept of the welfare state and planning, the State is now not only meant for maintaining law and order but is also expected to look after the socio-economic and political welfare of the individuals. For this, the State has to incur heavy expenses on education, healthcare, and other public utility works, which are met through taxation. Therefore, the pertinent question is not to tax or not, but to maintain a sound, equitable, and just tax system and an efficient and effective tax administration. Government finance needs to be sustained to promote sustainable development. Provisions need to be made to provide social security, and infrastructure for health care needs to be developed. Tax revenues need to finance public goods and services to achieve sustainability. Taxation structure is crucial for development and can be used to incentivise/disincentivise certain activities. Tax administration is also an important institution of democracy.

Developing countries find it hard to collect adequate revenues. Sufficient tax revenues increase their development effort and give them policy independence from fiscal space to flexibly design developmental projects and manage the vagaries of the economic cycle. Adequate tax revenues in developing nations provide them autonomy, and that would mean less foreign and domestic borrowings and more stability of the revenues. Taxes are less volatile and more predictable than aid (in terms of flows) and debt (in terms of yields) and require no servicing, unlike debt.

Taxation is therefore limited to these issues, and an impartial and effective taxation system is important for improving the financial situation (UN, 2002).[1] The link between development and taxation finds mention in the erstwhile UN's Millennium Development Goals (MDGs). Governments across the globe do acknowledge that revenue mobilisation is vital to achieving the MDGs (Maaike, 2008)[2]. UN's Sustainable Development Goal (SDG) 8, given in 2015 (UN, 2015)[3], has the notions of MDG Goal no. 8, amongst which the relevant are enumerated as under:

"8.1 Sustain per capita economic growth in accordance with national circumstances, and in particular at least 7% per annum GDP growth in the least-developed countries

8.2 Achieve higher levels of productivity of economies through diversification, technological upgrading and innovation, including through a focus on high value-added and labor-intensive sectors

8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage formalization and growth of micro-, small- and medium-sized enterprises including through access to financial services."

India, like many other countries of the world, is still struggling with basic deprivations. Going by the performance of the Indian economy on the standard developmental parameters and development still remaining the fundamental goal of all public policy, taxation has a vital part in this domain. The public policy measures are the interventions done by any government through the framing of laws, rules & regulations, including setting its priorities through annual financial statements (Budgets). The taxation proposals in the annual budgets laid down before the legislature establish the financial and monetary priorities for the government, and various tweaks are undertaken to channelise the flow of funds through a targeted approach. The government aims to bring about inclusive growth through diverse social welfare programs, infrastructure projects, and human capital social development programs. Direct taxes account for more than 50% of the total tax revenues of the Indian Union, and this share is expected to grow in the coming years with the widening of the tax base in the country. The ratio of total tax revenue to GDP in the OECD countries is about 33 to 34 percent, while in India, we have a long way to go, as the ratio hovers from 10 to 15 percent. Even though the compliance levels may vary, so far, the direct taxes are concerned amongst the developing nations, a major indicator in the form of tax to GDP ratio remains more or less in the same bracket.

The policy measures through direct taxation directly impact the money or capital left in the pocket of individuals and the entities viz. companies, firms, etc., which further provide employment and become partners in growth. Any status-quo on the taxation provisions could have a disastrous impact on liquidity in the market, leading to the building up of recessionary tendencies in the economy. Therefore, this paper intends to evaluate the impact of steps taken during the critical Covid pandemic times in revival strategies made by the government for

resource mobilization, explicitly focusing on the interventions made through the application of direct taxation. The SDG 8 can be achieved through policy interventions of the direct tax administration.

2. Method and Materials

The researchers shall follow partly the 'Doctrinal' and partly the 'Empirical' methods of research. Relevant legislative, administrative steps and decisions would be analysed besides relevant Government reports on tax revenues and GDP data.

Christian von Haldenwang, Jakob Schwab "Pathways to International Tax Governance: Has the German G20 Presidency Made a Difference?" *Global Summitry*, Vol 3, Issue 2, Winter 2017, pp 141–155.[4] This article deals with developments in global tax and progress reached so far. It is limited to studying Germany and managing spillovers in the current international system for developing countries. It does not talk about direct tax measures to combat the pandemic.

Daniel Susskind, David Vines "The economics of the Covid-19 pandemic: an assessment "*Oxford Review of Economic Policy*, Vol. 36, Issue Supplement 1, 2020, pp S1–S13[5]. The study deals with the crisis of the Covid pandemic and the challenging task of policymakers to have newer interventions. It observes that global challenges require international cooperation. The focus of the paper is on global cooperation.

K D Ewing, Lord Hendy (2020) "Covid-19 and the Failure of Labour Law: Part 1" *Industrial Law Journal*, Vol 49, Issue 4, pp 497–538.[6] This article considers how Covid revealed that the central function as close as labour law had been ignored by previous régimes in Britain. The research look at the absence of satisfactory provisions for income security, exploitation of key sector workers, and their health and safety issues related to work. The research talks about revelations related to the workforce and does not talk about the effect of direct tax measures on post covid scenarios.

Neil Levy and Julian Savulescu (2021) "After the Pandemic: New Responsibilities" *Public Health Ethics*[7]. The research focuses on the challenge of Covid-19 and response to it. It advised that our reply to the pandemic changes our wisdom on the questions of options we have. It does talk about responsibilities but not tax measures and their role in post-covid recovery.

Mary Johnstone-Louis, Bridget Kustin, Colin Mayer, Judith Stroehle, Boya Wang "Business in times of crisis "*Oxford Review of Economic Policy*, Vol 36, Issue Supplement_1, 2020, pp S242–S255[8]. The article brings out that as part of Covid-19 crisis management, the government has provided special bailout packages to businesses and institutional investors. It expresses that businesses must adapt to the changing choices of the customers, preferences of employees, and communities by knowing the value proposals justifying seeking risk capital of institutional investors. The research is, however, not towards tax measures.

Richard Gower, Emily Benson, and Hannah Stoddart (2015), "Aligning corporate tax policy with the Sustainable Development Goals" background paper for the Business and Sustainable Development Commission[9]. The research reflects that tax plays a vital role in every modern economy. Many businesses justifiably cite tax as a significant obstacle to enterprise development and economic growth. It deals with the interplay between business practice and taxation, affecting the Sustainable Development Goals (SDGs). Business tax revenue is a key part of this

picture. Corporate income taxes already contribute 17 percent of total tax revenue in developing countries, almost ten times as much as personal income taxes. However, the SDGs cannot be achieved through revenue-raising alone. It concludes that investment incentives are needed for positive, sustainable development outcomes.

Yadawananda Neog & Achal Kumar Gaur "Tax structure and economic growth: a study of selected Indian states" Journal of Economic Structures 9, Article number: 38 (2020)[10]. The study discusses the relationship between tax structure and growth (1991–2016). The model of Acosta-Ormaechea and Yoo (2012) has been analysed and verified through the panel regression method. The effect of income tax, goods/services tax, and asset/capital transaction tax on growth has been studied. It finds that a 'U' shape relationship exists between growth performance and tax structure.

Gregory De Paepe and Ben Dickinson (2014) "Tax revenues as a motor for sustainable development" Development Co-operation Directorate and Centre for Tax Policy and Administration, OECD[11]. The article discusses that tax revenues and sustainable development reduce poverty and increase State accountability. It contends that the OECD nations collect an average of 34% of their GDP as tax, whereas developing countries hover at less than or near to one-half of this percentage. This indicates the possible potential tax income in developing countries and the challenges faced by the tax administrations.

"The impact of tax on delivering the sustainable development goals" KPMG Report[12] (Morgan, 2017) highlights how tax policy may support the SDGs – either through general tax-raising or supporting specific SDGs. It raises points for further discussion.

The literature review revealed that a study to weigh the direct tax measures and their contribution to post covid recovery is need of the hour. The emphasis is also laid on analyzing suggestions of the global bodies, the efforts recommended by them and taken in India to come out of the ongoing corona pandemic. Critical focus is also placed on relevant authoritative texts and scholarly material available on the subject matter.

3. Discussion and Results

The Covid-19 pandemic forced nations across the globe, including India, to lock down to contain its spread. This had a profoundly adverse impact on the ongoing economic activities, especially for the developing nations, which were already struggling to come out of the subtle recession across the globe. The Union government in India took immediate steps on the economic front to address the falling incomes of individuals and entities. The economic measures included the announcement of a relief package of Rupees twenty lakh crore by the government in March 2020 for various sectors of the economy, giving direct money transfers to farmers to the tune of Rupees 6,000 per year to around nine crore eligible farmers, etc. These steps provided the immediate support needed to the falling economy due to the sudden lockdown. The Union Budget announced on February 1, 2021, further enhanced the momentum of these sustained measures. The reform measures by the direct tax administration in India gained momentum with the announcement of the Budget 2021 viz. introduction of Faceless Assessment & Appeal Schemes and Faceless Penalty Scheme and faster processing of Income Tax Returns (ITRs) by the Centralised Processing Centre & consequential issuance of refunds, etc.

3.1 **International organisation's response / recommendations [OECD / IMF / UNCTAD]**

The OECD became one of the front-runners and came with an initial report[13] (OECD, 2020) in April 2020, suggesting various measures for various countries on using tax as a relief measure in coming out of the COVID situation and the need for post COVID recovery efforts to support the individuals and businesses facing liquidity issues and compliance burden. It advocated for exceptional tax measures to restore economic growth and increase the falling cash flow in the economy due to the Covid-19 slowdown. In a recently released OECD Report in May 2021, namely, Tax Co-operation for Development (Progress Report in the Covid-19 era)[14], the OECD highlighted that the current pandemic spotlighted the challenges faced by health sector financing, demonstrating the pan-global nature of such challenges. It concluded that tax reforms could contribute to sustainable health financing in developing countries through targeted taxes for health sector spending, wider social security actions/reforms, and even taxation for environmental protection.

It suggested increasing the international collaboration through Information Technology platforms for seeking new ways of recovery and enhance welfare payments, social security contributions, and income support for the people. It also advocated the e-processing of income returns and the issuance of refunds to the taxpayers to enable them to absorb the economic shock.

The tax equity[15] (Murphy and Nagel, 2002) implementation has been challenging for the governments. Taking into consideration such equitable measures, the Fiscal Affairs Department (Gaspar, 2020) of the [16]International Monetary Fund (IMF), looking after the international lending, economic and capacity development, opines that taxation has to play a progressive and inclusive role to provide a level playing field to small and large taxpayers through IT-related intervention. Another publication of the IMF Fiscal Affairs Department, titled, Tax Policy for Inclusive growth after the pandemic[17](Ruud, 2020), released in December 2020, acknowledged that the fiscal policy would continue to play an important role, suggested for inclusive recovery through the progressive tax system. It concludes that most countries have options to promote inclusive growth through tax reform.

For developing nations, [18]economic reforms (Corea, 1977) and technological upgrades are important. Considering this, the Secretary-General of the [19]UNCTAD (Kituyi, 2020) suggested various measures for the global economies to tide over the current COVID crisis. It was recommended to help local MSMEs, which are the backbone of the economies of any nation and can play a vital role during this pandemic in terms of industrial production/manufacturing and employment. In a recent SDG Investment Trends Monitor Issue[20] (Zhan, 2021), on progress since 2015 in promoting SDG investment in developing economies now at risk due to Covid-19, UNCTD stated that the outlook for investment in the SDGs is highly uncertain. It further noted that the Covid-19 pandemic significantly exacerbates SDG financial gaps in the developing economies and suggested international private investment to plug such gaps as large public support would have an overall asymmetric effect on SDGs. The UNCTAD supported focusing on the flow of free trade, and the role of the private sector has been specially recognised and highlighted for more equitable and sustainable economic growth.

3.2 Sustainable Development Goals

It is estimated that low-income nations need to increase expenditure to reach the SDGs. These countries may require international co-financing as investments are likely to grow more than the mobilization of private and domestic public resources. In some situations, targeted taxation will help achieve identified goals such as relating to changes in the environment or funding higher education; however, the most significant issue is increasing the overall tax collections in developing nations to invest in the SDGs. Tax is linked to development in its most complete, holistic sense. A progressive tax structure can help promote equality, democracy, accountability, and good governance. The multifaceted role tax policy plays can be seen in looking at Goals 8 and 10. Goal 8 (Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all) and Goal 10 (Reduce inequality within and among countries) show that balance needs to be maintained. Taxes need to support sustainable economic development, remain progressive, decrease inequality, and encourage inclusive growth. The above two objectives are not necessarily in conflict but are not totally aligned. Extremely high taxes on business and wealthy individuals to fund SDGs may help achieve some goals in the short term and may also be detrimental. Increasing VAT (indirect taxes) and reducing personal income tax and corporation tax may also have the same effect. Therefore, the tax must be fair, reduce inequality, and sustain economic growth. In the long term, these goals go hand in hand as an unequal society cannot support growth while poor economic performance reduces the tax required to sustain public assets. It is often argued that corporate taxes are inefficient in nature and act to impede economic development and should be low and as needed to raise sufficient tax for development. There could be a low tax rate on new businesses though it can be a disincentive for businesses to grow.

3.3 Measures by Indian Government

In continuation to the self-reliant approach adopted by India to reduce the dependence on foreign capital and technologies[21] (Baru, 1983), in May 2020, Aatmanirbharta, a new self-reliant approach, was advocated by the Prime Minister of India, wherein the new India needs to leverage the local resources and technology for a self-sufficient India. Under the overall guiding framework of this approach, a substantial financial package for about Rupees twenty lakh crore was brought by the government for boosting economic growth and countering the adverse impact of Covid.

In addition, the Government of India, in November 2020, also approved a Production-Linked Incentive (PLI) Scheme for the ten key sectors of the Indian economy, intending to enhance India's manufacturing capabilities as well as exports for an initial outlay of Rupees 1,45,980 Crore. The industries covered under this scheme will be incentivized on the increase of their production and employment in the country as per the formula devised by the government. This new scheme will inter-alia attract global investments, the latest technologies in India, enhance efficiency and make India an integral part of the worldwide supply chain. The extension of the scheme to the food processing industry in March 2021 will increase employment opportunities and ensure sustainable prices of farm produce for the country's farmers.

The stimulus plans to invigorate MSMEs which are the backbone of our industrial sector, target the poor, including farmers, undertake government reforms, and look for new horizons of

growth in the country. The [22]overall stimulus (Sitharaman, 2020) provided by the government earlier, and measures introduced in five parts are stated to be around Rupees 20,97,053 Crore.

3.4 **Direct Tax measures**

The Central Board of Direct Taxes (CBDT) of the Government of India, the body responsible for the management of Direct taxes in India, took immediate steps to negate the effects of falling economic growth on account of nationwide lockdown in March 2020. The Taxation and Other Laws (Relaxation and Amendment of Certain Provisions) Act, 2020, was brought, which addressed the issues related to the strict timelines provided under the Indian Income Tax Act, 1961.

The important [23]steps (CBDT, 2020) taken in this direction inter-alia include the '*Jhatpatonline* Processing' (express online processing) initiative introduced to fast process the ITRs and expeditiously grant the refunds. By the end of March 2021, around Rupees 2.61 lakh crore of direct tax refunds have been issued to 2.38 crore taxpayers during this financial year. The government introduced a dispute resolution scheme in March 2020 under the name '*Vivad se Vishwas*' Scheme, which was extended up to March 31, 2021, and to be filed through web-portal only. As a progressive tax policy and to honour the honest, CBDT, in August 2020, introduced a Taxpayer Charter in the form of fourteen-point obligations of the revenue and six-point duties of the taxpayer, which includes providing time-bound electronically enabled services to the taxpayers.

Further, in this direction, the Prime Minister of India, on August 13, 2020, launched a team-based faceless tax assessment (called Audit in developed nations) of ITRs to provide transparency and technology-driven governance. This seeks to do away with the human interface and conduct a faceless assessment. The scheme's key features include the selection of the assessment unit/ jurisdiction only through the system using data analytics and artificial intelligence in an automated manner. In order to operationalise the above features by the CBDT, a framework for faceless assessment would set up as 'centres' and 'units' with their respective jurisdiction. There is an establishment of 'National e-Assessment Centre' and 'Regional e-Assessment Centers' for identifying points or issues. 'Verification units' for enquiry, cross verification, etc., and 'Review units' for reviewing the draft assessment order. The above scheme is presently running successfully, and around one lakh cases have already been finalized out of more than two lakh cases assigned under this scheme so far. This will also bring down the compliance costs for the taxpayers and therefore is a great step for progressive taxation policy as recommended by the international agencies. The CBDT also introduced the faceless first tax-appeal scheme in September 2020 as a continuation of the government initiative for fairness and transparency to eliminate the physical human interaction. The tax administration has also launched a web-based tax evasion reporting portal in January 2021 for facilitating ordinary citizens in lodging complaints about tax evasion and Benami (masked) transactions.

The other direct tax measure under Budget 2021 to reduce compliance burden was that it decided to exclude senior citizens over seventy years of age to file their ITRs who have only pension and interest as the sources of income. The above immediate policy steps taken by the CBDT not only brought the necessary relief for the taxpayer but also contributed to the essential boost required for sustaining the economic growth in India. On the one hand, the faster tax refunds directly in the bank accounts placed the money in the pocket of the taxpayer battered by

the pandemic, while on the other, the faceless compliance management provided hassle-free electronic access and response without the requirement of any physical presence. A downward alteration in the rate of taxes helped substantially in lowering the cost of living for the people while any rise in tax rates would have entailed an overall price rise, and therefore the balancing act was the challenge for any tax administration and more so during the challenging times (Pesuth, 2015).[24]

Considering the unprecedented situation, some fifty officers of the [25]Indian Revenue Service (Jha et al., 2020) submitted a report to the Government giving various recommendations on mobilising revenue and bringing back the economic momentum to battle the COVID. After analysing the impact of the Covid on the Indian and world economies, the report inter-alia recommended that in line with the e-enabled 'Vivad se Vishwas' dispute settlement scheme for pending appeal cases, a new amnesty scheme for the taxpayers may be introduced in those cases where there are no pending appeals and the tax demands have been finalised. Reliance on one type of tax to turn around the economy will be an unsound approach. Therefore, the taxpayer's willingness and culture of paying taxes amongst the community are the key factors to revive the economic growth and recuperate falling revenues.

The Government has also used taxation as a tool to change the behavior of individuals and other entities and can punish or reward them in the form of economic alternatives. Providing deduction on profits against CSR funding of the corporate for Covid related matters is such an example wherein the spender would also get a morale boost for contributing to the nation's social cause and welfare.

3.5 **Economic Survey 2020-21 and Indian Union Budget 2021**

The Economic Survey (Ministry of Finance, 2020)[26] stated Covid-19 as once in a century crisis. As per the survey, due to falling revenue on account of slowing economic activity, the Union Government decided to increase market borrowings to Rupees 12 lakh crore from an earlier permissible limit of Rupees 7.8 lakh crore. The government's stimulus focused on increasing domestic capital expenditure, increasing demand & consumption, and providing manufacturing-related incentives.

The important steps mentioned in the economic survey concerning direct tax interventions includes reforms undertaken in the tax administration of 'honoring the honest' taxpayer launched in August 2020, including through e-campaigns; launch of a new platform with features using technological intervention, data analytics, and treating the taxpayer as an associate in building of the nation. It further added that the government provided direct money transfers to the 'Jan Dhan' (People's money) account holders and initiated a food grain supply program for the needy migrants and labourers.

As a constitutional necessity, the Union government in India has to seek the approval annual of the Parliament for its taxation and expenditure proposals. The IMF gave a [27]code of generalized principles (Mitra and Kumar, 2000) on fiscal transparency, which is expected to be followed by the nations. The Finance Minister of India presented the [28]Union Budget 2021 on February 1, 2021. Various direct tax proposals were brought to bring relief to the stressed sectors and individual taxpayers. This includes introducing faceless proceedings, allotment of Rupees 1500 Crore for a new fund to accelerate growth further, and incentivizing businesses to make

digital payments, helping technologically driven international funds such as IFSC (International Financial Services Centre) relocate to India. There is a proposal for an online web portal to collect relevant information on construction and migrant workers for social security schemes. There is an encouragement to local entrepreneurship, and eligibility for claiming tax holiday for start-ups has been extended by one another year.

Another two noteworthy sustainable development features in the Budget 2021 are allowing dividend distributions to Real Estate Investment Trusts & Infrastructure Investment Trusts, exclusion from tax deduction at source, and extension of extra tax exemption of Rupees 1.5 lakh on interest charged on a housing loan for the purchase of affordable housing by one more year until 31 March 2022. The first measure would leave more money in the hands of small taxpayers and also help them in overcoming unnecessary compliance burdens, while the second measure would promote the real estate sector in the affordable housing sector, which in turn would create more employment and help in increasing the pace of sluggish demand/supply cycle.

The government has dedicated Rupees 35,000 crore in the Budget 2021 for the free Covid vaccination of the country's eligible population, which is a big step considering the poor population that may not afford the vaccination at the market rate. The overall Budget outlay for health for F.Y. 2021-22 is Rupees 2.23 lakh crore, marking a 137% rise over last F.Y. 2020-21. This step will strengthen the citizens' sustainability who are otherwise fighting the challenges of unemployment amid the pandemic.

Social security benefits have been extended to contractual workers under the Union Budget 2021. A web portal is planned to collect information about this segment and also to ensure accurate monitoring. The MSME sector has been given a tax holiday for one more year, and budget outlay has been increased to enable small businesses to contribute with confidence to the national economy in the pandemic period and sustain the employability of the workforce.

Further, a simplistic understanding of the fiscal response to the Covid crisis mentioned above is that government revenues were suppressed for easing supply-side constraints, and at the same time, government expenditure was increased. However, such policy shifts can be sustained through sound tax-based revenue streaming, allowing a lot of flexibility to the government in countering economic disruptions without compromising on fiscal prudence (Thirlwall, 2003).[29] The above taxation relief and digitally based good governance measures proposed by the government are expected to spur the dwindling revenues and bring the taxpayer's confidence in the country.

3.6 Results

The results have been compiled in the form of three tables discussed subsequently and showing the trends of GDP, per capita income, employment, and direct tax collections. The results demonstrate the effect of legislative and administrative efforts made by the Indian government in an attempt to come out of the situation created due to the impact of Covid-19.

Table 1[30] (Statistics, 2020) below shows the quarterly estimates of the GDP at 2011-12 constant prices, at current prices, and annual growth in per capita income in real terms at 2011-12 prices in India.

Table 1. Growth Data

Financial Year (F.Y.)	Quarter	% Quarterly estimate of Expenditures on GDP at (2011-12) prices	% Quarterly estimates of Expenditures on GDP at current prices	% Growth in per capita income in real terms at (2011-12) prices
2019-20	Apr – June	5.24	8.06	2.5 [Rupees 94,566/- Or USD 1291]
	July – Sept	4.42	5.87	
	Oct – Dec	4.08	7.39	
	Jan - Mar	3.09	7.53	
2020-21	April – June	-23.92	-22.57	-9.1 [Rupees 85,929/- or USD 1174]
	July – Sept	-7.54	-4.04	
	Oct – Dec	-8.0	-3.80	
	Jan - Mar	N.A.	N.A.	

It can be inferred that the Indian economy slowed down in Quarter 4 (Q4) of the F.Y. 2019-20 owing to the Covid-19 pandemic followed by the nationwide lockdown. GDP at constant prices in Q4 of F.Y. 2019-20 is estimated at Rupees 38.04 lakh crore, compared to Rupees 36.90 lakh crore in Q4 of F.Y. 2018-19. However, the GDP growth estimates exceeded the estimates made by various rating agencies and economists. Therefore, the full F.Y. 2019-20 GDP growth stood at 4.2 percent at 2011-12 constant prices. Real GDP or Gross Domestic Product (GDP) at Constant (2011-12) Prices in the F.Y. 2019-20 is ₹145.66 lakh crore, as against ₹ 139.81 lakh crore for the F.Y. 2018-19. Similarly, the GDP at Current Prices in the F.Y. 2019-20 is ₹ 203.40 lakh crore, against ₹189.71 lakh crore in 2018-19. The per capita income in real terms (at 2011-12 Prices) during 2019-20 is ₹94,566 compared to ₹92,085 in the year 2018-19. The per capita income at current prices during 2019-20 is estimated to be ₹134,226, compared to ₹ 1,26,521 during 2018-19. The efforts made by the Indian government recovered the sudden fall of GDP in the first quarter of F.Y. 2020-21 and a corresponding fall in the per capita income. However, the second wave in the ongoing F.Y. 2021-22 would be having a greater adverse impact on the economy and livelihood of the citizens of India, more so when it came unexpectedly.

Table 2[31] (CMIE, 2021) provides the F.Y. wise labour force in India, the unemployment rate, and labour participation rates

Table 2. Employment Data

Month of the Financial Year (F.Y.)	Labour Force in Million F.Y. 2019-20	Labour Force in Million F.Y. 2020-21	Unemployment rate in India		Labour force participation rate	
			F.Y. 2019-20	F.Y. 2020-21	F.Y. 2019-20	F.Y. 2020-21
April	430.9	369	7.35	23.52	42.5	35.6
July	435	423.7	7.34	7.40	42.7	40.6
October	439.7	N.A.	8.10	7.02	42.9	40.6
January	442.4	N.A.	7.22	6.52	42.9	40.6

The above indicates that the labour force available in India during F.Y. 2019-20 increased marginally in the last quarter; however, due to sudden nationwide lockdown in India, the availability decreased drastically to 369 million in April 2020 (F.Y. 2020-21) from the corresponding figure of 442.4 million in January 2020. A similar trend was seen in India's unemployment and labour force participation rates for F.Y. 2019-20 and F.Y. 2020-21.

Due to efforts of legislative and administrative efforts of the Indian government, the above indices improved immediately in the second quarter of the F.Y. 2020-21 and more or less stabilised with nearly pre-Covid-19 levels. The capacity utilization is also attaining the normal levels; however, the recent second Covid-19 wave has not only impacted economic recovery but also affected the demand levels in the country in ongoing F.Y. 2021-22. The labour force which migrated from cities to the countryside was given employment under the MNREGA scheme. In April 2021 alone, 301 million persons were provided jobs under this scheme by the Union government in India.

Table 3 below shows the target of the direct tax collections and the actual achievement for the F.Y.s 2019-20 and 2020-21.

Table 3. Direct Taxes Data

Financial Year	Target for Direct Taxes (Rupees Crore)	Actual collection of Direct Taxes (Rupees Crore)	Percentage of collection w.r.t. target (%)
2019-20[32]	11,70,000 [$159.80 Billion]	10,27,634 [$140.35 Billion]	-8.0 (Refer Note 1)
2020-21[33]	9,05,000 [$126.33 Billion]	9,45,000 [$129.07 Billion]	+5.0 (Refer Note 2)

(Source: PIB, 2020 & 2021)

Note 1: In F.Y. 2019-20, refunds worth ₹1.84 lakh crore were given by the CBDT, a fourteen percent increase over ₹1.61 lakh crore given in F.Y. 2018-19

Note 2: The gross direct tax collection in the last fiscal stood at ₹ 12.06 lakh crore. After taking out the refunds of ₹2.61 lakh crore, the net mop up stood at ₹ 9.45 lakh crore.

Table 3 reflects that the direct taxes collections during F.Y. 2019-20 fell 8% below the target; however, it was more due to fourteen percent increase in the refunds vis-à-vis previous F.Y. 2018-19 and slowing down of economic activity due to the outbreak of Covid-19 in India in February 2020. The direct tax collection target was also reduced by the government on 30.03.2020 from Rupees 13,35,000 Crores to Rupees 11,70,000 Crores owing to the prevailing circumstances and in a bid to reduce pressure on the tax administration at the one hand and acknowledging the effect of the slowdown of business activity on the other.

The direct tax budget collection target for F.Y. 2020-21 was kept low by the Government at Rupees 9,05,000 crore and corresponding collection exceeded by five percent during the year. The highest ever refunds of Rupees 2,61,000 lakh crore were issued during the year to provide more money in the hands of the taxpayers to reignite the demand/supply cycle of the economy and sustaining the livelihood of small taxpayers by giving them timely refunds.

4. Conclusion and way ahead

Apart from being relevant to particular SDGs, tax helps raise revenue to pay for development, but different levers have to be used for different countries. Developing countries need better enforcement of laws and widening of the tax base, which may be very difficult due to varied interests. Increasing transparency on behalf of governments is essential to encourage investment and trade, which can benefit tax revenues. Domestic resource mobilization is not just a technical issue but a societal issue as well. There needs to be a balance between residence and source taxation and its relevance in a globalised economy where value intangible assets are co-created in multiple locations. The extent to which developing countries give away tax through incentives needs to be considered through the cost and benefit analysis of incentives, and targeted measures encourage inward investment.

There is no one way that fits all countries, but it is clear that tax regimes significantly impact delivering specific SDGs and how funds are raised to meet the overall goals and development in the broadest sense. The relevant actions for the Indian State revolve around raising voluntary compliance through taxpayers' education and increasing their accountability to grow tax collections. We need to imbibe international best practices and cooperation and use targeted measures to drive specific SDGs for raising more revenue. India needs to find the right balance of taxes given its characteristics such as the presence of natural resources, GDP, distribution of wealth, industrial base, and geographical location.

We need to involve civil society in effective tax bargaining to increase tax compliance and clarify the connection between revenue inflow through taxes and outgo through expenses. We need to make domestic revenue collections publicly available to make informed policy decisions and reforms through participative discussions. Existing tax systems could be much better aligned to the SDGs with minor amendments only. In particular, they could raise more revenue in developing countries, send stronger signals to investors and address the equity concerns. We need to simplify investment incentives in developing countries and reduce tax uncertainty for investors. Social attitudes to tax are shifting, and tax systems have yet to catch up. The gap this has created between legal systems and social attitudes has made tax a normative issue where the cost of a misstep for business can be significant. However, it has also created an

opportunity for tax reforms that could be harnessed to help achieve the ambitions of the Sustainable Development Goals.

The revenue collected from the taxation has a [34]potential role (Cobham, 2005) in human development matters. The Covid relief packages announced by the Indian government to infuse confidence and liquidity in the market draw their strength from the robust taxation system and its prompt responsiveness.

The progressive direct taxation policy interventions have ensured that more money is given to the taxpayers in the form of express refunds to reduce the strain on sustaining their livelihoods. The taxation rates were not raised on the one hand in the Budget 2021 applicable for F.Y. 2021-22, while on the other, the direct tax collection target for the F.Y. 2020-21 was rationalized to optimise with the prevailing conditions. More money in the hands of people gave them extra purchasing power necessary to sustain their livelihood and face the health challenges under Covid-19. This has also ensured employment retention in various organizations that would otherwise have cut their workforce for reducing their expenses to overcome the pandemic effect. It is time to implement the Fiscal Responsibility and Budget Management (FRBM) Act brought about in the year 2003 for the management of fiscal deficit, imposing a financial restraint. The Indian government had planned to bring down the fiscal deficit to 3.1 percent of the GDP while eliminating the primary budget deficit altogether by F.Y. 2022-23. Covid has made this task huge, and the fiscal deficit projected for the F.Y. 2021-22 has been pegged at 6.8 percent of the GDP. It is lower than the last financial year's comparative number of 9.5 percent. As a positive indicator during the unpredictable times, as an ongoing fiscal strengthening and consolidation plan, the Government plans to bring down the fiscal deficit down to 4.5 percent of the GDP by the F.Y. 2025-26.

However, [35]higher government spending as a percentage of GDP per capita (Oishi et al., 2012) without adoption of progressive taxation would not necessarily bring high quality of public and common goods on a long-term sustainable basis; therefore, for bringing all-round development, the Indian government must reconsider the progressive taxation measures. In line with the fundamental revamp, the focus is required to create a positively inclined workforce. Emphasis is also needed for information gathering for risk profiling and routine activities like processing and refunds to meet the citizens' expectations.

Retaining money in the hands of the individual taxpayers through rationalization of direct taxes, as even suggested by the OECD, will have a multiplier consumption demand effect and will fast set in motion the demand-supply cycle. The progress on implementation of various progressive schemes brought out by the Indian government for MSMEs must be monitored rigorously as they form a majority of our enterprises, providing gainful employment to a large number of people. It is suggested that the tax administration takes advantage of modern technology contributions that the market has to offer and thus effectively and sustainably contributes to nation-building.

Direct taxes will form a significant component of revenue generation. The contribution of the direct taxes to the exchequer has come up to more than Rupees eleven lakhs crores estimated to be collected within this financial year 2021 -22. With this growth in the collection comes the enhanced ability of the government to provide for the country's social development to bring about more inclusive growth. The direct tax has become a significant variable in the fiscal policy

of the government. Growth with stability is possible only with a low fiscal deficit which can only be brought about by an increase in tax revenue.

The role of direct tax administration is not merely in raising revenue but providing the means for adjusting the distribution of income. An acceptable distribution[36] (Head, 2009) of income is important for the quality of life and social stability. The equity or distributional effect of public policy of taxation is an intrinsic part of the vision of a good society. Social development has to be understood in relation to both individuals and collectives. An institution of social relevance will motivate people to engage and participate and is linked to a sense of ownership and empowerment.

The relevance of direct taxes for social development is based on the efficacy of tax collection, the extent to which current concerns are addressed and ameliorated, and how the Indian Income-tax Act, 1961, is tuned to present situations and circumstances. Enhancing its relevance will have to be a structured as well as an integrated process. The various limbs of the organization have to be energized to facilitate a citizen-centric process of engagement.

The tax administration as a social institution is an enduring feature of social life, organizing a relatively stable pattern of human activity, mainly related to revenue administration and mobilization, thereby producing life-sustaining resources and regenerating society, and sustaining viable societal structures within the environment. The philosophy of a tax system goes beyond the economics of revenue collection to being a partner in the nation-building process and that the direct taxes in the revenue scheme of things are quintessential for social development, inclusive growth, and generation of employment.

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Inspired by Law? A Contractual Approach to Closed-Loop Supply Chains

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Abstract

In the ongoing pandemic, options for repair and recycling face challenges. Instead, takeaway options have become the preferred – albeit often the only available and thus not entirely voluntary – choice. Contractual frameworks for a closed-loop supply chain are required as they may facilitate recycling even in pandemic times. The paper will pursue a contract-chain approach combining both top-down and bottom-up approaches. The contractual relations involved along a closed-loop supply chain (manufacturer-retailer-logistic service provider (3PL)-costumer) will be examined from a contractual perspective. Taking into account the operational processes, it will be assessed to what extent contractual and policy-related improvements are possible to achieve a closed-loop supply chain. For that purpose, international uniform law and German law will provide the main legal basis. The current COVID-19 situation has led to a boost in e-commerce and challenges the target of sustainable production and consumption. For commercial parts of an international supply chain, either national law or international conventions on the transportation or sale of goods apply. None of the currently applicable rules pay attention to sustainable production or consumption. The sales contract – between manufacturer and retailer or retailer and costumer – is an agreement with a definite duration and with a designated end-of-life product status. There are no rules on whether the 3PL, the retailer or the manufacturer is obliged to take back the goods to recycle them. Exercising a right to cure after several months is not combined with pick-up and packing services. This contradicts the desired decrease in packaging waste. Defect-unrelated return systems for end-of-life products are not included in sales law. Ensuring a closed-loop supply chain will also require securities or insurances along the supply chain to combat insolvency risks and compensate for the unavailability of individual participants. The paper will discuss at which points along the contractual supply chain new duties should be implemented and where regulatory measures may be required. One way could be to extend the logistic contract between the retailer and 3PL to a return service. This may even offer advantages to retailers attempting to prove the poor condition or quality of goods to their respective partners and to seek remedies. An alternative would be to include "buy-back" or "pick-up for recycling" options or "recycling guarantees" in the contracts between retailer and manufacturer or costumer and retailer. Further, renting or lending packing container or package that conveys the goods ("packing units") could reduce waste in the transit of goods. The options could be combined with, for example, a "reward-penalty" approach to make a closed-loop regime also economically attractive to all participants. The topic relates to SDG 12 (Responsible Consumption and

Production) and notably to targets 12.5 and 12.6. Furthermore, it addresses the question of how contractual models can offer incentives for recycling despite pandemic-related restrictions.

Keywords: Closed-Loop Supply Chain, Commercial Law, Sustainable Production

1. Introduction

The first fully synthetic plastic bottle was invented by Leo Baekeland in 1907 (Mercelis, 2020). Just one century later, plastic waste – be it packaging material or components of a final product – amounted to many million tons (Eurostat, 2021). The COVID-19 pandemic severely disrupted global supply chains. As a consequence, it became more difficult to return products to recycling and recovery facilities and contribute to a more efficient utilisation of resources. One reason may also be that contractual options for combating resource exploitation have still not been established. Given the limited coverage in the legal literature, this paper aims to give an overview of the main legal gaps within the closed-loop supply chain (CLSC) and proposes mechanisms for improved contract management. The paper is organised as follows. After a brief introduction to its methodology (2), a basic description of the CLSC and related legal questions will be presented (3). This is followed by a legal analysis of the forward (4) and reverse supply chain (5), internationally as well as with regard to German law. Finally, the paper discusses legal mechanisms to close the loop, combining both top-down and bottom-up approaches (6).

2. Methods

The paper will pursue both a comparative and a doctrinal approach whereby international transport convention and the uniform sales law of the United Nations Convention on Contracts for the International Sale of Goods (CISG) will be compared with alternative mechanisms under German law. Given the international character of trade, an examination of harmonised uniform law is indispensable. As uniform law on both sales and carriage provides rules only for certain aspects, some legal issues must be decided under national law. German law was chosen to exemplify. The paper aims to identify contractual options and needs for legislative action and thereby combines top-down and bottom-up approaches. While undertaking a monodisciplinary analysis, the findings will be linked to a management-based description of CLSC and therefore pursue an interdisciplinary goal.

3. CLSC – a logistic and economic dream of combating resource wastage

3.1. Basic description of CLSC

A CLSC combines a forward and a reverse supply chain (Guide et al., 2003). It thereby prevents natural resource wastage (Bell et al., 2012) and facilitates effective resource utilisation by using strategic recovery procedures. These take into account not only ecological concerns but also economic interests seeking the most profitable waste management options, such as remanufacturing, reuse and repair

(Guide et al., 2003). While forward supply chains focus on the distribution of products to the customer, reverse supply chains reach from collection and inspection to disassembly and recovery of products for reuse (Kaoud et al., 2020). Companies that seek to combine forward and reverse supply chains need to assess the characteristics of alternative types of return to adjust quality preserving mechanisms (Guide et al., 2003). Coordinating the CLSC is key. Different models of who can lead the CLSC are first distinguished by centralised and decentralised frameworks. In a centralised model, one decision maker within the CLSC determines both retail and collection prices, the latter being necessary for recirculation of the product (Saha et al., 2016). This may be performed by a third-party recycling or transport operator, the manufacturer or the retailer (Giri and Chakraborty, 2017). In a decentralised model, the various participants make their own decisions at different stages of the supply chain (Giannoccaro and Pontranolfo, 2004). Given models of extended producer responsibility, for example in articles 8f of the waste framework directive (WFD), it is presumed that the manufacturer usually takes the lead decision-making role. Thus, the centralised model seems to be legislator's preferred choice.

3.2. Requirements for legal implementation

An effective CLSC requires an adequate business model which addresses resource utilisation and therefore environmental goals equally to economic targets (Guide et al., 2003). Predicting costs should not only concern costs for shipment, purchasing and recovery (Kaoud et al., 2020) but also the risk of potential legal claims.

Abstract centralised or decentralised models are not equally possible in a legal context. There is the principle of privity of the contract, whereby contracts have binding effect *inter partes* and thus only between parties to the contract. An *erga omnes* (towards everyone) effect of decisions is only possible under titles related to property law.

Article 8 (2) WFD contains provisions under which the member states should *encourage* producers to manufacture products that are suitable for multiple reuse and environmentally sound recovery processes, meaning suitable for disassembly. Given the soft wording, a binding obligation is not imposed on the manufacturer to conclude certain contracts. While servicing of the supply chain may increase manufacturers' responsibility (Pongracz and Veikko, 2004), in this paper the focus is on sales and transport contracts. This is because service contracts are not covered by uniform law, such as the CISG. Such harmonised law decreases costs incurred under contradictory national provisions, national legal culture and differing interpretations (UNCTAD, 2003).

In the following, the existing uncertainties for the individual legal relationships in forward and reverse supply chains will be assessed. Detecting legal gaps is necessary to create a reliable solidarity between CLSC participants. This can be facilitated by using revenue-sharing (Govindan et al., 2013) but also risk-sharing models – or, putting it legally, joint liability for and/or joint contribution to security and insurance.

4. Forward supply chain – legal framework

The parties involved in a forward supply chain are connected mainly by sales/manufacturing and transport contracts. The manufacturer and retailer usually enter into a sales contract. The possibility exists that it is a contract for work according to sections 631ff German Civil Code (BGB); however, this paper's focus is solely on sales contracts (4.1). Retailers and costumers are also related through a sales contract, while either the manufacturer or the retailer concludes transport contracts with a transport operator to ship the desired item to the customer (4.2).

4.1. Contract of sale

The CISG governs international commercial sale of goods contracts, provided that the parties do not exclude its applicability pursuant to article 6 CISG. Domestically and for all contracts where German law was chosen, sections 433ff BGB and, for commercial sales contracts, specifically sections 373ff of the German Commercial Code (HGB) apply.

The sales contract imposes the duty to deliver the goods unimpaired and to transfer ownership. The WFD prescribes that goods need to be suitable for recycling and recovery processes. However, if the parties do not specifically agree upon such a duty, the particular design will not amount to the necessary conformity of the goods within article 35 CISG or section 434 (1) S. 2 BGB. In the absence of an explicit agreement, the current legal framework is merely a blunt sword against designs which are unsuitable for a CLSC. Further, the lack of disassembly characteristics may be detected only after expiry of the two-year limitation period pursuant to section 438 BGB (the CISG does not provide for rules on limitation periods). As a consequence, even explicit agreements may not be enforceable either.

Further, the second main duty of the seller, to transfer ownership, creates a huge obstacle. It is fulfilled the moment that ownership has been transferred. The various national property law approaches differ significantly. To give an example, the principle of separation and abstraction, whereby the contractual transaction is considered independently of the disposal level, is a typical and unique characteristic of German law and unknown to other jurisdictions (Zweigert and Kötz, 1971). In this case the conclusion of the contract of sale does not automatically lead to a transfer of ownership, which may, however, happen later on. This also provides solutions how to deal with the ownership, by delaying "delay" the transfer of ownership (see 6.2.3.1).

4.2. Transport contract

International contracts of carriage are governed by international transport conventions, CMNI (2001), CMR (1956), COTIF-CIM (1999), HVR (1986), MC (1999), applying mandatorily only to one transport mode and providing for different liability regimes (see Figure 2 – abbreviation key in the figure caption).

	CMR	CMNI	COTIF-CIM	HVR	MC
Transport Mode	Road	Inland Waterways	Rail	Sea	Air
Types of Damage	Loss, Partial Loss, Damage, Delay (no consequential damage in case of loss or damage)	Loss, Damage, Delay (no consequential damage in case of loss or damage)	Loss, Partial Loss, Damage, Delay (no consequential damage in case of loss or damage)	Loss, Damage (no consequential damage)	Destruction, Loss, Damage, Delay (no consequential damage in case of loss or damage)
Limit of liability	8, 33 SDR	2 SDR or collo: 666,67 or container 25000 + 1500 (Container)	17 SDR	2 SDR or collo: 666, 67	22 SDR
Notification Period + Effect	immediately - Prima facie Evidence that goods are unharmed (rebuttable only within 7 days)	7 days (21 days if damage after delay)- Prima facie Evidence that goods are unharmed (rebuttable)	immediately - Prima facie Evidence that goods are unharmed (rebuttable only within 7 days)	3 days – Prima facie Evidence that goods are unharmed (rebuttable)	14 days – no action against the carrier possible
Limitation of Liability	1 year	1 year	1 year	1 year	2 years

Figure 2: Overview of the Transport Conventions' Liability Regimes

Abbreviation Key: Budapest Convention on the Contract for the Carriage of Goods by Inland Waterway 22 June 2001 (CMNI); Convention on the Contract for the International Carriage of Goods by Road, 19 May 1956 (CMR; Uniform Rules Concerning the Contract of International Carriage of Goods by Rail (CIM – Appendix B to the COTIF Convention) 3 June 1999 (COTIF-CIM); International Convention for the Unification of Certain Rules of Law relating to Bills of Lading, as amended by the Brussels Protocol 23 February 1968 (HVR); Convention for the Unification of Certain Rules for International Carriage by Air (Montreal Convention) 28 May 1999 (MC); Special Drawing Rights (SDR)

The transport conventions apply only to contracts of carriage. A shipper, usually the manufacturer or seller, concludes a contract with a carrier. The transport contract includes an *obligation de résultat*: the successful unharmed delivery of the goods at a certain destination (Hoeks, 2010; Koller, 2016; section 407 HGB, paras. 35-37), for which the carrier assumes responsibility (Hörnig, 2019). It is therefore a contract based on linear shipping concepts. The buyer, although a participant in the forward supply chain, is not considered a contractual party to the contract of carriage but only the beneficiary that can claim for surrender of the goods, for example under article 13 CMR. The current parcel logistic services challenge the classical model of carriage contracts and are, rather, legally embedded in a freight forwarding contract. Such contracts are not harmonised internationally and intricate differences arise when it comes to their national legal conception (Smeele, 2015). Considering the – also economic (UNCTAD, 2003) – advantages of a harmonised legal regime, some national rules (e.g. German sections 458-460 HGB, Dutch articles 8:62 and 8:63 Burgerlijk Wetboek (BW)) and courts (OGH 2012, BGH 1982) tend to apply the international transport conventions to freight forwarding contracts if the predominant characteristic is the transport itself. Exceptions are visible in France and Belgium (Verheyen, 2014).

Further, the duties of the parties deserve particular attention. The shipper is obliged to inform the carrier sufficiently about the nature and characteristics of the goods (e.g. article 6.3 CMNI, implicit article 14 COTIF-CIM). The carrier is not obliged to check the goods or the packaging beyond detecting apparent defects (OLG Düsseldorf, 1982). For legal proceedings, the carrier must duly notify such a defect in the transport document to be successful in establishing a defence in legal proceedings that the damage was caused without their contribution. Further, *inter alia* according to article 31 (2) MC a complaint about damage must be submitted within 14 days of the date of receipt. Otherwise, no action can be brought against the carrier (article 31 (4) MC). Such a mechanism does not exist in sales law. Further, and problematically for the CLSC, sale and transport law provisions differ considerably with regards to damages and create liability gaps. *Inter alia*, contrary to sales law according to article 74 CISG, consequential damages for positive breach of contract (Hoge Raad, 2015; BGH, 1978) are excluded by the conventions, as well as, for example, loss of profits due to damage or loss (Clarke, 2014, p. 294f para. 94).

5. Reverse supply chain – legal framework

The contractual relationships of the reverse stream with regard to sale and transport contracts and their main duties are the same as those in the forward supply chain. However, given that the cargo being shipped is now already used and considered waste or by-products, different issues arise concerning value-based provisions, organisational duties and standard of care.

5.1. Contracts of sale

Despite incurring the same legal duties, the occasion that leads to a reverse stream is relevant. According to article 35 CISG, the seller is liable if the goods' quality is impaired. This also includes adequate packaging according to article 35 (2) lit. d CISG – in contrast to German national law. The standard for adequate packing is protection of the cargo from the perils of ordinary transport (Schwenzer, 2019, article 35 para. 31). However, duties that require reuse of the original packing material are not included.

For end-of-life products, adequate legal provisions are lacking. The guarantee – within the meaning of article 36 (2) CISG or section 443 BGB – can be an option for agreeing on return mechanisms. German law provides additional options as section 443 BGB allows for a guarantee which includes any characteristics important to the parties, even beyond product quality (Westermann, 2019, section 443 BGB, para. 1). Here, environmental aspects such as the return of packaging units may also be included.

For the context of CLSC, most relevant is the fact that in remanufacturing and processing returned products during recovery procedures, ownership is transferred to the remanufacturer according to section 950 BGB. The requirement for this transfer is that the value of the new product is not significantly lower than that of the used product. Significantly lower means a minimum of 40 % below the objective value of the used product (OLG Düsseldorf, 2001). If the recovery process results in a

downgraded product, the original owner retains ownership. This legal mechanism is, however, only applicable if the remanufacturer receives the product. Here again, the responsibility remains with the product owner until the remanufacturer receives it.

5.2. Transport contracts

Despite having the same duties under the transport conventions, the reverse logistic stream raises questions already about the conclusion of the contract of carriage. None of the transport conventions provide rules on the conclusion of a transport contract. It is therefore the applicable law determined by the Rome I Regulation No 593/2008 (EC) that answers this question.

Who concludes the contract of carriage largely depends on who initiates the contractual interaction. Particularly for commercial returns where the use of return labels has been established (DHL, 2021), the manufacturer or retailer communicates in the first place with the carrier. If manufacturers aim to coordinate the reverse supply chain in a CLSC system by sending carrier return labels to the customer, they are not automatically released from their duties as shippers. This is because the transport contract is concluded between the seller - in its role as shipper – and the carrier with the condition that if the customer makes use of the return, they hand the goods over to the carrier. The customer is thus only involved as an agent who submits the package and the declaration on behalf of the shipper. It also means that the shipper is still responsible for providing the carrier with all necessary information about the characteristics of the cargo (articles 10 MC, 6(2) CMNI, 6 CMR, 8 COTIF-CIM) and potentially for ensuring adequate packing, if agreed upon (Hörnig, 2019). For example, the electronic equipment directive 2012/19/EU provides for specific labelling as “used product”, which concerns the transport contract (according to its annex VI). This creates a challenge for the shipper in conducting the handover and labelling remotely. But it can also be a chance to send reusable containers to the customer ahead with the label. This enables the shipper to exercise control over the packaging and labelling and a packing unit is used across the entire circle ensuring an effective evidentiary basis for legal proceedings.

Further, the compensation provided in the transport conventions is linked to the pre-shipment (articles 23, 25 CMR, article 30 (1) COTIF-CIM) and delivery value (article IV (5) HVR, article 19 (1) CMNI) of the cargo. While a diminished value can be calculated on the basis of the sale value and the value after use, end-of-life products may require certain treatment to be suitable for further use. Assessing the value of a product is a case-by-case decision, which in the present context entails great uncertainty caused by the manifold regulations on recovery standards and thus expenses for recycling (Umweltbundesamt and Arcadis Belgium, 2020). *Inter alia*, assessing the value of used steel includes a comparison of the respective external costs of recovering the used material and extracting the virgin material (European Commission, 2000). The uncertainty may even create incentives for the carrier not to comply with the duty to protect the (allegedly valueless) good from any harm.

Further, the limits on liability according to article 29 CMR may be easily barred before German courts based on their jurisdiction on organisational fault (Bahnsen 2020, article 29 CMR, para. 21). A company cannot be relieved of liability by simply delegating a duty but is required to control the performance of the duty. Reverse transport may require multiple operational steps, such as intermediate storage, sorting, consolidating or choosing the appropriate recovery procedure – outsourcing is likely and economically desirable. However, interface checks (BGH, 2014) and regular inbound and outbound checks (OLG Brandenburg, 2020) are inevitable. Like the question whether choosing the wrong transport mode (Verheyen, 2017) may incur unlimited liability, the question of inappropriate recovery methods or facilities brings similar risks.

Reverse transport is, despite the aforementioned obstacles, beneficial for the transport operator. Carriers are obliged to check the apparent state of the goods at the moment of taking over. Otherwise, a difficult evidentiary situation lies in wait to prove whether damage to or loss of the cargo occurred before or after the carrier took charge of it. Combining reverse and forward logistic streams offers the possibility that the transport operator may benefit from the usually longer period granted to the customer to check the goods simply because the customer used the goods until the end of their life-spans or at least for a certain period of time. In this way, the customer does an extensive check, which the transport operator can then record at the moment of taking over for reverse transport.

6. Ideas for closing the loop

Combining the forward and reverse supply chains requires a legal bridge and incentives for the owner to return and contribute the goods to a recovery process. A bottom-up approach through cooperation and contract management enhances the acceptance of rules since they are then based on consensus between the stakeholders, while top-down approaches ensure a minimum level of rules (Verheyen, 2019) and therefore decrease legal uncertainty.

6.1. Top-down improvements

Top-down improvements include not only statutory rules but also model rules suggested by either a supranational or an intergovernmental body. Both alternatives play a role in the current setting.

6.1.1. Improving return systems in sales law

Private law improvements relate mainly to end-of-life products. The WFD suggests expanded return systems and improved product design without addressing necessary aspects of the private obligations. Return systems which do not require a product defect, such as warranty-related returns, need a place in legal regimes. A reliable legal framework for returns may facilitate end-of-life returns and make them more attractive to all participants in the supply chain. Section 950 BGB grants the remanufacturer ownership of the new secondary raw material or product subject to adequate recycling. The

remanufacturer thus receives an economically valuable resource. Contractual defect-unrelated return systems should consider this and combine the return with repurchase prices and incentives. Further, these rules must necessarily include specific and extended rules on limitation periods, reusable packing units, frequency of offering returns of end-of-life products, and return duties such as compensation for reuse value and the standard of care at the time that the buyer makes use of the repurchase option.

6.1.2. Model cooperation – contract management that fits all interests

Coordinating the CLSC requires some kind of agreement between its participants beyond their individual contracts. To avoid inefficient negotiations on a case-by-case basis, contract management is required to predict legal risks and improve contractual quality (Hirvonen-Ere, 2019). Offering a model contract or model rules at an international level is well accepted in commercial practice. The International Chamber of Commerce (ICC) offers many types of model contract for parties to use without time-consuming negotiations (ICC, 2021). Further, the International Air Transport Association (IATA) provides, for example, a standard ground handling agreement as a basis for all its members worldwide. However, none of these clauses are suitable for complex multiparty agreements combining both sales and transport contracts. Developing contract-based cooperation between CLSC participants requires an anticipation of legal gaps and potential risks of, for example, efficient breaches (see 6.2.4 and 6.2.5 below). Such a model may be appreciated if it is introduced by the European Union (EU) but can also be used voluntarily by the parties to reduce costs attributable to legal uncertainties, as was proposed by the expert group of the project on integrated services in the multimodal chain (Clarke et al., 2005). Model cooperation needs to consider all the liability gaps pointed out and indicated in *Figure 2* above – particularly gaps between transport and sales contracts.

6.2. Bottom-up – making use of the existing rules

Particularly for the aforementioned model cooperation (6.1.2), all contractual possibilities must be considered. The CLSC participants must make use of the contractual opportunities already provided to them by law.

6.2.1. Identifying legal gaps and contractual certainty

The analysis above (4.2 and 5.2) showed that different regimes exist for different parts of the forward and reverse supply chains. Closing the loop requires consideration of the different limitation and notification periods in transport law (see Figure 2). Further, the reverse chain exhibits problems regarding a higher standard of care for organisational duties and the compensation provided in the transport conventions remains unclear for used products or waste. Relying on pre-shipment or delivery value may no longer be suitable for the entire CLSC. An option could be to declare the value and bind the carrier to this declared amount for compensation (e.g. article 24 CMR, article 34 COTIF-CIM).

6.2.2. Mixed or umbrella contracts

The categorising of contract types according to a certain numerus clauses of contract types dates back to Roman law (Zimmermann, 1996). Common law does not similarly distinguish as, for instance, does German law. To ensure a harmonised legal environment, the role of mixed or umbrella contracts is essential (House of Lords, 2007). Thereby, the main contractual duties of sale or carriage are combined with contractual duties whose nature is qualified differently. Article 3 CISG acknowledges contractual constructions that are not limited to sales elements. Accordingly, the CISG only applies to contracts consisting of more than a sales component as long as the latter is preponderant. Duties such as providing packing are service-related but are also necessary duties under the CISG (supra 5.2.1). Whether the sales element predominates can be assessed on the basis of *inter alia* the economic value test (CISG Advisory Council, 2021). In 2014, the German Supreme Court had to decide on the applicability of the CISG to a repurchase option of a furniture item (BGH, 2014a). The BGH decided that despite being embedded in a leasing contract – essentially being a contract of rent and service –, issues concerning the resale or sale of goods were to be decided by sales law, here CISG.

Combining repurchase options and repair services with the rent of transport units can facilitate a circulation of products and decrease packaging waste through a bottom-up approach. Further, including a reusable packing unit may have procedural advantages and satisfy the operators' organisational responsibility (see supra 5.2). It should be used as an additional option (Gómez-Padilla et al., 2020). By being an auxiliary option the applicability of the CISG can be ensured.

Despite not being expressly provided by the transport conventions, mixed carriage contracts that include certain auxiliary service duties are accepted by national courts. This is particularly relevant for carriers which aim for a dual channel that combines the forward and reverse transport or if they provide preparatory services for waste recovery, such as sorting or distributing to waste recovery facilities. Transport conventions do apply if the carriage part is still predominant (Hörnig, 2019; Koller, 2016, section 452 HGB, paras. 14-15; Court of Appeal, 1998; House of Lords, 2007). Adding duties and services – notably coordination and integration of streams – to the carriage contract is necessary to enable a CLSC. Consider the issue of packing material. An additional duty to take back the transport unit in which the cargo was delivered can facilitate the use of reusable transport units. Further, requiring the carrier to take back the transport unit gives it a better evidentiary position against the shipper since the customer has necessarily had the goods unpacked (supra 5.2.2). Further, traceability can be assured through the reusable packing units. However, services such as sorting and distributing may be assessed differently in national courts with regard to organisational responsibility. All participants should therefore share the risk of the wrong choice of recovery.

6.2.3. Dealing with ownership

Contrary to the contractual basis, property law is not harmonised. Anticipating the needs of CLSC in the sales contract of the forward supply chain could open a way to recirculate the product.

6.2.3.1. Delaying ownership

Commercial sales law offers possibilities for the change towards less ownership (Pongracz and Veikko, 2004) and enhanced responsibility (European Commission, 2020) beside servicing. Parties may deviate from the immediate duty to transfer ownership by agreeing conditional sales obligations. More generally, the BGB provides for conditional obligations under section 158 BGB. It is quite common in commercial supply chains to make use of the retention of title (*Eigentumsvorbehalt*) under section 449 BGB. (Westermann, 2020, section 158 para. 11, Staudinger, 2019, Annex to sections 305-310, para. A 95), an option which the CISG omits. Under German law and according to section 449 BGB, ownership is transferred subject to the condition precedent that the purchase price is paid in full. While from a common law perspective this conditional transaction may be non-sale (Thomas, 2019), it is under German law. As visible in *Figure 3*, there are different types of retention of title (Kindl, 2021, section 929 paras. 44ff).

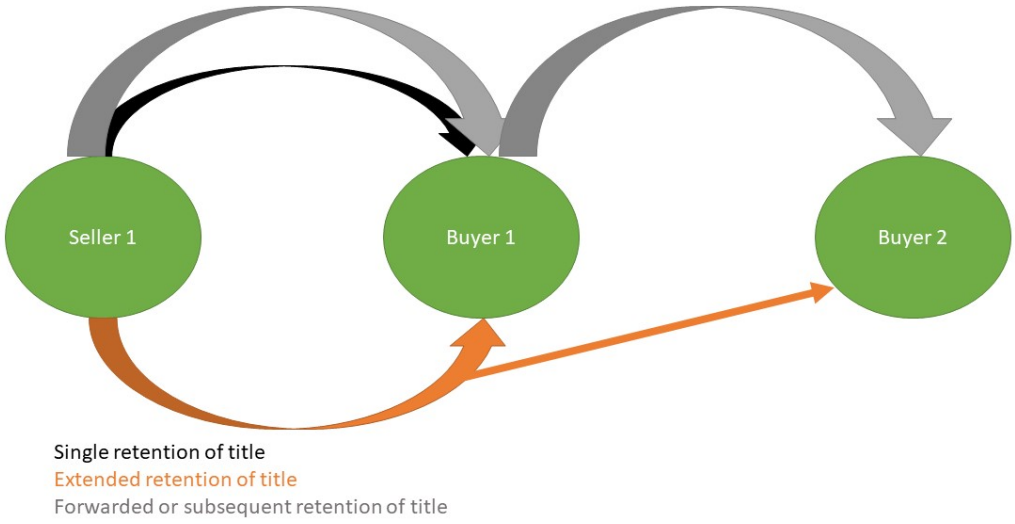

Figure 3: different models of retention of title according to German law

In addition to the single retention of title within a single transaction between seller 1 and buyer 1 (so-called *einfacher Eigentumsvorbehalt*), extended retention of title (*verlängerter Eigentumsvorbehalt)* transfers ownership from seller 1 to buyer 1 subject to an assignment of rights from buyer 1 against buyer 2 to seller 1. Within a forwarded retention of title (*weitergeleiteter Eigentumsvorbehalt*), the expectation of ownership (*Anwartschaftsrecht*) is disclosed and transferred along the supply chain, growing into full ownership upon payment of the purchase price. Lastly, forwarded retention of title

(*weitergeleiteter Eigentumsvorbehalt*) also exists without disclosing the lack of full ownership and is called subsequent retention of title (*nachgeschalteter Eigentumsvorbehalt*). There, the end-customer receives full ownership upon payment of the purchase price to either seller 1 or buyer 1, also protecting seller 1, which loses its ownership at this moment (BGH, 1971). From a legal and economic point of view, forwarded retention of title is less desirable as it cannot be part of the standards and conditions (BGH, 1991) and requires seller 2 to consider all the different clauses of the contract between buyer 1 and seller 1 (Westermann, 2019, section 449 BGB, para. 88).

Subsequent retention of title, however, could be a model for CLSC. Buyer 1 is then required to dispose of the property rights of the product subject only to payment of the purchase price, which can form part of the standards and conditions. It is comparable to leasing models (BGH**,** 1990). Although the single conditional clause may not be governed by the CISG, the remaining contract will. It has the further advantage that any defect in the goods may only be checked by the end-customer (BGH**,** 1990), who needs to inform the first seller. This may decrease costs along the CLSC from the manufacturer to the recycler. Relying on retention of title, however, always bears the risk that one of the participants may pay the full purchase price, transferring ownership along the supply chain (BGH, 1982a). Additional repurchase options are necessary to close the loop sustainably. These repurchase options must be combined with adequate pricing models to compensate, if necessary, for the usage of the product.

6.2.3.2. Regaining Ownership

More important and even forgotten in the legal landscape nowadays is the buy-back option. Although the CISG does not provide for buy-back options, it applies likewise to repurchase contracts if the contract of sale providing for this option is subject to the CISG (BGH, 2014a). The seller reserved a right to repurchase the furniture item if the party to which the buyer leased it did not make use of its purchase option in the sales contract. Thus harmonised law can cover the entire CLSC.

Repurchase options are also available under German law in sections 456ff BGB. Despite being developed as a mechanism to prevent speculation in immovable property (BGH, 2000), they also serve as security that the buyer has complied with the presumed contractual purpose (Daum, 2021, section 456 BGB, para. 6). The Reichsgericht, as well as the BGH, assumed that the second sales contract was already determined and agreed upon by the parties in the first sales contract (RG, 1904, BGH 1962). A manufacturer thereby can already coordinate the second contract through contractual clauses in the first sales contract. Crucial for the CLSC context is the duty of care imposed on the buyer to maintain the quality of the item for which a repurchase option was agreed upon (Daum, 2021, section 456 BGB, para. 31). This mechanism ensures an increasing duty of care along the CLSC. Further, the repurchase option can also be agreed to the benefit of a third party (Daum, 2021, section 456 BGB, para. 22; Westermann, 2019b, section 456, para. 7). If *inter alia* the retailer and the end-customer agreed upon a repurchase option for the manufacturer, the latter would receive a genuine right to demand the item's

return. Moreover, according to section 461 BGB, more than one person can be entitled under the repurchase clause. In this case, all parties must jointly invoke this right. For the CLSC, this could mean that a framework agreement must be in place empowering all other participants to repurchase the product from, for example, the end-customer.

Further, the aforementioned section 950 BGB which grants ownership after a remanufacture process should be seen as a chance. Since the upgrading or at least processing of products resulting in a maximum 39 % lesser value leads to a transfer of ownership to the processor, this can be an incentive for either the recycling manufacturer or the recycling company from which the manufacturer seeks to regain ownership. Adequate recycling is a guarantee that the manufacturer will regain ownership if the procedure is executed under its responsibility. Otherwise, the aforementioned repurchase options are necessary – implemented in the contract between the end-customer and the seller.

6.2.4. Cooperation and tackling the legal gaps

One cooperation framework could ensure risk- and revenue-sharing along the CLSC. This paper does not address the anti-trust implications which may arise.

One model known from partnerships and corporate entities may be to facilitate risk-sharing within the CLSC by creating joint ownership of the good under German law through tenancy in common (section 1008ff and 741 ff BGB). Thereby, all CLSC participants would jointly own the product and be responsible for it. Given the associated risks, this may not be economically feasible. Further provisions, such as section 950 BGB, would intervene if one of the participants reprocessed the product adequately.

As was shown, the manufacturer can take the lead in coordinating a centralised CLSC by initiating the reverse supply chain, including buy-back options, sending return-labels and establishing the rent of containers as an auxiliary operation encompassing the entire circle. Existing risks and legal gaps must be attributed between the participants without creating an incentive to rely on a limited share of the risks and to violate the rules – committing an efficient breach (Markovits and Schwartz, 2017). This may be assured through penalty clauses combined with Key-Performance-Indicator standards, by termination options or by adjusting shares according to a *bonus malus* system.

6.2.5. Securing the circle

A CLSC cooperation contract may be endangered not only by efficient breaches but also by bankruptcy. Old principles of *lex mercatoria* may help. On one side is the maritime loan of ancient times, the *Foenus nauticum* (Roman Digest, 22. 2). The loan was offered to a merchant to buy products, finance the transport and sell the goods at a destination market. The loan was due for repayment upon successful arrival at the port of destination. The loan could cover not only the forward but also the reverse supply chain and its expenses (Finley, 1993). It was the lender that bore the risk of marine casualties and required in exchange a certain amount of interest and a lien on the property – either vessel or cargo

(Kleinschmidt 1878). For the present discussion this provides useful concepts for a centralised CLSC model. The maritime loan brought all parties together as it delivered the necessary financial basis to initiate the supply chain. However, it also marked the birth of modern risk insurance – interest was required for the risk of marine casualties (Lohsse, 2016). Lohsse (2016) compared the risks the lender had to bear with those borne by a landlord for deterioration of its property when occupied by tenants. Servicing the CLSC would in the end lead to similar risks for the manufacturer. Given its sales background, the maritime lien could also be a model for giving the manufacturer or seller the contractual lead in a CLSC.

On the other side, the *lex Rhodia de iactu* (Roman Digest 14.2.1) – known as "general average" (GA) – can be used to allocate the financial burdens and balance bankruptcy risks. The inherent mechanisms required that losses from a voluntary sacrifice of part of maritime property in danger would be allocated proportionally between the members of the risk community (Kruit, 2017). Particularly in medieval times, this principle was also transferred to land scenarios, notably war and fire, which constituted a common danger (Zimmermann, 1996). Nowadays, the York-Antwerp Rules (YAR) provide written rules in the form of soft law. Here again, the top-down approach through model clauses is well excepted. The principle of GA may even serve as a concept to shield the bankruptcy of single participants, acknowledging the willingness of parties to share risk in case of common distress (Casey, 2020). It could therefore function as a model of risk pooling along the supply chain (Valverde and Talla, 2012).

One could question what the danger required by GA might be here, since the CLSC itself is not in danger. It is, rather, the environment which is threatened by linear supply chains – causing external costs of resource exploitation and waste pollution (Jacobs and Subramanian, 2012). These costs should be internalised as a sacrifice all participants bear to rescue the environment. The distribution mechanism of GA also applies when the danger was caused by the wilful misconduct of one of the participants. However, the misbehaving participant cannot claim reimbursement for its sacrifice and may additionally be held liable by the other participants afterwards (Rule D of YAR). As a result, efficient breaches are no longer worth a try. Allocating the risk by paying a certain lump sum or membership contribution at the beginning of the CLSC, which must – given its circular nature – be determined by the parties, increases the likelihood of their compliance with the rules (Finsinger and Simon, 1987). For the decisive initial moment, the manufacturer's actual possession of the product should be considered relevant as they take the lead and coordinate the CLSC according to this paper's presumptions.

7. Conclusions

The paper has detected various legal obstacles to the forward (4) and reverse (5) supply chains. For both, the regulatory framework is insufficient to close the loop (4.1 and 5.1). Given the principle of privity of the contract, each contract – whether transport or sale contract – needed to be assessed. As shown (4.2 and 5.2), the manufacturer can coordinate both the forward and reverse supply chains by

taking an active role in sales and transport contract management. The legislator should provide for adequate return frameworks (6.1.1) and provide for model contracts to reduce the costs of individual contract negotiation (6.1.2). Further, the parties are free to create their own legal certainty by addressing existing legal gaps (6.2.1). Given the cost-efficient nature of harmonised law, mixed contracts should be the preferred basic contract models (6.2.2). Options delaying the transfer of ownership are possible (6.2.3.1) but need to be combined with buy-back clauses (6.2.3.2). Improving contract management for the entire CLSC (6.2.4) should include aspects of risk pooling and cooperative agreements, which were already established in *lex mercatoria* during ancient times (6.2.5). These agreements should also include risk- and revenue-sharing, as well as sanctions to prevent efficient breaches by participants.

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Differences in the national regulation of management of protected areas as limitations for transboundary cooperation for nature conservation: case of the Pasvik – Inari Trilateral Park (Norway, Russia, Finland)

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Abstract

The Pasvik - Inari Trilateral Park is a transboundary park located in three countries (Norway, Russia, Finland). Its distinctive feature is the combination of several approaches to the protection of these territories (nature reserve, national park, landscape protection area), which at the same time leads to environmental problems. In the Pasvik – Inari Trilateral Park domesticated reindeer from Norwegian part, where economic activities are allowed, destroy the ecosystem on the Russian territory a high degree of protection. Attempts to resolve this issue at the intergovernmental level were unsuccessful. This case raises the following questions: why does one natural territory with similar characteristics in different countries have different conservation status? What factors influence the assignment of the territory of a protection status? To answer these questions, first of all, the categories of protected areas in Norway and Russia that currently exist was considered. Then the trialogue model of governance was used to understand the role of government, society and a scientific community in the creation and management of protected areas in Russia and Norway. This research revealed that despite a number of general characteristics (similar approaches to the classification of protected areas, the key role of the government in decision-making, limited participation of society and scientific community), the management systems of protected areas that have developed in both countries will rather hinder than help to resolve the situation in the Pasvik - Inari Trilateral Park. A possible solution to this situation may be the active involvement of the professional and scientific community, both in the negotiation process and in the management of protected areas.

Keywords: Protected areas, Russia, Norway, Transboundary conservation, Trialogue model of Governance

1. Introduction

The International Union for Conservation of Nature considers cross-border cooperation between countries, as well as the creation of transboundary protected areas, as one of the most effective mechanisms for preserving the environment and biodiversity (Vasilijević and Pezold, 2011). One example of such cross-border cooperation is the Pasvik – Inari Trilateral Park. Located in three countries (Norway, Russia, Finland), the park is "renowned for its cultural values and rich nature. The Pasvik River and surrounding wilderness comprises a unique nature system where European, Asian and Arctic species meet" (Ojanlatva, 2008). In addition, the park has a belt of old-growth forests recognized as virgin and oldest in northern Europe.

The history of the creation of this park began in 1978, when it was proposed to create a reserve in the Norwegian part of Lake Höyhenjärvi (Fjærvann) in the Pasvik River valley due to its great natural value. Bilateral negotiations between the Norwegian and Soviet sides began in 1989, when the first agreement on environmental issues was signed. During these negotiations, the idea of creating a joint Russian-Norwegian nature reserve was first discussed. The next bilateral treaty, signed in 1990, saw Finland as a future partner for a cross-border park (Vasilijević and Pezold, 2011).

At subsequent meetings in 1991, Finland, Norway and Russia decided that they should cooperate at the local level in the field of nature conservation and environmental management in the Pasvik-Inari region. In addition, the parties aimed to protect a large untouched natural territory as a common object. The Vätsäri Wilderness Area was established in the same year. The Pasvik State Nature Reserve on Russian territory was established in 1992, while the Pasvik Nature Reserve was officially created on the Norwegian territory in 1993. In 1996, the Norwegian part of the reserve received the status of RAMSAR international protected areas, thanks to the rich and unique waterfowl fauna (Vasilijević and Pezold, 2011).

Currently, it consists of the Vätsäri Wilderness Area in Finland, Øvre Pasvik National Park and Øvre Pasvik Landscape Protection Area in Norway and the joint Norwegian – Russian Pasvik Nature Reserve (Figure 1). In accordance with Finnish and Norwegian legislation, tourism and other economic activities, including reindeer husbandry, are allowed in wilderness areas and national parks, respectively (Metsähallitus, 2016, Norwegian Environmental Agency, 2009). On the Russian territory, a high degree of protection has been established, in which any economic activity is prohibited. Such differences in approaches to the protection of ecosystems lead to an aggravation of a number of environmental problems on the territory of Trilateral Park.

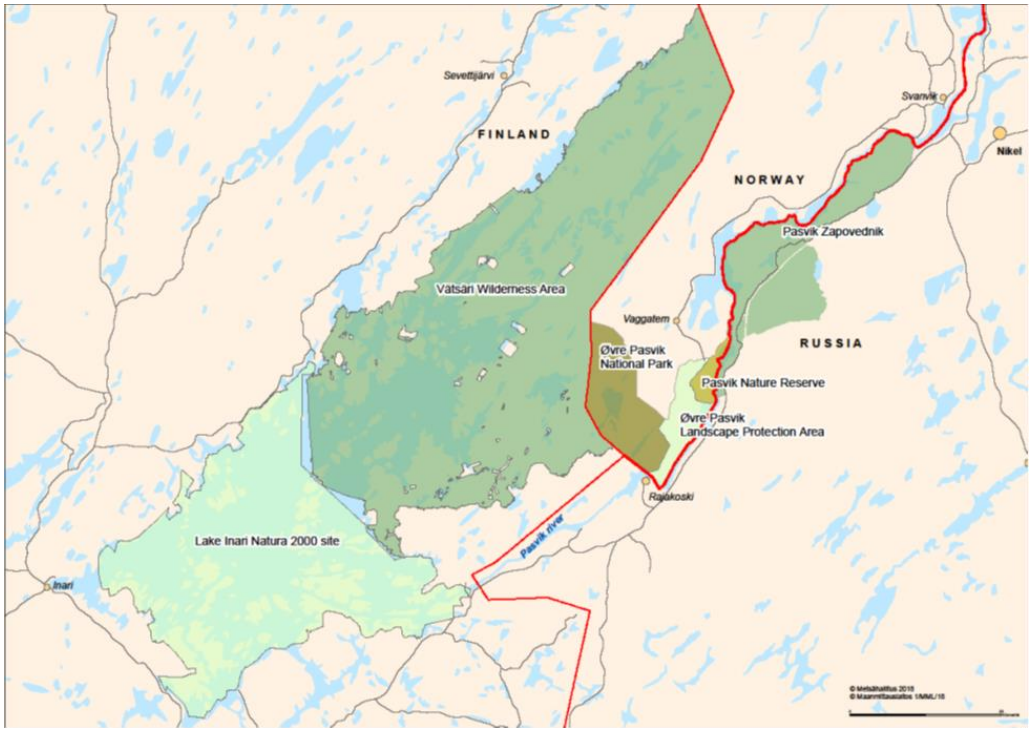

Figure 1. *Map of Pasvik-Inari Trilateral Park*

Source: https://prosjekt.fylkesmannen.no/Documents/Pasvik%20-%20Inari/Bilder/Map_pitp_2018.png

Reindeer husbandry is one of the main sources of livelihood in the north. Wildlife, in turn, is a huge pasture. Currently, there are about 6 thousand deer pastures in the forests of Vätsäri and Øvre Pasvik. Depending on the time of year and the availability of food, herds graze in different territories. The problem is the regular transfer of domestic deer from Norway to the territory of the Russian Pasvik nature reserve. Reindeer upset the ecosystem's balance of the natural reserve by destroying reindeer moss and introducing introduced species (wolverines follow reindeer) into the area (Lesnyak, 2019).

According to the existing 1977 Agreement on the mutual return of deer crossing the state border between the Government of the Soviet Union and the Kingdom of Norway, the border services of Russia and Norway are obliged to return the reindeer to their owners within a short time after detection. In this case, actions take place with the participation of Norwegian reindeer herders, who, with the help of snowmobiles and specially trained dogs, drive the deer into herds and drive them to the Norwegian river bank. These actions, in addition to damage to trees and snow compaction, are also a tremendous concern to the entire animal population of the territory. All the long-term attempts of the reserve managers to amend the 1977 intergovernmental agreement and prohibit deer grazing on the territory of the reserve are unsuccessful so far, numerous attempts to negotiate with Norwegian reindeer herders do not give due result due to the absence of an intergovernmental agreement on the reserve on the border and coordination of actions between the countries in case of violation of law.

This case raises the following questions: why does one natural territory with similar characteristics in different countries have different conservation status? What factors influence the assignment of the territory of a protection status? To answer these questions, first of all, the categories of protected areas in Norway and Russia that currently exist will be considered. Using the trialogue model of governance, the role of government, society and a scientific community in the creation and management of protected areas in Russia as well as in Norway will be analyzed.

2. Methods

The Government-Society-Science model or the Trialogue model of Governance is an attempt to explain the processes taking place in the so-called "the black box of governance" (Turton et. al., 2007). Since governance is seen as a process that includes decision-making, according to the model it is influenced by three actor-clusters: government, society and science (Turton et. al., 2007).

The first actor-cluster, government, traditionally includes three branches of government: legislative, executive and judicial. The second society cluster represents civil society, the economy and the environment. Science is the third actor which can be defined as "the organized, systematic enterprise that gathers knowledge about the world and condenses the knowledge into testable laws and principles" (Turton et. al., 2007).

The main feature of the Trialogue model of Governance is interfaces among three actor-clusters (Turton et. al., 2007). In the context of interface between society and government, government should take into account the needs of society. It also includes "the legitimacy of the political process, and the permeability of government to new ideas from civil society and the corporate world" (Turton et. al., 2007). In the framework of this interface the level of satisfaction of society by government is analysed. Science, in turn, provides a basis for political decision-making, and government, stimulating science, is one of the drivers of scientific progress. The Science-Society interface can be determined as "science in the service of society, consisting of a number of elements, including the way that scientific knowledge is diffused into society" (Turton et. al., 2007).

Usually, this model is used to analyse the effectiveness of water governance (Meissner and Jacobs, 2016). However, this model allows us to examine the role of the main stakeholders (state, society and the scientific community), as well as their interaction with each other, therefore it has potential when studying management of other resources and components of the environment. In this work the Government-Society-Science model is used for comparative analysis of Norwegian and Russian management systems of protected areas.

3. Results and Discussion

Categories of protected areas in Norway and Russia

In Norway 2009 Nature Diversity Act No.100 (Norwegian Environmental Agency, 2009) defines the following categories of protected areas, as well as the degree of their protection and use for different purposes including recreation:

- National parks

National parks are large areas of natural habitat that contain distinctive or representative ecosystems or landscapes without major infrastructure development. In national parks, any activity that could harm the landscape and its plants, animals, geological features and cultural monuments is prohibited. Another goal of creating national parks is the development of tourism and providing citizens with access to an undisturbed natural environment.

- Protected landscapes

Natural or cultural landscapes can be considered as protected landscapes if they have ecological or cultural value or if they are a source of enjoyment for people. Any buildings and other elements of the cultural heritage that contribute to its distinctive character are considered to be part of the landscape. This form of protection is often employed for agricultural or other landscapes that are actively used. In a protected landscape, no projects may be initiated which may substantially alter the nature or character of the landscape.

- Nature reserves

According to the 2009 Nature Diversity Act nature reserves are protected in the strictest way. The purpose of creating such protected areas is to protect endangered, rare or vulnerable species and preserve their habitats, as well as landscape types. In addition, distinctive geological features and areas of special scientific interest can be protected in nature reserves. On the territory of nature reserves, any activity that may harm the environment is prohibited, including the implementation of various projects and access for the public or passage.

- Habitat management areas

Habitat management areas means a territory that is a habitat for certain species of flora and fauna and performs certain ecological functions for them. For example, they could be spawning or nursery areas, migration routes, feeding areas, molding grounds, display grounds or mating areas, or breeding areas.

In the habitat management areas, some activities may be restricted, and access for the public or passage may also be limited if they have a negative impact or destroy habitat management areas.

- Marine protected areas

The creation of marine protected areas can be carried out for two main reasons: the protection of marine areas themselves on the ground of their high value as well as the conservation of marine areas as ecologically necessary for terrestrial species. The criteria for their establishment are the same as those for nature reserves. A marine protected area may be protected from all activity, pollution, projects and use, subject to the limitations that follow from international law.

In 2017 there were more than 2 thousand nature reserves, 39 national parks and 194 landscape protected areas, in Norway, the remaining categories accounted for 458 protected areas. At the same time, it should be noted that the area occupied by national parks in Norway is almost five times large than the area of nature reserves (31 294 km^2 and 6 782 km^2 respectively). In total, the area of all protected areas is 7.2% of the total area of the country (Statistics Norway, 2019).

Currently, in accordance with the Russian legislation, there are six main categories of protected areas (Pyrkova 2008):

- State nature zapovedniks (reserves), including Biosphere reserves (biosphere zapovedniks)

Reserves in Russia are the most traditional and strict form of territorial nature conservation, the priority of which is the conservation of biological diversity. On the territory of the reserves, specially protected natural complexes and objects (land, water, subsoil, flora and fauna) that have environmental, scientific, environmental and educational significance as examples of the natural environment, typical or rare landscapes, places of conservation of genetic resources are completely withdrawn from economic use.

- National Parks

National parks are environmental, environmental education and research institutions, the territory (water area) of which include natural complexes and objects of special environmental, historical and aesthetic value, and which are intended for use in environmental, educational, scientific and cultural purposes and regulated tourism. The task of national parks along with the environmental function is to create conditions for regulated tourism and recreation in natural conditions.

- Nature parks

A relatively new category of protected areas in Russia. They are environmental recreational institutions under the jurisdiction of subjects of the Russian Federation, the territories (waters) of which include

natural complexes and objects of significant environmental and aesthetic value, and are intended for use in environmental, educational and recreational purposes.

- State nature zakazniks

One of the most widespread categories of specially protected natural areas are state nature zakazniks, which are located in almost all regions of the Russian Federation. State nature zakazniks can be under the jurisdiction of the federal government or subjects of the Russian Federation and have different purposes. Landscape zakazniks are designed to preserve and restore natural complexes (natural landscapes); biological (botanical and zoological) zakazniks are for conservation and restoration of rare and endangered species of plants and animals (including valuable species economically, scientifically and culturally); paleontological zakazniks are created for conservation of fossil objects; hydrological zakazniks (swamps, lakes, rivers, marine areas) are for conservation and restoration of valuable water bodies and ecological systems; geological ones are designed to conserve valuable objects and complexes of inanimate nature.

- Natural Monuments

Natural monuments are unique, irreplaceable, valuable in ecological, scientific, cultural and aesthetic respects natural complexes, as well as objects of natural and artificial origin. Sites of land and water, as well as single natural objects, can be declared natural monuments. Natural monuments can be created at federal, regional or local level depending on the environmental, aesthetic and other value of protected natural complexes and objects.

- Dendrological parks and botanical gardens

Botanical gardens and dendrological parks are used for introducing plants of natural flora, studying their ecology, biology under stationary conditions, developing the scientific foundations of decorative gardening, landscape architecture, landscaping, introducing wild plants into crops, protecting introduced plants from pests and diseases, and developing methods of selection and agricultural techniques for creating sustainable decorative expositions. Dendrological parks and

It is also worth noting that in accordance with the 1995 Federal Law on Protected Areas No. 33-FZ, the Government of the Russian Federation, the executive bodies of the subjects of the Russian Federation, and local governments have the right to establish other categories of protected areas (Danilova et. al. 2018).

In addition to the categories of protected areas specified in the Law on Protected Areas, a number of additional types of protected areas can be distinguished in the legislation. For instance, in accordance with the 2002 Federal Law on Environmental Protection No. 7-FZ, objects included in the UNESCO

World Cultural Heritage List and the World Natural Heritage List as well as the original habitat, places of traditional residence and economic activity of the indigenous peoples of the Russian Federation, the continental shelf and the exclusive economic zone of the Russian Federation, and rare or endangered soils, forests and other vegetation, animals and other organisms, their habitats are also protected by the government (Pyrkova, 2008). In the Water Code there is another category of protected areas - specially protected water bodies. They include water bodies or parts thereof, which have a special environmental, scientific, cultural, aesthetic or recreational value (Danilova et. al., 2018).

According to the State Report on the State and Environmental Protection in the Russian Federation in 2017 (Ministry of Natural Resources and Environment, 2018) there are about 12 thousand protected areas at federal, regional and local level in Russia, the total area of which is 232.7 million hectares (including marine areas). The total area occupied by protected areas is 13.6% of the territory of the Russian Federation (in 2010 this figure was 12.3%). It should be noted that in the system of protected areas of the Russian Federation, the largest number of protected areas are at regional and local level: in 2017 their total number was 11 601 units, or 97.5% of the total number of protected areas in the country.

The distribution of protected areas by category is the following: out of 298 federal protected areas, 105 are state nature reserves (35.2% of the total number of federal protected areas); 52 national parks (17.4%), 57 state nature zakazniks (19.1%) and 17 natural monuments (0.06%). At the regional level, the number of state nature zakazniks exceeds 2,000; the number of natural monuments exceeds 7,000 units; the number of nature parks and protected areas of other categories is insignificant (Ministry of Natural Resources and Environment, 2018).

Based on a comparison of the Norwegian and Russian approaches to the classification of protected areas, the following conclusions can be drawn. Both in Norway and in Russia, approaches to the classification of protected areas are very similar. In both countries there are territories with strict protection and a complete ban on economic activities (nature zapovedniks in Russia and nature reserves in Norway), as well as national parks, the purpose of which, in addition to preserving the environment, is to develop tourism and environmental education. There are a number of differences. For example, in Norway marine protected areas are a separate category, while in Russia, marine areas are usually part of nature reserves or national parks. In addition, due to the different state structure of countries in Russia, there are categories of protected areas that can be created only at the federal level (nature zapovedniks and national parks) or only at the regional level (nature parks).

If we talk about the distribution of protected areas by category, then in Norway the priority is given to national parks, in Russia at the federal level the main category is nature reserves, and at the regional level - natural monuments.

Comparative analysis of Norwegian and Russian management systems of protected areas

In Norway, after the 2009 reform, the so-called local management boards became key actors of the management system of protected areas. The purpose of this reform was to increase the effectiveness of environmental protection measures. As the results of state monitoring showed, despite the increase in the area of protected areas, measures taken to prevent further degradation of the natural environment in protected areas are insufficient. There has also been an increase in cases of violations of regulations, "which had occurred in 55% of the threatened areas" (Fauchald and Gulbrandsen, 2012). In addition, these measures reflected a commitment to the international principles of conservation of nature. The 2009 Nature Diversity Act was "extensively influenced by international rules and policies, including the IUCN guidelines for protected areas" (Fauchald et. al., 2014).

As of 2011, local management boards managed 107 protected areas, most of which were represented by national parks and large areas of protected landscapes. In addition, in accordance with the 1998 reform, municipalities administer 200 small protected areas (Fauchald and Gulbrandsen, 2012).

In the course the reform of local management boards, three core functions were transferred that were previously performed by government institutions (Falleth and Hovik, 2009). First of all, local management boards were given the responsibility to draw up plans for management of the protected areas and revision of such plans. In addition, local management boards have the right to make decisions regarding individual applications concerning activities which are unlawful within the protected areas. Also, these bodies can management activities to ensure against threats to the protected environment.

Since local management boards are elected bodies, it is within their framework that interaction is carried out through the Government-Society interface. Members of local management boards can be divided into three groups: representatives of municipalities (mainly mayors), representatives of regional councils and members of the Sami Parliament. Typically, more than half of the seats on local management boards are held by representatives of municipalities, about a quarter of the seats are representatives of regional councils, and only 10% of the members of local management boards are indigenous peoples (Fauchald and Gulbrandsen, 2012). However, according to some experts (Fauchald and Gulbrandsen, 2012), such a membership of local management boards will more likely contribute to the politicization of this body than to the implementation of environmental conservation tasks. For example, mayors, who are members of local management boards, will strive to take into account and realize the interests of the majority, which in turn can increase their chances of re-election. However, these interests may be the needs of landowners, resource users and tourist businesses, rather than environmental protection interests and other minority interests (Fauchald and Gulbrandsen, 2012). There is also a relatively low level of involvement of environmental NGOs in the work of local management boards (Fauchald and Gulbrandsen, 2012).

In addition, such an actor-cluster as science is almost completely excluded from this management system of protected areas. First of all, this is expressed in the absence of representatives of the scientific and professional community as members of local management boards. In addition, in recent years there has been a reduction in environmental specialists in municipalities. Consequently, the managers exercise their discretion relatively insulated from professional concerns and priorities in nature conservation, including national and international conservation objectives (Fauchald and Gulbrandsen, 2012).

At the center of the Russian protected areas management system is government. In the Russian Federation, the Ministry of Natural Resources and Environment of Russian Federation is engaged in the development and implementation of state policy, as well as legal regulation in the field of protection of protected areas. This ministry exercises public administration functions in the field of organization and functioning of federal protected areas (Danilova et. al., 2018). At the regional and local level, the relevant functions are performed by authorized bodies of regional and local authorities. At the same time, state authorities of the subjects of the Russian Federation coordinate their decisions on the creation of regional protected areas, on changing the regime of their special protection with federal executive bodies (Stepanitsky and Sinitsyn, 2008).

Society (including citizens, as well as public associations and non-profit organizations operating in the field of environmental protection), along with the executive authorities of the federal subjects and local governments, may come forward with the initiative to create protected areas at regional and local level. In this case, the initiator or initiative group notifies the state authorities of the subject of the Russian Federation or local authorities, the public about the need to take special measures to preserve the natural and historical-cultural complexes and objects (the Government-Society interface). The initiator of the creation of protected areas can take the necessary measures to conduct a comprehensive environmental survey of the territory, prepare materials for a comprehensive environmental survey of the territory (the Science-Society interface and the Government-Science interface) and submit them to the state environmental assessment (Stepanitsky and Sinitsyn, 2008).

Until recently, federal legislation also defined a mechanism for direct public participation in managerial decisions in the creation of protected areas, which was implemented through public discussions of materials submitted for environmental assessment. Practice has confirmed the high interest and active participation of the public in the development of the system of protected areas in Russia. Public participation in the process of creating protected areas made it possible at the design stage to determine the sufficiency and objectivity of the proposed design solutions, to identify controversial positions, the preservation of which could lead to subsequent conflicts with the local communities and nature users during the functioning of the protected areas. The identification of these issues, the search for solutions that suit all interested parties, was carried out during the EIA procedure and the state environmental

assessment during the work of observers from public organizations. The significance of public participation increases many times at the stage of reorganization of protected areas. Often, only the active position of the local communities and environmental organizations allowed to defend and preserve valuable natural territories and objects located within the boundaries of protected areas from their economic development (Mnatsekanov and Sergeeva, 2018).

However, in 2018, due to changes in the legislation, the materials of a comprehensive environmental survey of areas that substantiate the giving of these territories the legal status of specially protected natural territories at federal or regional level were excluded from the environmental assessment. On the one hand, this measure simplifies the procedure for creating protected areas, which is undoubtedly a positive undertaking that facilitates the development of Russia's protected areas system and significantly accelerates the process of ensuring the territorial protection of unique natural complexes and objects (Mnatsekanov and Sergeeva, 2018). On the other hand, these actions have led to a limitation of the participation of society and the scientific community in decision-making regarding the management of protected areas, since both state and public expertise on materials justifying the creation and reorganization of protected areas, as well as public hearings, will not be held.

A comparative analysis of management systems of protected areas based on the Trialogue model of Governance made it possible to identify the main characteristics of these systems in Norway and Russia, as well as to determine the similarities and differences in them. So, the Russian management systems of protected areas is in line with the IUCN's idea of managing protected areas. In other words, it is “the classic form of governance for protected areas in which decision-making continues to be by the state for all aspects of acquisition, establishment and management of areas designated as formal protected areas” (Lausche, 2011). The management system of protected areas in Norway is a co-management model or shared governance, “when responsibility for management is shared (formally or informally) among government and non-government actors, often local actors (Fedreheim and Blanco, 2017).

In both countries there is a lack of balance between the three main actor-clusters (government, society and science). In both cases, government actor-cluster comes to the fore. In Russia, all the functions of managing protected areas are performed by the Ministry of Natural Resources and Environment with a partial transfer of authority to the federal subjects in the case of regional protected areas. Following the 2009 reform in Norway, the leading role in managing protected areas is played by local management boards combining the functions of planning and implementing environmental protection activities in protected areas.

Despite the leading role of local management boards in managing protected areas and decision-making, the Norwegian model involves public participation in this work, since this body is elected and consists of representatives of municipalities, regional authorities and indigenous peoples. However, there is a

possibility that representatives of mainly municipalities will try to take into account the interests of the majority, and these interests will not always be directly related to environmental activities. In Russia at the moment there is no mechanism for interaction between the government and society when making decisions regarding protected areas. However, at the same time, citizens and public associations can initiate the creation of protected areas at the regional and local level.

Also, a characteristic feature for both systems is the extremely insignificant role of the scientific community in decision-making regarding the management of protected areas. In Russia the preparation of the materials of a comprehensive environmental survey of areas, as well as their state and public expertise, was a very effective mechanism for the interaction of the scientific community and the public and its influence on decision-making on the creation and reorganization of protected areas. However, at the moment, this mechanism has been abolished. In Norway, mechanisms for involving the scientific community in the work of local management boards are also absent.

4. Conclusions

To conclude, we can assume that despite a number of general characteristics (similar approaches to the classification of protected areas, the role of government), the management systems of protected areas that have developed in both countries will rather hinder than help to resolve the situation in the Pasvik - Inari Trilateral Park. The reform carried out in Norway may complicate possible negotiations between the Russian and Norwegian parties regarding the change of agreements at the international level regarding the Pasvik - Inari Trilateral Park, since now the management has been moved to the local level, and the settlement of such a situation at the level of the relevant environmental ministries would have been much easier. At the same time, possible changes in existing agreements between the countries will affect the interests of stakeholders at the local level, in particular reindeer herders. A possible solution to this situation may be the active involvement of the professional and scientific community, both in the negotiation process and in the management of protected areas, since “professional expertise in nature conservation is characterized by the use of scientific arguments, the definition of issues in technical, non- political terms and by processes on the bureaucratic arena” (Fauchald and Gulbrandsen, 2012).

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The Human Rights Crises and The Economic Impact: Malaysian Covid-19 Containment Measures in the Case of Foreign Worker

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Abstract

In the National Transformation 2050 Plan, Malaysia aims to become the 20th best nation in the world in economy, happiness, creativity, and innovation. This strategy relatively has a significant impact on the workforce. Undeniably, foreign workers are making a major impact on the Malaysian economy. In reality, the addiction and reliance on the foreign workforce are escalating, and this country has been hosting millions of foreign workers for decades. Prior to the outbreak of COVID-19, Malaysia is already muddled with the treatment of the foreign workers and part of the government containment measure in flattening the curve of the COVID-19 pandemic. Malaysian is seen to be at the lowest point in its effort in handling the crisis. Although the government promised not to detain illegal workers during the screening process, the decision is overturned, and as a result, all undocumented foreign workers are being detained in immigration depot regardless of their status. This decision has hindered the process of containment, as exercising physical distancing is impossible in the cramped detention centre. Moreover, the health facilities provided in the detention centres are not at par with what been enjoyed by the local citizen. This scenario had gained global attention as it violates human rights law. The protection of labour rights is parallel with the Sustainable Development Plan 2030 in Sustainable Development Goals (SDG) 8 as in Target 8.8. Furthermore, the outbreak has a causal impact as it has impaired the economy since most Malaysian workforce relies on foreign workers. This paper reviewed the containment measures adopted by the Malaysian authorities using the secondary data's content analysis and literature reviews. The focal point of discussion emphasised the containment measures adopted by the government, the human rights law that comes with it, and its effect on the economy. Malaysia is determined to achieve economic growth as in Target 8.1 and strives in enhancing production by diversification, technical development, and innovation as in Target 8.2. Economic stability must be the government priority as of now, and along the way, the suppression matters must be exercised carefully by not violating any legal provision. This paper offers several immediate solutions to curtail the virus's spreading, namely an advance screening test to foreign workers to allow those who are positive to be isolated besides immediately review the entry protocol of illegal immigrants into the Immigration Detention Depot. The government is also urged to legalise undocumented foreign workers' status. Since their presence distorts the economy, the government agreed to remove an earlier cap on recruiting foreign workers to secure local employment in most industries. Thus, they would be confined to involve in construction, agriculture, and plantation sectors only. Indeed, the planning cannot be materialised without the holistic approach and cooperation from all government machinery and society at large.

Keywords: COVID-19, pandemic, human right, foreign worker, economy, containment

1. Introduction

To achieve the Malaysian next vision of the National Transformation 2050 Plan (TN50), Malaysia aims to become the 20th best nation in the world in economy, happiness, and creativity and innovation. This strategy has the biggest effect on the country workforce as Malaysia has been benefitting greatly from its relatively open immigration policy for over 50 years (Owen, 2005). To date, there are various migrant workers residing in the country relative to the total population in the Asia Pacific (WHO, 2020a).

The domestic workforce development rate in Malaysia is considerably greater than in most Southeast Asian countries as Malaysia's reliance on migrant labour with workforce growth pace of 2-3 per cent annually (Kaur, 2017). Within no time, Malaysia has shifted from labour importer to labour exporter. Rapid Malaysia's immigration transformation took place decades ago before its economy reached maximum jobs and income per capita (Lim, 1996).

The foreign worker is a term that applies to foreign nationals who entered Malaysia lawfully to work in less-skilled jobs under the Visit Pass (Temporary Employment, VP(TE)) scheme. The employment is secured prior to coming to Malaysia (Loh et al., 2019). In addition, a foreign worker also refers to a worker, either legal or illegal, professional or unskilled, employed in numerous industries in this nation (Marhani Mohd Arif et al., 2012). In a wider definition, the International Labour Organization (ILO) identified a foreign worker as an individual that migrates to work for someone else and involves any person who is routinely accepted as a migrant for jobs (ILO, 1999).

Mohamed et al. (2012) defined foreign workers to as an individual who is serving on a contractual basis in a nation in which the person is not a resident. They are employed by a corporation, a recruiting firm, or when job searching in the world to complement the country's workers for a short time or to have expertise on a temporary basis that the country requires. They are working mostly in the 3D job sectors (dirty, dangerous, and difficult) (Ismail, 2013; Kumar, 2016; Marhani Mohd Arif et al., 2012; Rodzi., 2020). Hence, the scope of this paper covers all types of foreign workers regardless of legal or illegal.

Historically, Malaysia received foreign workers who were involved in agriculture, construction, and mining since the British colonial age at the beginning of the 19th century (Abdul-Aziz, 2001; Dannecker, 2005; Kaur, 2017; Lee & Sivananthiran, 1996). The inflow of foreign worker began in the 1970s since the provision of legal employment was absent, and only until the 1980s, after the massive inflow of foreign workers in Malaysia, the Immigration Rule was extended to foreigners (Azizah Kassim & Ragayah Mat Zin, 2011; Kanapathy, 2008; Kaur, 2017). The migration phenomenon of foreign workers is unavoidable, particularly when maximising economic development is the main focus of most countries in the world (Noor et al., 2011).

Ministry of Home Affairs revealed that, from 10 international workers, 4 of them were irregular. The overall foreign worker population was around 3 to 3.3 million, and around 1.2 million to 1.5 million were irregular (World Bank, 2019). In 2018, Malaysia was home to over 2-4 million undocumented migrant workers (IOM, 2020). As of August last year, the Temporary Visiting Work Permit Malaysia has registered 1.99 million foreign workers, and the Malaysian Employers Federation (MEF) estimated that approximately 3.3 million foreign workers are undocumented (New Straits Times, 2020a). Basically, legal foreign workers from 18 to 45 years are involved in construction, manufacturing, agriculture plantation, and services, as well as domestic work (Immigration Department of Malaysia, 2020).

The bitter truth is that foreign workers have been participating and contributing to Malaysia economy and even dominating certain sectors that are not gain the interest of local (Azizah Kassim, 2005). When pandemic COVID-19 hit Malaysia in early 2020, it carries together a huge impact on the whole health

system in the country and impacted our economy greatly. Many foreign workers, particularly undocumented or migrant, are being detained as part of the containment measures to curtail the outbreak. As most Malaysian are pleased with the government precaution and measures to flatten the curve, it does, however, attract the attention of many other parties. The growing concern is on violation of the human right law. This paper, therefore, focuses on the scenario of the pandemic revolving around foreign workers, the humanitarian law and the economic impacts of COVID-19 that come along. At the end of the discussion, this paper seeks to offer possible recommendations to solve the issue.

2. The COVID-19 outbreak

At the end of 2019, the COVID-19 outbreak has provoked the most urgent assessments of national capacities for reacting to health crises to date. Cases were first reported in China, and from there, they grew exponentially before spreading worldwide. As confirmed cases increased, the number of deaths followed. In a matter of days, on 30th January 2020, the outbreak was reported as a significant international public health concern, and consequently, on 11th March, the World Health Organisation (WHO) proclaimed that the infection became a global pandemic (WHO, 2020b).

The outbreak of COVID-19 in Malaysia is recognised within three stages. The first wave is from 25th January – 16th February 2020, commenced by three cases from China via Singapore on 24th January 2020 and risen to only 22 cases by mid-February. The second wave was highly strengthened by mass dissemination at a religious congregation in Sri Petaling Kuala Lumpur, with approximately 14,500 Malaysians and 1,500 foreigners participated in a 4-day gathering from 27th February to 3rd March (WHO, 2020a). The cluster reported a total of 3,375 infections and spawned to 17 sub-clusters with more than 30 deaths and was officially declared over on 8th July, and the second wave continues until 30th June 2020. The third wave begins on 20th September 2020 and until present (The Star, 2020g). The fourth wave, on the other hand, can only occur if domestic or local transmission cases reach zero in the present third wave until the number of cases spikes the next day dramatically (The Star, 2021a).

Since most foreign workers in Malaysia are unskilled, many of them are filling in labour shortages in economic sectors that require little expertise. The minimum requirements set by Labour Department are not met as their living conditions are often cramped and crowded with inadequate ventilation and sanitation and limited or unclean water, both of which contribute to the breeding and spreading of communicable diseases and hinder the precautions to curb the COVID-19 spreading (Milton Lum, 2020).

In fact, it is common in the construction sector for employers to build a temporary house at the site using the cheapest, even used construction materials (Abdul-Aziz, 2001). The living condition of foreign workers are terrible, crammed, dimmed, poorly ventilated, dirty, and with no proper drainage and disposal system (ILO, 2020a; World Bank, 2020). To date, there are no legislative and administrative requirements that can be imposed by the government to require the contractor to provide decent accommodation to the foreign workers. This poor living condition might affect foreign workers health and eventually can spread diseases to the public at large. In fact, it is worth mentioning that in 1996 and 1997, there was a dengue fever outbreak where the virus was traced in the waterlogged at the construction sites (Abdul-Aziz, 2001).

3. Methodology

This research draws on current literature and secondary references, such as scholarly reviews, press coverage of migrant workers and reports from the International Labour Organisation as well as the World Bank. This study highlights the containment measures implemented by the Malaysian authority in curbing the COVID 19 pandemic and its violation of human right and its effects on the economy.

4. Discussion

To curtail the COVID-19 spreading, the authority declared the Movement Control Order (MCO) commenced on 18th March 2020 following the Sri Petaling gathering comprised of six distinct stages and six critical measures. The four separate and incremental transitions of the MCO, a Conditional MCO (CMCO) and the Recovery MCO (RMCO) all of which extended nationally and included bans on domestic and international travel, major meetings, closures of government and private premises, as well as educational institutions. An extended movement control order (EMCO) was also created for applications in a locality undergoing outbreaks or clusters of cases (WHO, 2020a).

Since many attendees at the Sri Petaling gathering are identified as migrants who might be concealing themselves due to a lack of appropriate documentation, in March 2020, the Defence Minister announced that all foreign workers need to come forward for the screening process, and they should not fear of detention as the government's priority is to fight COVID-19 (New Straits Times, 2020d). The authority also encourages undocumented foreign workers in manufactures and non-governmental organisation to come forward to the screening test through an amnesty program (BH Online, 2020a; The Star, 2020c).

Unfortunately, since migrant workers were found to be the main contributors to the increase in positive COVID-19 cases (The Star, 2020e), the decision was overturned, and in May 2020, the Defence Minister declared that the government have the right to detain illegal immigrants as they are not supposed to be walking freely without proper documentation after the detention period is over (BH Online, 2020c; New Straits Times, 2020e).

Moreover, the government is also tackling this COVID-19 spreading among foreign workers and illegal immigrants in residences and temporary detention depots. Among the causes of infection or contagion is due to congestion in local residences or shared houses and temporary detention centres. It was understood that some shared houses could be resided by up to 40 people, and this situation caused COVID-19 to spread rapidly (Sinar Harian, 2021). This situation is also proven as other countries experience as Singapore, Bahrain, United Arab Emirates, and Kuwait also concurred that rapid dissemination of COVID-19 is mostly caused by crowded and insecure living environments and inadequate access to health for a foreign worker (Andika Wahab, 2020).

In addition, the authority had tightened security at all Malaysian entrance, and several foreigners have also been apprehended as they were trying to depart illegally (New Straits Times, 2020g). In further, a complete lockdown was announced in April when a cluster of 79 infections was detected in foreign workers residential area in Kuala Lumpur, where around 75% of 6000 residents are foreign nationals (The Star, 2020a).

The numbers of positive cases among foreign workers keep on rising as of mid-April 2020. 601 foreigners were tested positive at that time (The Star, 2020d). By the end of April, 811 positive cases (Sukumaran & Jaipragas, 2020), 235 positive cases in early May (Latiff & Ananthalakshmi, 2020), 1,302 positive cases by middle May (Malaysia Kini, 2020a), 44 infections by the end of May (The Star, 2020f), and by the end of November more than 2,684 were tested positive (ILO, 2020d).

The authority further declared that all foreign workers across various sectors have to go through COVID-19 testing, with costs borne by their employers (The Star, 2020e). Starting on 1st January 2021, noncompliance employers are regarded as a violation of the Prevention and Control of Infectious Diseases Act 1988 (New Straits Times, 2020b). Furthermore, the government proceeded to restrict the entry of foreigners from Indonesia, the Philippines, and India with long-term pass holders effective on 2nd September 2020 following the increase of COVID-19 cases in the countries. The restrictions include six categories, namely those who hold permanent resident status (PR), Malaysia My Second Home Program (MM2H), expatriates including Employment Pass category 1, Professional Visit Pass, Resident Pass, Spouse Visa, and students who wish to study in Malaysia from abovementioned countries (New Straits Times, 2020f).

Despite numerous efforts by the government to flatten the curve, by the end of last year, only 49,248 foreign workers from 1,990 employers went for COVID-19 screening (New Straits Times, 2020b). As of early January this year, a total of 99,163 foreign workers have undergone a swab test, and 2,079 were tested positive (Setiawan, 2021). Data from the Ministry of Health Official Website indicate that as of the end of January this year, there was a sharp increase of COVID-19 infection among foreign workers with 1,310 positive cases. In total, there are all 5,785 confirmed cases recorded (MOH, 2021). In February 2021, over 7000 positive cases involving foreign workers were recorded (The Star, 2021b).

For years, Malaysia has been criticised for the treatment of foreign workers, especially undocumented migrants, refugees, and asylum seekers. Even prior to the COVID-19 outbreak, when the economy is going down, the government measure is to reduce undocumented foreign workers figures by placing them in detention facilities or threatening them to drop immigration, but on the contrary, when the economy is stable, the government will find a way of jacking out the workers' entry (Ganesan, 2020). Therefore, as part of the containment measure, significant attention should be given, especially when Malaysia is hosting most undocumented foreign workers as compared to the legal ones (Andika Wahab, 2020).

(a) The Human Right Issue

Even though this country has been hosting millions of foreign workers legally or illegally, this country is not a signatory of important international human rights treaties, including the 1951 Convention on the Status of Refugees or the 1967 Protocol on the Status of Refugees, the two primary diplomatic instruments governing refugee rights. Consequently, Malaysia provides no clear formal immunity to individuals fleeing their home country out of fear of persecution under the Convention (SUARAM, 2008).

Amidst the struggle in battling the health crisis, it does not deter illegal immigrant to find ways to enter Malaysia. In April 2020, thousands of desperate Rohingyas, intending to head for Malaysia, were denied passage by the Malaysian Navy, claiming to be preventive to contain the spread of COVID-19. Many that were allowed to land were arrested as "illegal migrants" and charged and jailed for immigration offences (Bangkok Post, 2020b; Human Rights Watch, 2020a).

This incident attracted global attention as many human right activists condemned the government by claiming that Rohingya people are genocide survivors who need protection and not to be left to die at sea (Nontarat Phaicharoen & Nisha David, 2020), and this pandemic would not justify putting refugees' lives at risk on overcrowded shipping (Press, 2020). Further, it is illegal and considered as death penalty to take an ill-equipped ship with refugees out to sea. The United Nations, human rights spokesman,

advocated that Malaysia should be more compassionate towards those in desperate needs of assistance and protection (Bangkok Post, 2020a).

Malaysia once again attracted the attention of the world following the arrest of Rayhan Kabir, a migrant worker from Bangladesh who was featured in an Al Jazeera documentary concerning the appalling conditions endured by migrants and refugees in Malaysia amidst the lockdown (The Star, 2020b). As a result, he was deported back to his home country for good and two Al Jazeera journalists permits who cover the news were not extended (News Straits Times, 2020). This is permissible as the Immigration Act 1959/63 allows the termination and revocation of non-citizens immigration status. Chhoa-Howard and Yesudas (2020) contemplated that the Act as provided under section 36, allow the authority to whip, which is an inhumane, humiliating, cruel, and violation of international human right law.

This outbreak is a platform for the authority to redefine its stance on the reception of refugees fundamentally. The new crackdown reflects the reality that without adequate domestic legislation to safeguard migrant human rights, they are exposed to threats of exploitation, illegal imprisonment and other violations (Human Rights Watch, 2020b). The United Nation, the Bar Council, and 62 NGOs (Malaysia Kini, 2020b) such as SUHAKAM and Amnesty International also expressed their concerns on the issue.

The United Nations urged the government to restrain from looting locked-down areas to apprehend and detain migrants as it will eventually hinder migrant communities from coming forward even though they exhibit signs of the coronavirus as they are staying in overcrowded immigration detention facilities. Moreover, in the atmosphere of hatred that persists against refugees, hateful rhetoric against them is on the rise. Human right activists were harassed, and media was hampered due to reporting on refugees' issues. Posts like intimidation and hateful rhetoric have come from all members of the government, political groups, and elected representatives (Jules Rahman Ong, 2020; United Nation, 2020).

Amnesty International, on the other note, contended that the mass imprisonment of refugees and migrants during COVID-19 is a serious violation of civil rights and prosecution of a fragile group as refugees and migrants, regardless of their status, have the right to fair justice and wellbeing. This is a blatant misuse of authority by the government. Mass arrests amid a pandemic caused prisoners to be stuck in cramped buses, not wearing masks, and incapable of practising social distancing (Amnesty, 2020).

Similarly, the Human Rights Commission of Malaysia or better known as SUHAKAM, also condemned the preventive measure of arresting undocumented migrant despite the assurance made by the government of not detaining them. The large scale or arrest had reinforced the negative perception of them and a violation of Article 5(1) of the Federal Constitution, which ensured the preservation of life (SUHAKAM, 2020).

In a similar vein, the Malaysian Bar urged the authority to consider stopping the new enforced intervention but rather to concentrate cooperation of all individuals works together on flattening COVID-19 transmission. Hence, admission to COVID-19 tests for all foreign workers must be permitted and should offer adequate medical treatment to those who tested positive without fear of repercussions for their status (Loheswar, 2020).

In fact, the Malaysian Trades Union Congress (MTUC) confirmed the following common abuses of labour rights of migrant workers during the pandemic, which include: wrongful dismissal; unpaid salaries; forcing to work in non-essential sectors; and confusion of employment status due to lack of communication (Florida Sandanasamy et al., 2020).

The General Director of Health urged that a holistic approach of all government machinery and society is necessary so that this issue can be addressed and recommend screening tests be done in advance to allow those who are positive to be isolated. At the same time, the protocol for the entry of illegal immigrants into the Immigration Detention Depot should also be reviewed (BH Online, 2020b).

Additionally, all states shall ensure the security of everyone, including migrants, as coherent with the human right principle (Article 25(1), 1948) and the 2030 Agenda for Sustainable Development Goals (SDGs). The SDGs or the Global Goals are embraced by all United Nations Member States since 2015 as a universal call to action to eradicate hunger, preserve the environment, and ensure security and prosperity for all citizens and dedication to "leaving no one behind". Thus, to achieve the SDGs in all contexts, all sectors of society must contribute their innovation, know-how, technology, and financial capital.

The target of 8.8 of SDGs specifically focuses on labour rights security and the promotion of healthy and stable working conditions for all employees, including migrant workers, especially woman migrants and those in perilous jobs. The significant indicator in achieving this target is actually by ratification and implementation of ILO labour standards and compliance in law and practice (Ritchie et al., 2018). The non-incarceration and community-based approach to prisons was also integrated into this proposal (New Straits Times, 2020j).

(b) The Economic impact

Globally, challenges of managing foreign trade had a detrimental influence on emerging countries even before the lockdowns were expanded. The drop in product prices worldwide would also weaken the market status of exporting countries and decrease jobs in exporting industries, which in turn decreases tax revenue. Huge capital outflows have contributed to currency devaluations, accelerated debt servicing and imports of food and medical supplies, all of which have put added strain on the fiscal balance of developing countries (ILO, 2020b).

In Malaysia, following the closing of the Malaysian borders and the return of foreign workers to their homeland during the MCO, the population density decreased from 3.1 million in 2019 to 3.0 million in 2020. In contrast, the population increased to 1.1% and stayed steady from 29.4 million in 2019 to 29.7 million in 2020. It is projected that Malaysia has an annual rate of growth of 32.7 million in 2020 compared to 0.4% in 2019, which is 32.5 million (DOSM, 2020a).

Last year, approximately 62,522 foreign workers returned to their home country, with 11,566 to Indonesia (Medcom. id, 2020) and 51,000 to Thailand (New Straits Times, 2020h). Moreover, thousands of foreign workers dominated the garment industry lost their job when the industry shut down during the pandemic (Loone, 2020; New Straits Times, 2020c). The job loss rate was estimated to be at 951,000 as compared to 16 million employed labour in 2019 (MIER, 2020). As of July 2020, the government announced that over 67,000 local residents and several thousand foreign nationals had lost their employment (Liz Lee, 2020).

This scenario has a huge impact on the Malaysian economy since the Malaysian labour workforce is depending on foreign workers. Remarkably, foreign workers dominated in three leading sectors, namely agriculture, construction, and manufacturing, besides the engineering sector (BH Online, 2020e; Yan Nee Lee, 2020). Other than the economy, it also affects productivity, household expenditure, investment, and the labour market.

Despite the difficulties of containing the spread of the COVID-19 across different phases of MCOs with the reopening of economic activities, the economy has been experiencing a continuous recovery in the third quarter of 2020, and there has been an increase in the ban on international transports. As the economic industries recovered, this quarter unemployment declined to 4.7% compared to 5.1% in the second quarter (DOSM, 2020b).

The Malaysian Institute of Economic Research (MIER, 2020) estimated that the pandemic might have a substantive impact on the macroeconomy of the country. The real Gross Domestic Product (GDP) will be contracted by 2.61%, with real GDP growth is expected to be 1.57%. On the other hand, the value of real GDP losses is estimated to be RM38 billion as compared to RM73 billion in a nominal term.

Beginning in January 2017, it is mandatory for employers who are given a certificate to employ foreign workers to sign 'Employer Pledge' and to bear the full levy payment. The Malaysian Employers Federation (MEF), on the contrary, disagreed since it has an adverse impact on the people and the Malaysian economy as it transfers the responsibility of paying levies from foreign workers to employers. The ringgit outflow is expected to increase up to RM4 billion a year and would contribute to the expected inflation rate of more than 4%, thus leading to a sharp rise in the price of goods. The salaries of foreign workers will increase up to 15 to 16 per cent affecting around 400,000 employers to cover the cost. This does not include other costs such as providing better accommodation through centralised housing, medical examinations, and insurance of foreign workers as contained in the Employer Pledge (BH Online, 2017).

Last year, the Malaysian economy was predicted to contract 3.1 per cent because of a sharp downturn in economic activities resulting from COVID-19 and efforts to curtail it, while the epidemic is expected to restore development of 6.9% by 2021 (The World Bank, 2020) and stabilisation by 2022 (Asian Fund Managers, 2021). Between 2024 and 2028, Malaysia is expected to shift to a high-income country as GNI per capita is currently estimated to be US$11,200, falling just US$1,335 short of the current definition of a high-income economy as according to GNI per capita ratio under target 8.1 in The Sustainable Development Goals (Ritchie et al., 2018).

While the COVID-19 pandemic has slowed down the momentum toward the threshold, the country now has the potential to adopt strategies for future prosperity that benefits everyone in the country. Malaysia's authority strives to continuously evaluate the consistency, inclusiveness, and sustainability of the country's growth. Additionally, the government has budgeted for the UN Sustainable Development Goals per year (The World Bank, 2021). Both policies will ensure sustainable development is maintained via tailored, outcome-oriented economic strategy, enabling the country to seize the opportunities offered by a post-COVID-19 economy and, in the next 5 years, re-establishing a road to high-income nation status.

Recommendations

As for human rights law, human right activists are of the opinion that Malaysia could ratify the 1951 Convention on Refugee as the country is bound by international standards for refugees. As of 2020, more than 175 thousand refugees and asylum seekers, mostly from Myanmar, are registered with the UNHCR office without legal status (Human Rights Watch, 2020a).

According to the United Nations Special Rapporteur, alternate custody must be addressed first since the arrangements to expel arrested migrants to their homeland remain uncertain, and whether they have rights to counsel and to appeal their confinement and extradition. A thorough investigation of each situation must be conducted as the government is putting the risks of exposing people to violence and other forms of ill-treatment in their home countries. This effort, in turn, will be counter to the universal concept of non-refoulment (United Nation, 2020).

Secretary-General of the Malaysian Trades Union Congress (MTUC) stressed that, for too long, excessive employment of foreign workers has led to their influx in Malaysia, widespread layoffs, while low wage rates are at odds with achieving high-income country status (BH Online, 2020d).

Currently, there is a need to examine more broadly and transparently the recruitment of foreign workers, including how and to whom licenses are issued, their wages and employment. MTUC, at its annual delegation meeting over the past three years, made the following resolutions:

Eliminate the practice of allowing agents, contractors, and mediators to act as suppliers of foreign workers and strictly restrict all foreign recruitment except as required, including not more than 25% of the total workforce in the construction, manufacturing, and agriculture sectors. Generally, the hiring agency promises generous salaries and conditions, but upon arrival in Malaysia, their employer would pressure them to sign another deal, typically with considerably lower compensation and benefits, as the legal contract (Hamid et al., 2018; Robertson Jr, 2009). As a result, many of them escaped and became illegal immigrants (Rudnik, 1996).

The government needs to form a strong and long-term employment policy, more active and directly, rather than giving it to profit-motivated personal contractors. There are some areas that need government control and should not be privatised. Labour inspections and enforcement must also be stepped up. This initiative will help the government to monitor the actual workforce needs of employers and better control the recruitment of foreign workers.

As for the economic impact, Malaysia, especially since the formation of the ASEAN Economic Community (AEC), needs a comprehensive review of employment practices, including recruitment and employment conditions. The AEC Blueprint was created to invest in 'employees', share responsibilities, and enhance synergies between companies, employees, and the government to ensure competitiveness, dynamics, and inclusiveness for ASEAN members. The government should immediately involve the MTUC in discussions on implementing reforms. Employers should cooperate and support government efforts. The Home Ministry should renegotiate with the United Nations High Commission for Refugees (UNHCR) for the settlement of refugee status detainees at immigration depots nationwide (BH Online, 2020d).

Besides, the Central Bank report came out with several possible suggestions. The government stand must be clear on the low skilled foreign worker role in the Malaysian economy. Secondly, policy and implementation must be clearly communicated to all industry player even though it may create a pushback at the beginning. Third, the government must set a limit in term of quota, dependency ceiling and levies. This enforcement is to ensure that there is control on how many workforces are needed in selected industries. Fourth, to ensure that foreign workers receive better treatment in all aspects so that employer will not have a chance to manipulate them, and lastly, effective monitoring and enforcement must be exercise, and penalty must also be imposed on an employer who violated the rules (Ang Jian Wei et al., 2018).

Furthermore, Human Resource Minister contended that Malaysia removed an earlier restriction on recruiting foreign employees to protect employment for Malaysians in most industries. Foreign workers will be restricted to the manufacturing, agricultural, and plantation industries (Liz Lee, 2020).

Undeniably, foreign workers play an important role in moulding the Malaysian economy for decades, over dependency on them is a distortion to the economy and eventually discourage industrial upgrading. The government spent around RM8 billion since 2008 for technology adoption and commercialisation (Ang Jian Wei et al., 2018). Moreover, it will impair the pursuit of becoming a developed nation and hinder the achievement of the TN50 vision. Malaysia could profit from maintaining domestic expertise and recruiting advanced-skilled international talents. Malaysia's ambition to become a high-income economy would need the idea to maintain more of its domestic talent (World Bank, 2011). In addition, this country needs to generate approximately 2 million additional high-skilled workers to achieve parity with the average of the Organization for Economic Cooperation and Development (OECD) country. It can be materialised by creating fundamental human capital through improved health and education, improving skills and reassigning skill of the workforce, and mobilising underutilised labour resources both within and outside Malaysia. It is essential to improve the synchronisation of labour demand and supply policies (World Bank Group, 2021).

With regard to the sentiment that local workers are avoiding 3D sector involvement that is currently dominated by foreign workers, the allegation is rebuttable since past study proved that local workers are willing to participate in the sectors provided the wages are commensurate. In fact, around 40% of Malaysian citizen working in Singapore as middle and low skilled workers with attractive payment (Ang Jian Wei et al., 2018). In 2015, there were over 1,123,000 Malaysians living in Singapore alone, the majority of whom are qualified. Hence, Malaysia would need to understand the variables that influence individuals' migration decisions in order to attract more domestic talents (Testaverde et al., 2017).

Moving toward the SGDs target, Malaysia has begun a journey towards sustainable development as early as the 1970s with the new economic policy that was launched to reduce hunger and restructure social imbalances. In 2009, Malaysia formulated its New Economic Model (NEM), which further strengthened its pledge to be sustainability-focused on three main objectives: high revenues, inclusiveness, and sustainability. Further, it is also included in the five-year planning of the 11th Malaysia Development Plan 2016-2020 with an objective of sustainable economic growth and the striving for fair distribution in the community, access to essential infrastructures, education and health facilities and comprehensive environmental protection (Economic Planning Unit, 2017; New Straits Times, 2020i).

Apart from that, Malaysia's 2020 budget seeks to facilitate a move away from low-skilled migrant jobs. However, prior to the pandemic, the analyst noted that the recruitment of foreign workers would induce a cheap labour policy that hampered the implementation of technology and slower productivity growth (Eng, 2019; ILO, 2020c). In addition, the government made an allocation to substitute foreign workers with the local in industries through the 2021 budget in which previously dominated by foreign workers (Aziz, 2020). The current scenario highlights the government commitment to fulfilling the SDGs target as planned since sustainable growth is embedded in the policy, and Malaysia is making substantial progress to it (New Straits Times, 2020i).

Currently, in the Malaysia 12th Malaysian Plan 2021-2025, the government strive to strengthen and enhance immigration and emigration strategies by streamlining and transparently managing migrant workers and promoting domestic skill retention and attraction.

Conclusion

By looking at the current scenario, the COVID-19 pandemic indeed has impacted every country around the globe. The over-dependency on foreign workers, especially on low skill, must be reversed as this will prevent the country mission from becoming a developed nation. The addiction to foreign labour is indeed the opposite direction of moulding Malaysia into becoming a country with high productivity and a high-income workforce. In addition, Malaysian is embarking on the Industrial Revolution of 4.0, where the country is focusing more on the use of technology. This statement is also in parallel with the country vision of TN50 and Sustainable Development Plan 2030 in Sustainable Development Goals (SDG) 8 as in Target 8.2 with higher economic growth by diversification, technological advancement, and innovation. Economic growth is necessary, but above all, attention and priority must be given to Malaysian citizen, and in doing so, the government is providing initiatives in levelling up our human capital. Over-dependency on foreign workers seems to contribute to the Malaysian economy, but in reality, it just widens the gap of unemployment rate among the local citizens. What can be learned from the crisis? The COVID-19 pandemic is a blessing in disguise. When foreign workers were detained in the detention centre, and even many of them were deported to their home country, it creates a huge opportunity for the local labour force to venture and taking over industries that are being dominated previously by the foreign workers. In addition, the government commitment is apparent as an incentive is provided in the 2021 Budget to help sectors of high reliance on foreign workers, such as on construction and plantation. The monetary incentive aims at increasing the local workforce and participation in replacing the foreign workers. For decades, Malaysian has been very lenient when it comes to treatment towards the migrants. The government containment rules in betting the COVID-19 pandemic are catching the eyes of many parties across the globe. Therefore, it is the right time for the government to make a drastic effort but at the same time safeguarding human rights. Personally, despite many pressures made by the human right activist to ratify the 1951 Convention, the author is of the opinion that by ratifying the 1951 convention, it does not, however, solve the issue but rather open a wider opportunity for migrant especially the refugees and asylum seekers to come to Malaysia and stay here forever.

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Legal and Judicial Aspects of Sustainable Development in Nepal: A Bird's Eye View

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Abstract

Nepal has recently promulgated a federal Constitution in the year 2015. This new Constitution comes with new facets, endorsing various international environmental law principles, mainly the polluter pays principle, precautionary principle, inter-generational principle and principle of sustainable development. It is a paradigm shift from rhetoric constitutions of 1990 and 2006. The present Constitution is a progressive constitution that has embraced these well-established principles in Article 30 of the Constitution along with defining the duties of each citizens to protect the environment. Promulgation of new Constitution recognizing and upholding these international environmental principles, shows Nepal's sincerity in maintaining a balance between right to development and right to clean and healthy environment, as was discussed for the first time in Stockholm Conference in 1972. Sustainable development as defined in Rio Conference of 1992, is keeping a balance between development and environment protection to meet the needs of the present as well as that of the future generation. Paradoxically, with the slogan of "Prosperous Nepal, Happy Nepali" of the current Nepalese government, the main focus is economic development. Nepal being a least developed country, development is a necessary, but it is also important to evaluate the impact of these state desired mega projects on the environment. However, the legal development over the last few years show that Nepal is committed to maintaining this balance. The very notion of sustainable development and its elements such as polluter pays principle and precautionary principle has been encapsulated in the Constitution 2015. Further, these principles have also been incorporated in recently enacted Environment Protection Act 2019, an umbrella Act encompassing the provisions of protecting environment with the objective of sustainable development. With the recognition of the need of sustainable development in the Constitution and in environment protection laws, the judiciary of Nepal has also played a pivotal

role in explicating the term sustainable development in Nepalese context. Even before the term "sustainable development" was coined in international arena, Nepalese judiciary had already pioneered the concept by giving decision providing for safeguarding of the environment while also promoting developmental activities. The apex court in many environment-related writs has established the need for sustainable development as well as give value to other principles of environment law. Infrastructure development and incorporation of the principle of sustainable development indeed remained a precursor in concurrence of it as legal principle, in the context of Nepal. Nepal being a least developing country, there is still a bitter debate ongoing about economic development versus environment protection. The recent ongoing debate is the construction of an international airport in the Nijgadh area by cutting down almost 2.4 million trees in the area. This Article will thus be relevant in viewing the debate in a legal and practical viewpoint. This paper will highlight those cases decided by the Supreme Court of Nepal, where the principles that surfaced after enactment of the UNCED will be critically analyzed in terms of domestic laws and the Constitution of Nepal.

Keywords

Development, Environment, Environment Principles, Nepal, Sustainable Development

1. Introduction

It took almost nine long years for Nepal to promulgate the current Constitution of Nepal 2015 (2072 B.S.). Prior to the present Constitution, there were several constitutions promulgated in accordance with the different political systems that governed Nepal. The current Constitution of 2015 is different from previous constitutions as it pervades the concept of 'Sustainable Development' in its preamble, fundamental rights, and state's directive principles. This Constitution adds new facets by endorsing various environmental principles such as precautionary principle, inter-generational equity, polluter pays principle including sustainable development.

These principles have been interpreted and defined in various petitions by the Supreme Court of Nepal. It needs to be further realized that the apex court of Nepal had made decisions in justifying sustainable development even prior to this Constitutional regime. When the Nepalese court had first given verdict in realizing a balance between the environment and development, the

terminology of 'sustainable development' had not yet been popularized. In the year 1953, the then Hon'ble Chief Justice Hari Prasad Pradhan and Hon'ble Justice Bhagawati Prasad Singh established that "if people are allowed to reside inside the forest, gradually the forest will start to diminish and it will consequently result in scarcity of water, that will adversely affect people therefore, people should not be allowed to reside inside the forest" (*Singh Bir Basnet v. Man Bir Buda*). That was the foremost case that established and recognized the principle of sustainable development and emphasized on protection of environment from human impacts.

The principle of sustainable development, according to Prof. Philippe Sands in environmental law context, is one of the main principles which have broad support and are frequently endorsed in practice[1]. Regarding the legal status of the environment related principles, Prof. Sands has opined that in the absence of judicial authority and conflicting interpretations under state practice, it is frequently difficult to establish the parameters or the precise international legal status of each general principle or rules. However, in the context of Nepal, apart from principles of sovereignty over their natural resources and the responsibility not to cause transboundary environmental damage; and the Principle of Common but Differentiated Responsibility, other general principles have been aptly recognized and interpreted by the Apex Court in many environmental public interest litigation matters. Also, by enacting Nepal Treaty Act 1990, the government has given recognition to ratified international treaties to be applicable as domestic laws. There are extensive environment related public interest litigations that deal with the general principles relating to environment, therefore, this paper deals with limited cases only that have directed the parliament to enact environment related legislations and or have led the government to take substantial initiations in the field on environment protection.

2. Methods

This research paper is purely doctrinal, and the authors have relied on the text of laws, mainly the Constitutions of Nepal and different precedents established by the Supreme Court to correlate the theory and practice of principle of sustainable development in Nepal. The authors also referred to few historical texts to get reference to historical facts and development. The authors have mainly focused the paper on national precedents and the principle of sustainable development. The authors

[1] Sands, Philippe et. al, Principles of International Environmental Law, 2019, Cambridge University press, page 198

have used analytical method to draw conclusions from the different precedents set by the Supreme Court at different time to give historical context to development and practice of sustainable development in Nepal. The authors have divided the paper into three main parts which highlight the historical development, judicial position and concluding remarks of the authors.

3. Results and Discussion

I. Genesis of Sustainable Development in Nepalese context

The term sustainable development was first coined and described in the Brundtland report as "to meet the needs of the present without compromising the needs of the future generation". Even before the term sustainable development was coined, earlier during 1700s, King Ram Shah[2] had enacted a dictum conferring order to not cut trees near spring water and penalizing with rupees five to those who refute the royal order. He had rationalized that if the trees are cut then it will dry the source of spring water and people will be deprived of drinking water and will cause landslides and soil erosion[3].

In 1863, the then Prime Minister of Nepal Jung Bahadur Rana had enacted a Civil Code where he had incorporated provisions relating to protection of environment for the benefit of the present and future generations.

These rules intrinsically recorded the very concept of sustainable development. Sustainable utilization, according to Philippe Sands, is about intergenerational equity which the Brundtland report has outlined. It inherently explains the necessity of protection of environment for the future generation while maintaining rights of the present generation. In response to these rules, the earliest judgments have also focused on the protection of species and trees against erosion caused by human activities. These verdicts have explicitly mentioned of sustainable utilization of natural

[2] King Ram Shah was a ruler of Gorkha (between 1666 BS – 1693 BS) and grandfather of Prithvi Narayan Shah, who unified Nepal.

[3] **Thirteenth Rule**: It is the command of His Majesty to maintain the trees along with the roadside. It is because tired poor people, people carrying loads and any other passersby, when feel hot they always seek the shadow of the trees; maintain trees; one who cuts the trees along with the roadside shall be fined Rupees Five; this is a Rule made by His Majesty.

Fourteenth Rule: Develop forest around the *Pandhara* (water source from where people fetch water for their domestic use); if trees are not there, water shall not be available for all the times when we really seek for it, water shall disappear from there. Deforestation shall cause *Ugharo* and it shall cause landslide. Excessive landslide shall cause *Upadhaha. Upadhaha* shall destroy the paddy field. Without forest house holding activities shall not really run properly. Therefore, grow forest, one who cuts the forest around the *Pandhara* he/she shall be fined Rupees Five; this is the Rule issued by His Majesty the King (Rules framed and issued by His Majesty King Ram Shah)

resources. In fact, earlier case verdicts highlight explicitly the sustainable utilization of natural resources[4].

II. Judicial Activism in augmenting the concept of Sustainable Development:

In Nepal, the Court has played an important role in interpreting terminologies adopted in various international conferences as well as applying principles of environmental law from Stockholm Declaration and Rio Declaration. Even though they are "soft laws", however, Court has extensively referenced it and has endorsed it as a '*Grundnorm*'.

Before entering into the case laws, it is important to mention briefly about the Constitution of Kingdom of Nepal, 1990. All these cases were introduced in the court in the form of Public Interest Litigation (PIL). The Constitution of 1990 was promulgated after a major political change. Prior to this, Nepal was ruled under Constitution of Nepal 1962, which was promulgated after King Mahendra by *coup d'état* took over all the state powers in his hands and initiated Panchayat (Village Council) system of self-governance. Note worthily, the Constitution of 1962 guaranteed basic fundamental rights to the citizens, but fundamental right to live in clean environment was not recognized, neither any provision related to environment protection was mentioned in the Directive Principles of the State. During the Panchayat rule, the Supreme Court has not entertained many PILs challenged by the public, even though in Article 71 of the Constitution of 1962 (amended by 2nd amendment) provided an extraordinary jurisdiction to the Supreme Court[5]. However, in the seventh amendment of Civil Code of Nepal dated 1963, under the chapter of Court Management in Number (Section) 10, it was provided that any person can file a petition in the court if the issues are related to public in nature[6]. Even with such provisions, judicial activism was not entertained, mainly due to the restrictive political system. Nevertheless, it can be said that this

[4] (1) *Midey Lal Upadhyaya vs. Buddhi Lal Gubhaju*; (2) *Singh Bir vs Man Bir*; (3) *Govinda Upreti vs Chame Majhi*

[5] The Constitution of Nepal 2019, Article 71, Extraordinary jurisdiction of the Supreme Court: *Subject to the Provisions of this Constitution (inserted by 2nd amendment in),* the Supreme Court shall have power to issue directions, orders or writs including writs in the nature of habeas corpus, mandamus, prohibition, quo warranto and certiorari for the enforcement of rights conferred by Part 3 or for the enforcement, in cases where no other remedy is provided, of rights conferred by any other law for the time being in force.
Provided that nothing in this Article shall apply in relation to matters falling within the jurisdiction of a Court Martial (changed by the 1st amendment in

[6] Bista, Saroj, Judicial activism in Nepal (analysis of the development of Public Interest Litigation in Nepal), 2017, http://bistasarojlaw.blogspot.com/2017/02/judicial-activism-in-nepal-analysis-of.html (accessed on 4/29/2020)

provision acted as a catalyst for future permissive provisions and PILs to be introduced in the Court.

Some of the considerable precedents set by the Supreme Court establishing principles of environment protection and sustainable development are highlighted below.

a. Godavari Marble Case[7]

Godavari marble case, a highlight precedent in the field of environment protection in Nepal, was challenged in the court by using Number 10 of Civil Code, before the Constitution of Kingdom of Nepal 1990 was promulgated but was decided under the enforced Constitution. The Constitution of Kingdom of Nepal 1990, Interim Constitution of Nepal 2006 and Constitution of Nepal 2015 has granted extra-ordinary jurisdictional power of the court[8]. As the Constitution of 1990 did not guarantee fundamental right to live in a clean environment, the petitioner advocate Surya Prasad Sharma Dhungel invoked the provisions under the Directive Principles of State Policies, where it was explicitly mentioned in Article 26(4) that state shall give priority to the environment. Further,

[7] *Surya Prasad Sharma Dhungel vs Godavari Marble Quarry Pvt Ltd. and others (Order Writ No. 35 of the year 2049 B.S (1992))*

[8] **Constitution of Kingdom of Nepal 1990:** Jurisdiction of Supreme Court, Article 88(1) Any Nepali citizen may file a petition in the Supreme Court to have any law or any part thereof declared void on the ground of inconsistency with this Constitution because it imposes an unreasonable restriction on the enjoyment of the fundamental rights conferred by this Constitution or on any other ground, and extraordinary power shall rest with the Supreme Court to declare that law as void either ab initio or from the date of its decision if it appears that the law in question is inconsistent with the Constitution.

Interim Constitution of Nepal 2006: Jurisdiction of Supreme Court, Article 107(1) Any citizen of Nepal may file a petition in the Supreme Court to have any law or any part thereof declared void on the ground of inconsistency with this Constitution because it imposes an unreasonable restriction on the enjoyment of the fundamental rights conferred by this Constitution or on any other ground; and the Supreme Court shall have extra-ordinary power to declare that law to be void either *ab initio* or from the date of its decision if it appears that the law in question is inconsistent with this Constitution.

Constitution of Nepal 2015: Jurisdiction of the Supreme court, Article 133 (1) Any Nepali citizen may file a petition in the Supreme Court to have any law or any part thereof declared void on the ground of inconsistency with this Constitution because it imposes an unreasonable restriction on the enjoyment of the fundamental rights conferred by this Constitution or on any other ground, or any law formulated by the Provincial Assembly is inconsistent with the law formulated by Federal Parliament or any law formulated by Municipal Assembly or Village Assembly is inconsistent with the law formulated by Federal Parliament or Provincial Assembly, and extra-ordinary power shall rest with the Supreme Court to declare that law void either ab initio or from the date of its decision if it appears that the law in question is inconsistent.

the contentious issue was whether a right to clean and healthy environment falls under the guaranteed right to life and hence the probability of the petition standing the ground of *locus standi* based on the same.

The petitioner claimed that the area surrounding Godavari Marbles Industry is home to 330 species of butterflies, 254 types of birds, 80 types of trees and 571 types of fruits. It is also close to the Pulchowki area, and the place where the extraction is planned, is home to endangered species such as musk deers and Ghorals. They claimed that the respondents' factory emitted dust, minerals, smoke and sands, which had excessively polluted the nearby water bodies, land and atmosphere of the said area, thus causing danger to the property, life and health of the people and animal species around. Thus, the petitioners filed this writ petition seeking mandamus in the name of the respondents, to enforce the right of the people to live in a healthy environment.

The Court sought to answer the following three questions in this case:

(1) whether constitution guarantees the right to clean environment as the part of right to life,
(2) whether there is *locus standi* of the NGO or individual working for the protection of environment to initiate the case,
(3) whether or not the court can issue an order in name of the Parliament to enact necessary laws.

The court was strongly of the view that a clean and healthy environment was an integral part of the right to life guaranteed under Article 11 (1) of the Constitution of the Kingdom of Nepal 1990[9]. The Court believed that 'Life was threatened in polluted environment and it was the legitimate right of an individual to be free from a polluted environment. As the protection of environment was directly related with life of a human being, it should be accepted that this matter was included and envisaged under Article 11(1) of the Constitution of the Kingdom of Nepal (1990).'

Regarding the presence of ground of *locus standi* in the petitioner to bring forth the claim, the court emphasized that the petitioner had a profound interest in the present environmental issue. In fact, an environmental problem was a matter of public interest and concern. The petitioner had a strong relationship with the environmental subject of the present dispute. The present Constitution

[9] Article 11, Right to Equality (1) All citizens shall be equal before the law. No person shall be denied the equal protection of the laws (Constitution of the Kingdom of Nepal 1990).

had established public interest as a protectable fundamental right. Also, environmental conservation according to the constitution was one of the basic Directive Principles of the State. Environmental conservation was one of the objectives of the applicant, so the applicant had *locus standi* for the prevention of the environmental degradation.

The court also stressed that it was beyond doubt that industry sector was the foundation of development of the country. Both the country and society need development, but it was essential to maintain environmental *balance* along with industrial development. The court clarified on the very notion of Sustainable development and balancing of economic development and environment protection. In this matter, the Hon`ble Judge Mr. Gajendra Keshari Bastola expressed in his opinion that there is absence of environmental law that is necessary. Since there is absence of the environmental law it cannot be done as contented by writ petitioner. Conversely, Hon'ble Justice Kedar Nath Upadhyaya gave a dissenting opinion saying that the environment of Godavari area needs to be balanced. He further said that if such balance cannot be maintained then it becomes the duty of the state to repudiate the license of such polluting company/industry or to amend the license by making that company/industry follow appropriate measures to protect the environment. When there were separate opinions by two judges, this case was finally decided by full bench of three judges.

The full bench decided that “It is beyond doubt that industry is the foundation of development of the country. Both the country and society need development, however, it is essential to maintain environmental balance along with industry. It is essential to establish balance between the need to provide continuity to developmental activities and priority to the protection of the environment. Stockholm Conference has developed the concept of "Sustainable Development" along with the report of the United Nations Commission on Environment, this matter has been substantiated There has always been more or some adverse impact on the environment form industries. Therefore, where there is development activity, there is adverse impact on the environment. First remedial and then regulatory measures need to be adopted to mitigate such negative effects. If these measures are unable to protect the environment, the activity that is causing environmental pollution needs to be closed. Development is for the interest, prosperity of human being. Therefore, life of human being is the end. Development is the means to live happily; human being cannot live

clean and healthy life without clean and healthy environment. Therefore, safety of the environment is the means. Environment protection measures should be initiated taking into account this fact. The full bench reiterated that it was important to bring balance between development initiatives and prioritizing the protection of environment. This judgment upheld the separate opinion of Justice Kedarnath Upadhyaya. For the sake argument, it can be said that the Supreme Court of Nepal had delicately applied the norms of sustainable development, which is balancing between the development and the environment.

The Court found that the petitioner, however, had not been able to clearly point out a specific section of the law that had not been obeyed or followed for an order of mandamus to be issued against the Government. For the purpose of mandamus, legal duty had to be definite and fixed. Therefore, the Court did not issue the order of mandamus. Taking into account the sensitive, humanitarian issue of national and international importance such as the protection of the environment of Godavari area, the court decided to issue directives in the name of the respondent Government to enforce the Mines and Minerals Act (1985), enact necessary legislation for protection of air, water, sound and environment and to take action for protection of the environment of Godavari area.

This decision was given after the Rio Conference in 1992. Hence, there is no doubt that court was influenced with happenings in the international forum. At the time, Nepal had already ratified the Climate Change Convention and the Biodiversity Convention. In line with Nepal's international obligations under these multilateral treaties and Conventions, in order to bring forth a legislation for the governance of environment, the parliament enacted Environment Protection Act in the year 1995. The Godavari marble case was a milestone in the development of Environment Protection Act 1995. Godavari marble case being the first major environment related case, was established as a *grundnorm* for other future cases. Its decision on right to clean and healthy environment as right to life was substantially recognized and enforced in the Interim constitution of Nepal 2006[10] and Constitution of Nepal 2015[11]. Godavari case was an opportunity for the Court to apply principles

[10] Article 16, Right relating to environment and health: (1) Every person shall have the right to live in a healthy environment. (2) Every citizen shall have the right to basic health services free of cost from the State, as provided in law. (Interim constitution 2006)

[11] Article 30, Right regarding clean environment: (1) Each person shall have the right to live in a healthy and clean environment. (2) The victim of environmental pollution and degradation shall have the right to be compensated by the

of environmental law[12] intrinsically to enhance the environmental legislation as well as practicing the environmental law principles that Nepal had adopted and ratified in the Rio Conference in 1992. Moreover, the court could have stopped the company by applying polluter pays principle, by ordering the Industry to bring back the environment in its former state and compensating the local inhabitants for the pollution it had caused. Unfortunately, Court did not enter into this subject-matter, even though the constitution had given prerogative right to the Court.

The court in this case, did not ask the industry to cease its activities as it was not prescribed in any domestic legislation but imposed restrictions on its activities by ordering amendment to the Mines and Minerals Act 1985. However, the company was not carrying out its activity appropriately as per the prescribed rules, meaning it was continuing to pollute the environment around the Godavari area with dust and particles. Therefore, second writ petition was filed by advocate Prakash Mani Sharma on the same matter.

b. Second Godavari Marble Case[13]

The Petitioner filed this petition invoking the provisions in Mines and Minerals Act 1985 and Environment Protection Act 1995 to revoke the license of the company for further ten years and to declare Godavari as prohibitory area for any industrial activity. Further the petitioner claimed application of the principles of polluter pays principle and intergenerational principle to issue mandamus decision against the respondent.

This case was heard by a full bench of three justices where it was decided that "gifts of nature cannot be compared with the benefits of development. Even if there are vast benefits given by physical development, if nature and environment are adversely affected then activities that aid destruction should not get continuity". Further the judgment stated that "nature's introduction and air, water, forest and biological diversity are not made for one generation. There need not be

pollutant as provided for by law. (3) Provided that this Article shall not be deemed to obstruct the making of required legal provisions to strike a balance between environment and development for the use of national development works.

[12] ***Oposa vs. Factoran*** is a landmark decision of the Supreme Court of the Philippines which recognizes the doctrine of Intergenerational Responsibility on the environment in the Philippine legal system. The case is a contributor to the development of international environmental law.

[13] *Prakash Mani Sharma and Others vs. Prime Minister and Office of the Prime Minister and Others, (Writ Number 068-WO-0082)*

destruction. Nobody is allowed to destroy environment in the name of development" and has explicitly accepted the concept of intergenerational equity.

Further, the Court mentioned "like we do not demolish historical legacy for economic benefit, likewise, price of biological diversity cannot be exchanged with marble or stones. There is no value of Godavari's cultural and religious heritage, biological diversity, threatened species of birds and butterflies, vegetation, ecological system and nature's beauty. Such valuable natural resources are to be protected and preserved for generations and even if there is a mine of gold or diamond, Godavari is a *Sanjeevani* (*Selaginella bryopteris*) hill that cannot be mined". It can be analyzed that the Court has elaborated on the principle of intergenerational equity and the duty of present generation to protect the environment or not to compromise the needs of the future generation. Likewise, the decision has extended the scope of judgment by saying that the economic benefit is negligent if environment is at stake and orders the industry to be stopped. This landmark decision has applied, precautionary principle, intergenerational equity[14], which are the elements of sustainable development. The Court has expressed need for symbiotic balance between right to live in clean and healthy environment and right to development. It has further extrapolated that if the benefit incurred by the development adversely affects environment, then such benefit should not be counted as development. However, the Court explicitly did not mention sustainable development in its decision, but the interpretation does express that sustainable development is *sine qua non* for nurturing the principles such as intergenerational equity and precautionary principle.

c. **Chure Hill Case**[15]

The Court in this case has expressly applied and interpreted different principles of environmental law. This case is mainly related with the mining of boulders, stone from the river in Chure Hill (southernmost foothills of the Himalayan Range in Nepal) and transport to India. Chure Hill has fragile geological formation and is prone to landslides and soil erosion affecting downstream

[14] Sands, Philippe and et. al, Principles of International Environmental Law, page 219, Fourth Edition, Cambridge University Press.

[15] *Narayan Prasad Devkota vs. Rt. Honorable Prime Minister and Prime Minister Office and Others, NKP 2067 (12), (Writ number 066-WO-0521).*

farming area. Moreover, these mining and processing of stones have caused adverse effect by polluting the environment with sand and dust particles. Further, the overloaded transportation in the truck by processing companies has eroded the quality of road by degrading it.

The Court decided the case by explaining that the Government is only a trustee of the natural resources found in Nepal in accordance to Public Trust Doctrine and these companies pay pittance revenue to the government. The protection of natural resources from damage by private enterprise is an essential element of the doctrine[16]. Therefore, government must not allow them to function for the pittance revenue". Further it has said that "before allowing any companies to function, government's first and most important task is to get consent from sensitive and vulnerable institutions such as hospitals, schools etc." This requirement can be taken as the participation of public, which is a prerequisite of good governance. Public participation is also an essential element of sustainable development.

Further the court stated that in the context of overloaded trucks that degraded the road and posed pollution in the area, polluter pays principle is to be strictly applied to the companies responsible for it. The two justices who presided in this case further said that "any sand mining done in Nepal that has degraded the bridges and adversely affected the road must be stopped". This, in fact, shows that the Court used its constitutional mandate, which the Interim Constitution of Nepal in Article 107 had stipulated. Nevertheless, principles such as sustainable development, public trust doctrine and polluter pays principle were strictly applied. However, the Court failed to address principles of intergenerational and intra-generational equity in this case. Sand or stone mining affects the present and future generation equally. Most importantly, it failed to point out that depletion of natural resources causes irreversible damage to the environment. Most importantly, after the finalization of this case, the government initiated a President Chure Hill Conservation Project. This case can be considered significant in the development of environment protection.

d. Yogi Narahari Nath Case[17]

In this case, the Court had extensively elaborated on the principle of public trust doctrine. In this landmark case, the government gave lease to American company for 49 years to construct a

[16] Sahasranaman, P. B., Handbook of Environmental Law, 2009, Oxford University Press.
[17] Yogi Narahari Nath vs. Prime Minister Girija Prasad Koirala and Others, NKP 2053.

medical research centre in Devghat area, which was rich culturally, religiously, archeologically and was forested home to many flora and fauna and birds. The writ petitioner filed this case to reinstate the protection and conservation of cultural and natural heritage. The petitioner demanded that as this place is rich in biological diversity, if it is given for construction lease then the natural resources will be irreparably damaged and destroyed.

While giving the judgment the Court said that "environment is coherent part of life, the deteriorating condition directly affects human beings, and other species. The pivotal role of the forest for environment conservation is universally accepted, the Constitution of the Kingdom of Nepal 1990 in Article 26(4) has accepted the environment protection as a principle of state policy". Further the Court said that "it is a duty of government to protect endangered wildlife, flora and fauna and archeological heritage. When taking decision on projects of national pride then it shall not work against the law and the norm of the Constitution. If Court cannot implement state policies mentioned in the constitution, it can at least point out bad intention of the government". Apart from public trust doctrine, this case also missed out on presenting an interpretation of the principle of intergenerational equity because protection of environment and conservation of cultural heritage is, ultimately is for the future generation.

e. **Chitwan National Park Road Construction Case**[18]

The petitioner invoked the rights of consumer to file the PIL. They claimed that Consumer protection is mentioned in UDHR 1948 and ESCR 1966. In accordance with it all nation state must make legislations or policies to benefit the consumer. The petitioner was informed through the news about the Thori-Madi-Bharatpur road construction project passing through the Chitwan National Park, which is a World heritage site. The petitioner claimed that the government had not done any Environment Impact assessment for the project.

As per Environment Protection Act of 1995, Environment Impact Assessment or Initial Environment Examination is a must for any project before initiation. This proposed road is of 30 KM and was published in red book. The petitioner claimed that construction of road through Chitwan national park is against Articles 12, 13, 16, 17(3), 35(4)(5), 32 and 107(2) of the Interim

[18] Advocate Ram Chandra Simkhada on behalf of Forum for protection of Consumer Rights vs. The Government of Nepal et. al. (Decision No. 10204, Supreme Court of Nepal)

Constitution of Nepal and Sections 3, 4, 5, 7, 9, 10, 17 of the Environment Protection Act, and Section 9 of the Treaty Act, Aquatic Act 2017, and other international instruments such as the CBD, CITES, World Heritage Convention, Ramsar Convention. Chitwan National park is the second largest park in Asia. 60% tourist come to visit this place for hiking as well to conduct scientific and environmental research. Chitwan National park is important also because of the availability of various species that are endangered, and it is also rich in biodiversity. It is right of every species to thrive and survive in their habitat without any fear. Chitwan National park is very sensitive area, with various biodiversity and has importance international and if road is constructed will have negative impact on the environment. Therefore, the petitioner requested for the proposed construction to be stopped.

The judges in this case held that "Chitwan National park is not only the oldest national park of Nepal but is also one of the richest in biodiversity, and very important from tourism perspective. As it is listed as a world heritage site under UNESCO, it is necessary to be preserved and protected for the benefit of the present and the future generation. Any kind of environmental evasion and encroachment must be stopped anyhow. the environment Study Report presented by the government of Nepal at the Conference of the World heritage Committee held in Poland from July 2-12, 2017, has highlighted that developmental activities such as the proposed Birgunj-Thori road causes a negative impact on property of Outstanding Universal Value such as the Chitwan National park. Additionally, UNESCO has specifically recommended that the Thori-Bharatpur road should not be expanded, empowered, or pitched. Similarly, in the letter by World heritage Committee dated October 24, 2018, it had brought into attention of the Nepal Government that that Environment impact assessment report should be included. Therefore, it is clear from the presented facts that it is imperative to protect the biological and environmental area of Chitwan national Park against any significant potential encroachment by the proposed Thori-Madi-Bharatpur road and it is the constitutional and legal duty of all Nepalese and this court as a guardian to do so. And hence the environmental impact assessment report was cancelled by an order of Certiorari and the government was ordered by an order of mandamus not to carry out any activity in relation to the road construction until the environmental impact assessment report is duly approved with recommendation from Chitwan National Park office, UNESCO and other relevant stakeholders." The Judiciary realized its role as a guardian to preserve and protect the environment and reaffirmed the principle of sustainable development by realizing that the environment belongs to the present

and the future generation as well and development cannot get prioritized when environment is at stake. Thus, this is a very apt adoption of the principle of sustainable development by the Nepalese Judiciary.

4. Conclusions

While applying principles of environmental law in case decisions, the Supreme Court has expanded the horizon of domestic law in terms of environment protection and promotion. Principles such as sustainable development, precautionary principle, polluter pays principle, public trust doctrines and principle of prevention has been extensively and impliedly recognized and adopted in many judgments by the Supreme Court of Nepal. In the usage of these principles, the Supreme Court has been highly influenced by the development in international courts.

It can be argued that Nepalese Court was initially cautious in applying these principles, however, the international development after Earth Summit, aided and guided the domestic court in using principles of environmental law in Court decisions. Moreover, many domestic legislations and reforms were adopted as a positive result of the judicial activism of the Apex court in actively protecting the environment and striking a balance between environment and industrial development. Godavari marble case acted as a milestone case in environment protection, leading to enactment of Environment Protection Act 1995. Likewise, the Chure Hill case led to initiation of President Chure Hill Conservation Programme. Similarly, Right to Information Act was guided by the by Arun III[19] case.

It appears that the Supreme Court has extensively elaborated and enriched in its decisions, principles of sustainable development and intergenerational equity. This process is still going on with the integration of international environmental law into domestic environmental legislation. However, we are yet to see decisions where it explains how to gain benefits from natural resources and hence, future debate will be focused in this. From the analysis of the above case laws, then it can be said that Supreme Court of Nepal has indeed recognized the notion of and emphasized the

[19] Gopal Siwakoti Chintan *vs.* HMG Ministry of Finance and Others, Decision date 2051/1/25…..the Court has specifically said that environmental issues are best handled with participation of all concerned citizens at the relevant level. At the national level each individual shall have appropriate access to information, effective access to judicial and administrative proceedings including redress and remedy, shall be provided.

importance of sustainable development. In a developing country like Nepal, it is a positive reinforcement to see that the judiciary is emphasizing on protecting the environment and is exemplary in its steps to create a balance between environment and development, upholding the principle of sustainable development.

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Partnering with Indigenous Peoples for the SDG: Addressing Issues and Challenges of Free, Prior and Informed Consent (FPIC) in the ASEAN Member States

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Abstract

Free, Prior and Informed Consent (FPIC) is one of the most critical principles that can safeguard indigenous peoples' right to participate in the decision-making process. It is rooted in the right to self-determination of indigenous peoples as enshrined in Article 3 of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Irrespective of any current recognition in international law, the indigenous peoples in the ASEAN Member States, including those of the Orang Asli in Peninsular Malaysia, Indigenous Cultural Communities (ICC) in the Philippines and Masyarakat Adat in Indonesia, face a lack of recognition of their right to customary land and participation in the decision-making process, marginalised and dominated by the majority due to conflicting interest over natural resources and the rights of indigenous peoples over their territories. It is self-evident that a lack of legal recognition in the decision-making process and FPIC is profoundly disruptive to the attainment of Sustainable Development Goals (SDG) 2030. Therefore, the main objective of this article is to critically analyse the law in theory and practice on FPIC as part of the right to self-determination of the indigenous peoples in ASEAN by looking at standards in international law. As the study focuses on the experience of indigenous people in the ASEAN Member States, it evaluates the issues and challenges in applying the principle of FPIC in Malaysia, the Philippines and Indonesia pursuant to domestic law compared to the international law standards. This article is a socio-legal study and adopts a qualitative approach. The study found out that the FPIC in the ASEAN Member States remains to be a regime of unfulfilled promise. This article suggests several legal and institutional reform to improve the recognition of FPIC as part of the right to self-determination of the indigenous peoples and will substantially complement the realisation of SDG 16 in promoting a just, peaceful and inclusive society. Ultimately, the proposed legal and institutional reform will be of great significance and relevance to accelerate the recognition of indigenous peoples to participate in the decision-making process at all levels, especially in the

unprecedented challenges of pandemic Covid-19. It is vital to advance the right of indigenous peoples, thus assisting the ASEAN Member States in achieving Target 16.7 and 16.10 of SDG 16.

Keywords: FPIC, Orang Asli, indigenous peoples, international law, UNDRIP

1. Introduction

The Association of Southeast Asian Nations (ASEAN) was founded on 8 August 1967, after signing the ASEAN Declaration (Bangkok Declaration), which consists of 10 member states, including Indonesia, Malaysia, and the Philippines (ASEAN). As of May 2019, ASEAN Statistical Yearbook 2020 discloses that the total population of ASEAN Member States, including the indigenous peoples, is 655,916,800. The indigenous peoples in the Southeast Asia region are referred to as hill tribes, native people, and ethnic minorities (Erni, 2010). As the current study focuses on the indigenous peoples in Malaysia, the Philippines, and Indonesia, it is argued that the protection and recognition of indigenous rights differ from one States to another.

In Malaysia, the indigenous people are categorised into two main groups, the Orang Asli in Peninsular Malaysia and the natives of Sabah and Sarawak. However, this article focuses on the rights of the Orang Asli since their position is weaker than the natives of Sabah and Sarawak. The word Asli is an Arabic word that means original, derived from the root word "Asali" (Carey, 1976). As of June 2018, the total population of Orang Asli in Peninsular Malaysia is 178,197, which represents 0.5 per cent of the total population of Malaysia (JAKOA, 2018). Since the early 20th century, the term Aboriginal refers to the 18 sub-ethnic groups of Orang Asli, which can then be divided into three major ethnic groups, namely the Negrito, Proto-Malay, and Senoi, according to their ethnographic, respectively (JAKOA, 2011-2015; Williams-Hunt, 1952; Carey, 1970). Orang Asli is a heterogeneous and non-homogeneous tribe because they have uniqueness and distinct socio-cultural and psychosocial-cognitive perspectives (JAKOA,2011-2015; Musa, M, 2011). Each Orang Asli sub-ethnic group is unique and distinct, including language, customs, traditions, practices and religion (Musa, 2011).

Unlike the Orang Asli in Malaysia, the indigenous peoples in the Philippines representing 10-20 per cent of the total Filipino population. According to the National Commission of Indigenous Peoples (NCIP), the Indigenous Cultural Community/Indigenous Peoples (ICC/IP) is a community of approximately 110 classified ethnic groups with reference to ethnic linguistics (National Commission of Indigenous Peoples). The total number of ICC/IP is 11,320,476 people from 12 provinces throughout the Philippines. ICC/IP can be classified according to certain regions, such as the Igorot tribe, which mainly inhabits the Cordillera Region located in the mountains of Luzon, while the Lumad tribe mostly live in the Mindanao archipelago (Padilla et al., 2013). In contrast, the Mangyan tribe inhabits the central Philippine archipelago (Padilla et al., 2013). Besides that, indigenous communities in the Philippines are also referred to as ethnic minorities, Tribal Filipinos or Native Citizens. However,

indigenous peoples are officially referred to as Indigenous Cultural Communities (ICC). Referring to Section 2, Chapter I, Rights of Indigenous Peoples Act 1997 (IPRA), Republic Act 8371, indigenous peoples are referred to as Indigenous Cultural Communities and Indigenous Peoples (ICC/IP). In addition, ICC/IP has been defined under section 3 (h), Chapter II of IPRA as indigenous people who have the right to determine their own identity (self-identification), live in groups, have their own cultural customs, are unique and distinct from majority peoples (MacDonald, 1995).

In Indonesia, indigenous communities are geographically isolated and are also known as komunitas adat terpencil by the Ministry of Social Affairs (Mamo, D, 2020). Kadir (2019) added that 'indigenous people' may be known in different languages, e.g., as 'pribumi' (native), as opposed to 'orang asing' (foreigner). These indigenous communities consist of 1,128 ethnic groups and are estimated by Aliansi Masyarakat Adat Nusantara (AMAN) to represent approximately 2 per cent to 2.8 per cent of the total population in Indonesia (Mamo, D, 2020). Several legislations in Indonesia, such as the Indonesian National Constitution, Act No. 5/1960 on Basic Agrarian Regulation, Act No. 39/1999 on Human Rights, and MPR Decree No. X/2001 on Agrarian Reform. Act No. 27/2007 on Management of Coastal and Small Islands and Act No. 32/2010 on Environment recognises indigenous peoples as Masyarakat adat and Masyarakat hukum adat (Mamo, D, 2020). Despite having the uniqueness and diversity of nature and culture that distinguish them from the majority, typically, indigenous communities of ASEAN live in rural and remote areas, such as in mountainous areas with limited infrastructure, facilities, and opportunities compared to the majority of people (Hassan & Nordin, 2016). Although some of the areas inhabited by indigenous peoples have an abundance of natural resources, their voices receive less attention due to a lack of political participation.

Even though Malaysia, the Philippines, and Indonesia are voted in favour of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), the indigenous peoples in the ASEAN Member States still face a lack of recognition of their right to customary land issues, marginalised and are often dominated by the majority (Nordin & Ibrahim, 2014; Human Rights Commission of Malaysia, 2013 & Hasan, 2009). The current legal recognition is arguably inadequate to provide comprehensive protection for the indigenous peoples compared to the standards set out in both UNDRIP and international law. The lacunae in the domestic law weaken the position of the indigenous peoples, which may affect the legal protection in practice.

Therefore, the main objective of this article is to critically analyse the law in theory and practice on FPIC as part of the right to self-determination of the indigenous peoples in the ASEAN Member States by looking at standards in international law. In relation to this objective, the research sets out to answer the following questions: 1) what is the position of self-determination of indigenous peoples and FPIC in the international law framework? 2); What is the relationship between FPIC and the SDG? 3) To what extent the FPIC has been recognised in the ASEAN Member States? 4) How to move forward and address the issue of FPIC as a regime of unfulfilled promise? To answer these research questions,

the study provides the background of the indigenous peoples in the ASEAN Member States and analyses the concept of FPIC as part of the right to self-determination of indigenous peoples under international law. As this study focuses on the indigenous peoples of ASEAN Member States, it will evaluate the issues and challenges in applying the principle of FPIC in Malaysia, the Philippines and Indonesia pursuant to domestic law compared to the international law standards. Finally, this study suggests several legal and institutional reform to improve the recognition of FPIC as part of the right to self-determination of the indigenous peoples and will substantially complement the realisation of SDG 16 in promoting a just, peaceful and inclusive society.

2. Methods

This study adopts a qualitative socio-legal approach that analyses the legal provision, phenomenon and its relationships with society. This socio-legal study uses an international legal framework that focuses on the study of Orang Asli in Peninsular Malaysia, Indigenous Cultural Communities/Indigenous People (ICC/IP) in the Philippines and Masyarakat Adat in Indonesia by analysing primary legal documents such as UNDRIP as an international law standard as well as domestic laws. The chosen method of analysis was used to examine the compatibility of the rights and protections of the indigenous peoples compared to FPIC and UNDRIP as an international law standard.

3. Results and Discussion

Indigenous Peoples and the SDG

The 2030 Agenda is an ambitious yet comprehensive framework that complements developed and developing countries since it places people as the focus of the development process. Most ASEAN countries have adopted Sustainable Development Goals in 2015 and reaffirmed their commitment to support and implement the 2030 Agenda for sustainable developments. The government has made efforts to integrate 17 SDGs and 169 targets involving the economy, society, and the environment into the national planning framework. It includes localising SDGs at subnational levels, mobilising resources and funding through a partnership with stakeholders, and strengthening data readiness to develop a comprehensive mechanism for SDG implementation (Economic Planning Unit, 2017). However, much remains to be done, particularly pertaining to indigenous peoples and SDGs. As the core element of the 2030 Agenda sets out clearly to "leave no one behind", all segments of society, including the indigenous peoples, must be included at every stage, from the early public policymaking to implementation and monitoring. Therefore, this study argues that the indigenous peoples have a significant role in the realisation of the SDGs and the 2030 Agenda as the subject of international law.

UN General Assembly has adopted Resolution on the Agenda 2030 for Sustainable Development, which highlighted indigenous people's issues related to Goals 2 and 4 (A/RES/70/1). Various targets set out in SDGs are highly relevant to indigenous peoples, and 73 out of the 169 targets

in SDGs have significant ties to the UN Declaration on the Rights of Indigenous Peoples (UNDRIP). Office of the High Commission for Human Rights (OHCHR) highlighted four fundamental elements in Agenda 2030 and SDG framework pertinent to indigenous peoples: leave no one behind, human rights, equality, participation and accountability. Furthermore, indigenous peoples are inextricably linked to core elements of achieving SDGs, including fostering peace and inclusive societies in SDG 16.

Nevertheless, the government has inadequately assured their commitment to implement the 2030 Agenda and the Sustainable Development Goals (SDGs) towards indigenous peoples. The lack of recognition and protection of indigenous peoples' rights is a source of conflict and will impede the realisation of SDGs and Agenda 2030. Failure to uphold the indigenous peoples' rights, particularly their rights to education, land, health and economics, will hinder achieving SDG 1 to end poverty, SDG 5 on gender equality and peacebuilding, and inclusive societies in SDG 16, especially during the pandemic of Covid 19. Some of the issues that plague the indigenous peoples in ASEAN are injustices and discrimination that largely influenced by the lack of respect for the indigenous culture, a lack of representation and participation in the decision-making processes. It is against the principles of international law, particularly the Free, Prior and Informed Consent (FPIC) of the indigenous peoples.

Self-determination of Indigenous Peoples in International Legal Framework

Article 1 of both the International Covenant on Civil and Political Rights (ICCPR) and the International Covenant on Economic, Social and Cultural Rights (ICESCR) recognises the right to self-determination of all peoples. In the context of indigenous peoples, Article 3 of UNDRIP recognises the right to self-determination of indigenous peoples. By virtue of that right, they freely determine their political status and freely pursue their economic, social and cultural development. As discussed in Hassan & Nordin (2016; 2017; 2018), the provision of the right to self-determination covers four main dimensions: the freedom of indigenous people to determine their political status and freedom to pursue their economic, social, and cultural developments. Daes (1996) added that these dimensions are also closely linked to recognising the right to natural resources.

The right to self-determination can be valued as independence, integrity and respect; and must be defined according to the principles of justice and equality. According to the National Aboriginal and Islanders representatives, the Legal Services Secretariat of Australia suggested that the right to self-determination is in the original form and genuine based on equality and non-discrimination (Chávez, 1999). Representatives from the Saami Council further described the concept of the right to self-determination as dynamic and not static (Chávez, 1999). This permits the right to self-determination to fit in many situations and be recognised beyond the traditional context, i.e., secession.

Furthermore, Daes (2001a) outlined the right to self-determination of indigenous peoples as independence, integrity and respect for indigenous peoples. It also allows indigenous peoples to have the freedom to live according to their customs and beliefs and to be respected by the majority. The

implementation of that right can be examined by assessing whether indigenous peoples have the freedom to choose and determine their way of life (Daes, 2001b). It can be implemented through autonomy and self-government by indigenous peoples, the economic dimension of self-determination, and participation in the decision-making process.

Article 4 of UNDRIP, however, limits the scope of the right to self-determination to include the right to autonomy or self-government only. In other words, it covers matters relating to indigenous peoples' internal and local affairs as well as ways and means of financing their autonomous functions. Nordin et al. (2012) argue that Article 4 limits indigenous peoples' right to self-determination whereby it applies only to internal aspects, whereas the rights of other people include the right to secession. It reflects an imbalance in recognition of the right to self-determination of all people, including the right of separation. This approach is contrary to the principle of equality. It discriminates against indigenous peoples in many situations even though indigenous peoples may never have dreamed of separation (Daes, 1993).

Free, Prior and Informed Consent (FPIC) and Indigenous Peoples

FPIC is recognised and embedded in several international law instruments as part of the self-determination of indigenous peoples and the decision-making process. Every component in FPIC should be defined for a comprehensive understanding (Hassan & Nordin, 2018). Firstly, free is best understood as free from influenced by any factor, coercion, intimidation or being forced or manipulated by certain parties (Permanent Forum on Indigenous Issues Fourth Session, 2005). The second element of FPIC is prior, which requires the consent of indigenous peoples to be obtained in advance before the carrying out of any project or activity (Permanent Forum on Indigenous Issues Fourth Session, 2005). Sufficient time should be allocated for the process to obtain permission, and it must involve all segments of society, including women, youth and children (Permanent Forum on Indigenous Issues Fourth Session, 2005).

Thirdly, indigenous peoples must be informed on the project or event that may affect them. The third element requires transparency, whereby the ASEAN Member States obliges to supply detailed information on a project to the indigenous peoples. To ensure transparency, the States must disclose all sort of information such as nature, size and scope of the project or activity, its objectives, a period of the project, the locations involved and affected, the assessment of impacts, such as economic, social, cultural, environmental, potential risks and benefits for equal sharing, the parties involved in executing the project and the procedures related to the project (Permanent Forum on Indigenous Issues Fourth Session, 2005). Therefore, the information presented to the indigenous peoples, including among women, youth, and children, must be accurate and understandable.

Fourthly, indigenous peoples' consent may be obtained in two ways, either through consultation or participation (Anaya, 2004). Both of these methods share the common characteristic that they shall

be conducted in good faith and with full participation to form the best mechanism for obtaining consent (Permanent Forum on Indigenous Issues Fourth Session, 2005).

As discussed in many works of literature, such as MacInnes (2017), Hanna & Vanclay (2013), the recognition of FPIC can be seen in several international instruments. Article 16, Conventions Concerning Indigenous and Tribal Peoples in Independent Countries (ILO Convention No. 169) recognises the application of the principle of FPIC where the government must seek consent from indigenous peoples before removing them from their customary lands. This provision requires that the places to which they are moved be equivalent to their places of origin and have a similar quality and legal status (Article 16 (4), ILO No 169). In addition, the government must negotiate with and seek the participation (Article 16, ILO No 169) of indigenous peoples regarding development (Article 2, ILO No 169) in several areas, including the development, natural resources and soil (Article 15, ILO No 169) with good faith (Article 16(2) ILO No 169) (Article 16, 2, 15, ILO No 169).

Referring to the provisions of FPIC in UNDRIP, Article 10 provides that indigenous peoples cannot be removed from their ancestral land unless the principle of FPIC is complied with and all compensations have been paid to the affected indigenous peoples. In the event of indigenous peoples' land being seized, taken, used, occupied or damaged without obtaining FPIC, the indigenous peoples are entitled to claim restitution or compensation that is reasonable and fair (Article 28). If mutual agreement has been reached, compensation may also be paid in the form of land, territories and natural resources of an equivalent value to what has been taken (Article 32 (2)). Compensation in the form of land is important to the indigenous peoples as it represents their identity. In addition to the ancestral lands, the FPIC process is also required to protect the values, customs and culture of indigenous peoples. If the government fails to obtain FPIC from indigenous peoples, they have the right to claim damages because the government has violated their rights of traditions and customs (Article 11 (2)).

FPIC is also required if the government plans to introduce a law or any administrative matters that might affect indigenous peoples. According to Article 19 of UNDRIP, the government must negotiate and cooperate in good faith with the indigenous peoples. The government must obtain FPIC in good faith before approving any project that affects the ancestral lands, territories and natural resources of indigenous peoples. It shall be made in accordance with UNDRIP Article 32 (2), which requires compliance with the principle of FPIC, particularly concerning the project development, utilisation or exploitation of mineral, water and other resources. Further, 'good faith' in Articles 19 and 32 (2) requires the government to be transparent in obtaining FPIC from indigenous peoples. Article 32 (3) of UNDRIP also demands the government to provide an effective mechanism to minimise undesirable impacts such as pollution, poor economy and sensitive culture. This is important to preserve the environment as it affects the traditional life of indigenous peoples who are reliant upon forests and natural resources. Therefore, governments shall comply with the FPIC process as it forms part of the

manifestation of the right to self-determination of indigenous peoples, including the indigenous peoples in the ASEAN Member States.

The Orang Asli in Peninsular Malaysia

Recognition of the rights of the Orang Asli can be found in various legal instruments (Hassan & Nordin, 2020). The main legal source is the Federal Constitution as the highest law of the land (Article 4 Federal Constitution). Article 153 of the Federal Constitution recognises the special position of Malays and natives of Sabah and Sarawak. However, special protection for the Orang Asli can be found in Article 8 (5) (c) of the Federal Constitution that provides "for the protection, well-being or advancement of Aboriginal peoples of the Malay Peninsula (including the reservation of land) or the reservation to aborigines of a reasonable proportion of suitable positions in the public service." The provisions of Article 8 (5) (c) allow discrimination favouring the Orang Asli, emphasising on the development, including reservation of land. The Ninth Schedule, Item 16 of the Federal Constitution, supports this provision that includes planning for the development; nevertheless, the principle of FPIC is not embedded in this provision.

In addition, the Aboriginal Peoples Act (APA) of 1954 is a significant act aimed at protecting the rights of Orang Asli. The APA contains 19 sections, including a definition of indigenous people, the various rights of the Orang Asli and the administration of Jabatan Kemajuan Orang Asli (JAKOA). The main purpose of the act is to provide for the protection, welfare and progress of the Orang Asli in Peninsular Malaysia. However, the provisions in APA are inadequate to provide full protection for the Orang Asli due to the lack of legal recognition concerning FPIC in this act.

The APA was initially drafted to prevent the Communists from obtaining the help of Orang Asli and prevent communist propaganda from being spread in the community (Nicholas, Engi & Ping, 2010). Therefore, the government made efforts to prevent any form of dissemination, including the control over the appointment of Batin (Nicholas, Engi & Ping, 2010). Dentan et al. (1996) were critical of APA as an act containing "paternalistic" elements. This "paternalistic" approach has negative implications on the Orang Asli to the extent that they are regarded as a ward of the State and not as indigenous peoples with a right to their ancestral land, in addition to other rights (Idrus, 2010; Nicholas, Engi & Ping, 2010; Nicholas & Baer, 2007). Nordin and Witbrodt (2012) classified the APA as a platform for JAKOA to control the Orang Asli. This statement is in line with the opinion of Hooker (1996), who claimed that the APA denies the rights of the Orang Asli, particularly in the administration of and in all matters relating to their customary land. It gives absolute power, for example, to the government to revoke, wholly or partly, the aboriginal area of aboriginal reserved land under section 6(3) and 7(3) of the APA (Nordin & Ibrahim, 2014). This element of paternalism and control by JAKOA highlights how the principle of FPIC is disregarded in the APA.

Furthermore, Malaysia has enacted the Access to Biological Resources and Benefit Sharing Act 2017 (ABS 2017), which came to force on 18 December 2020. Section 23 of ABS 2017 requires the prior informed consent of the communities where traditional knowledge of indigenous peoples and local communities on the biological resources is used. The benefits gained from its use must be shared with the communities. However, a lack of legal recognition of land would certainly affect the effectiveness of the ABS legislation to achieve its objective in protecting the right of Orang Asli.

Besides, the Wildlife Protection Act 1972 (the Wildlife Conservation Act 2010) is also related to the Orang Asli. The Orang Asli were not consulted in the amendment involving the Wildlife Conservation Act 1972. In 2010, the act was amended to reduce the number of species that the Orang Asli can hunt from 100 to 10 (Subramaniam, 2011). Orang Asli should be consulted prior to the amendment to the Wildlife Conservation Act 1972 because it will directly impact the Orang Asli way of life. The implication of the intended amendment concerns forest products, including hunted animals that represent a source of livelihood for the Orang Asli. Therefore, Subramaniam (2011) criticised the government when amendments were made unilaterally without the participation of the Orang Asli in the decision-making process.

The government took further steps to introduce the Statement of Policy Regarding the Administration of the Aboriginal Peoples of the Federation of Malaya, 1961, which aimed at strengthening efforts to provide better levels of protection and welfare to the Orang Asli (Jabatan Kemajuan Orang Asli, 1961). The objectives of the said policy are the integration and assimilation of Orang Asli with the mainstream communities in Peninsular Malaysia. This policy also emphasised their equal rights and opportunities next to other Malaysians. For that purpose, the government proposed several appropriate standards to protect and develop the lives of the Orang Asli. This policy also highlighted the economic and development progress of the Orang Asli.

While there is no specific provision under Malaysian law recognising the principle of FPIC, the provisions of paragraph (d), Policy 1961 indicated the element of FPIC as requiring the consent of the Orang Asli before remove them away from their ancestral land (Jabatan Kemajuan Orang Asli, 1961). However, the provisions of Policy 1961 did not provide clarification on mechanisms and guidelines for how consent from the Orang Asli could be obtained. In addition, enforcement of Policy 1961 is ambiguous compared to the APA or other laws.

In conclusion, Malaysia's legal position regarding FPIC remains inadequate compared to the standard under international law. The government should adopt a human rights-based approach to development and implement FPIC law by outlining consent-making processes that ensure effective participation of the Orang Asli as per recommendation in The National Inquiry into The Land Rights of Indigenous Peoples (Human Rights Commission of Malaysia, 2013).

FPIC In the Philippines

The primary law that recognises the rights of ICC/IP in the Philippines is the Rights of Indigenous Peoples Act (IPRA) 1997, which is an act that can be classified as the most progressive law pertaining to the rights of indigenous people (Erni et al., 2008). IPRA was drafted to recognise the rights of indigenous peoples, such as the right to customary land (ancestral domain), the right to self-government and empowerment, the right to social justice, and cultural integrity (Castro, 2008). IPRA is considered as Magna Carta on the rights of indigenous people, which consist of 84 sections, is intended to recognise, protect and promote the rights of ICC/IP.

Having said that, the IPRA uphold the rights of all ICCs/IPs to customary land. Section 7 provides the recognition of such rights to include the right to own, develop land and natural resources, the right to inhabit the customary territory, and several others. IPRA can also be considered an act that complies with international law, in particular articles 25 and 26 of the UNDRIP that recognise the right to customary land. The Act also describes the concept of customary land, the concept of land ownership, composition, ICC/IP responsibilities towards domains and customary land.

In line with the spirit of UNDRIP, the law under the IPRA specifically recognises ICC/IP in the decision-making process through the implementation of the FPIC. Section 3 (g), IPRA, explains the meaning of the FPIC. The IPRA provides several provision concerning FPIC as follows:

1. section 6 (c), relating to the right to reside in the territory of the original person;
2. section 32, relating to the rights of the community to intellectual property;
3. section 33 (a), on rights to material relating to ICC/IP values, religion and customs;
4. section 35, relating to access to genetic and biological resources;
5. section 46, (a) relating to the management of customary domains or lands;
6. section 58, relating to environmental considerations; and
7. section 59, deals with preconditions of confirmation.

Even though the provision of IPRA is comprehensive and meeting international standards, the ICC/IP faces several challenges in terms of implementations. Magno, C, (2013) describes that the inadequate systems in place and implementation setback have both linked to FPIC process flaws. According to the United Nations Special Rapporteur, the developer fails to observe the FPIC as required by law before undertaking development projects such as logging, dams, and mining projects (Stavenhagen, R, E/CN.4/2003/90/Add.3). Carino (2005) expounds that FPIC processes have also been hampered by implementation challenges where the industries fail to consult with local communities before the construction; in fact, bribery and extortion elements through gifts are also involved.

In addition to that, Halip (2012) discloses that consent was obtained influenced by the economic benefits. While the information provided solely by the project proponent, there is a lack of information on the direction by the government and limiting public release may hinder the achievement of SDG 16, particularly target SDG 16.10 to ensure indigenous people's access to information and protect fundamental freedoms. Halip (2012) further explains that inadequate information, education, and communication about the FPIC process, grievance processes, and the project itself to inform decision-making is another challenge faced by the communities. Another factor contributing to the setback of the implementation of FPIC is the failure to observe indigenous communities' traditional decision-making processes in line with the FPIC processes (Cathal Doyle and Jill Carino, 2013).

FPIC in Indonesia

Generally, the recognition of indigenous rights under Indonesian law is arguably inadequate. Referring to the Indonesian National Constitution, all-natural resources belong to the government unless granted to an individual for private property. Some existing laws also recognise customary land, such as the Basic Agrarian Law 1930, however, subject to development requirements by the government (Filer et al., 2020).

Unlike ICC/IP in the Philippines, the provision on FPIC in Indonesia is still lagging as there is no comprehensive legislation related to FPIC. Nevertheless, several rules and laws had been introduced to ensure that the government implements FPIC (Elfitra et al., 2019). As a result of NGO insistence, Elfitra et al. (2019) explain that the Indonesian government has included the FPIC element in regulations and laws pertaining to licensing and land acquisition by investors such as:

1. Law of the Republic of Indonesia Number 2 of 2012;
2. Decree of the Minister of Agrarian Affairs / Head of National Land Agency Number 21 of 1994 Concerning Procedure of Land Acquisition for Companies in the Framework of Investment;
3. Regulation of the Minister of Agrarian Affairs / Head of BPN No. 5 the year 2015 about Location permission;
4. Regulation of the Minister of Environment and Living and Forestry No. 34 of 2017 on Local Wisdom;
5. Government Regulation No. 27 of 2012 on Environmental Permits; and
6. Regulation of the State Minister of Environment of the Republic of Indonesia Number 17 of 2012 on Guidelines for Community Involvement in the Environmental Impact Analysis and Environmental Permit Process.

Furthermore, the practice of FPIC in Indonesia urged by two international bodies, namely Forest Steward Council (FSC) and Roundtable on Sustainable Palm Oil (RSPO), through the development and dissemination of land recognition and dispute management systems (Elfitra et al., 2019). The RSPO has endorsed FPIC Guide for RSPO Members on 20 November 2015 in Kuala Lumpur. These guidelines are important to ensure that the RSPO is permitted to carry out palm oil activities without any conflict over land. Accordingly, the RSPO establishes clear guidelines by taking into account representation from the local community, respecting the community dispute resolution system, gender equality and respecting indigenous customary land rights (FPIC Guide for RSPO Members, 2015).

Although the RSPO provides guides on FPIC, in practice, there are still various weaknesses, such as lack of influence at the grassroots level and also facing a backlog of cases (Filer et al. (2020); Laura Silva-Castañeda, 2015). Furthermore, the RSPO has registered a total of 56 complaints since 2010-2016, of which 41 per cent are related to violations of FPIC principles in Indonesia (Colchester, M, 2016).

FPIC and Indigenous people: regime of unfulfilled promise?

Pursuant to the above discussion, the law pertaining to FPIC in IPRA can be said more advanced as it recognises the rights of ICC/IP of the Philippines. However, implementation challenges signify that the laws, in theory, are not implemented effectively in practice. Nevertheless, such recognition on the FPIC is preferable compared to the absence of legal recognition in the laws of Indonesia and Malaysia, as the government is not legally bound to comply with the FPIC process. It will disrupt the achievement of SDG Goal 16 in promoting a just, peaceful and inclusive society. In line with the target 16.7 of SDG 16, the States must ensure the participation of indigenous peoples are all-encompassing, open and transparent in the decision-making process at all levels to decides for their future, especially during the unprecedented challenges of pandemic Covid-19.

Therefore, the current study suggests that the States must initiate legal and institutional reform to improve the recognition of FPIC as part of the right to self-determination of the indigenous peoples. These reforms will substantially complement the realisation of SDG 16 in promoting a just, peaceful and inclusive society. The government should address the lack of mechanisms to ensure indigenous peoples are not left behind by introducing a framework to warrant the inclusive participation of indigenous peoples in all decision-making processes, especially in the challenging time during the pandemic of Covid 19. UNDRIP and other international law instruments such as ILO Convention 169 should be the framework to address the target set out in Agenda 2030, including SDG 16 for peacebuilding development. Victoria Tauli-Corpuz, UN Special Rapporteur on the Rights of Indigenous Peoples, rightly suggested that the government should introduce special measures and measurements by establishing an appropriate mechanism to protect the rights of indigenous peoples. Therefore,

proactive measures must be taken to achieve the SDGs and enhance the protection of the rights of the indigenous peoples and implementing FPIC law towards indigenous peoples.

4. Conclusions

In conclusion, the recognition of the right of indigenous peoples of ASEAN Member States through FPIC is still inadequate compared to the international law standards. The ASEAN Member States must observe the elements of FPIC and consider the participation of indigenous peoples in decision-making processes at all levels. In the absence of any provision in domestic law that obliges compliance with the elements of FPIC, the States have moral obligations to implement and respect the rights of indigenous peoples as accorded through the spirit of UNDRIP. Therefore, this article suggests that the relevant law be amended. Any such amendment of the domestic law should recognise the right to self-determination and insert the principle of FPIC as enshrined in UNDRIP.

To guarantee the rights of the indigenous peoples in practice, the States and private sector should observe the laws and regulations that recognise the rights of the indigenous peoples. It is fundamental to ensure that the protection of the rights of the indigenous peoples are compatible with the standards of international law and thus assist the ASEAN Member States in meeting her international law obligations and will substantially complement the realisation of SDG 16 in promoting just, peaceful and inclusive society. Ultimately, the proposed legal and institutional reform will be of great significance and relevance to accelerate the recognition of indigenous peoples to participate in the decision-making process at all levels, especially in the unprecedented challenges of pandemic Covid-19.

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Sustainable Development as a Legal Concept

Introducing the possibility of formulating a Sustainable Development Model Law

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Abstract

Comparative legislative study on various sustainable development legislation determining the necessary and common provision to be included in a potential sustainable development model law. Analysis of various sources providing: a brief history of sustainable development; the growth of sustainable development through the years; the role that the sustainable development goals have in achieving sustainable development; legislative and policy considerations for sustainable development; and considerations of varying economic, social and environmental backgrounds among nations. This paper functions as a thought paper and proposal for the establishment of a sustainable development model law and why this model law is the next tool for achieving sustainable development at a practical level among national frameworks.

Keywords: Sustainable, Development, Model-Law, Legislation, Policy

1. Introduction

Sustainable development has been defined and redefined for many years and recently has led to the formulation of a global sustainable development agenda. Sustainable development has been highlighted as a key concern across the globe and many countries have taken major steps in an attempt to achieve sustainable development. Despite the importance of sustainable development, very little has been done to ensure national compliance and accountability. There is little or no means for citizens to hold national governments accountable for political commitments made. It is with this in mind that sustainable development legislation should be considered. But where do nations start? What should be considered in this legislation? How can uniformity be considered in attempts to achieve global goals of sustainable development? The formulation and utilisation of a sustainable development model law can help to provide answers to these key questions.

2. Methods

Comparative legislative overview of existing sustainable development legislation and an analytical overview of secondary sources to determine the validity and necessity of a sustainable development model law in the sustainable development agenda. Results and Discussions outlined below are based on research formulated in a Masters in Laws thesis presented by the author through the University of Stellenbosch.

3. Results and Discussion

Sustainable Development, as a concept, has been utilised for many years prior to the development of the United Nations Sustainable Development Goals (SDGs). In 1987, the World Commission on Environment and Development, in the Brundtland Report, provided the definition of sustainable development as: "[D]evelopment that meets the needs of the present without compromising the ability of future generations to meet their own needs."(World Commission on Environment and Development, 1987: 43). The Brundtland report is the first of its kind to provide a concise definition of sustainable development (Brinkman, 2016: 13). It should be noted that the definition provided was formulated under the specialisation of a body dedicated to the environment and development, indicating, from early inception, the interrelated nature of environment and development.

Looking more closely at sustainability, Brinkman (2016:1) provides that: "Sustainability can be succinctly defined as doing what we can not to preserve the environment for future generations". Sustainability consists of three founding elements, known commonly as the 3 E's of Sustainability, which are: environment, equity and economics (Brinkman, 2016: 1). On the other hand, development has often been synonymous with western concepts of economic growth and industrial progress, often resulting in countries with lower economic growth and industrial progress being classified as least developed or developing (Tomislav, 2018:68-69). Lele (1991: 609), identifies that development encompasses a series of targeted change, which include goals and resources to achieve these goals. Lele's intervention may be useful in determining how sustainable development now encompasses SDGs. However, irrespective of individual definitions, in today's context, development and sustainability are interconnected and there is no one without the other (Sachs, 2007: 28).

1. The Growth of Sustainable Development

Initially the term sustainable development was utilised in the forestry sector and specifically focused on measures of afforestation and harvesting of interconnected forests in ways that would not undermine the biological renewal of forests (Tomislav, 2018: 70). Prior to the definition provided in the Brundtland Report, the International Union for Conservation of Nature first mentioned the term sustainable development in its 1980 Nature Conservation and Natural Resources Strategy (IUCN, 1980). As

commonly known, one of the key international organisations affiliated with the development of the term sustainable development is the United Nations (UN).

As founded in 1945, one of the main goals of the UN: maintaining the peace and security in the world, promoting sustainable development, protecting the human rights and fundamental freedoms, promoting the international law, suppressing the poverty and promoting the mutual tolerance and cooperation (United Nations, 1945). Prior to the Introduction of the SDGs, the UN launched the Millennium Development Goals (MDGs) as the first step, within the UN, to address development concerns among UN member states.

a. The MDGs

In September 2001, the UN, based on the Millennium Declaration, introduced the MDGs, a list of development goals to be achieved by 2015 (United Nations, 2021). The MDGs consisted on 8 specific goals to address development, namely: eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria and other diseases; ensure environmental sustainability; and global partnership for development. Although these goals marked an initial starting point for development agendas worldwide, these goals were considered to be too broad and ineffective in achieving sustainable development or development for the long term (Sachs, 2012: 2206). It was often argued that the MDGs failed to consider aspects of globalisation and developments in the field of sustainability, however the MDGs were considered to be a good basis for sustainable development considerations (Fehling et al., 2013: 1112). These inefficiencies and concerns regarding the effectiveness of the MDGs were the topic of discussion at the 2012 United Nations Conference on Sustainable Development (Rio+20).

On the 20-22 June 2012, the UN hosted the Rio+20 Summit, which resulted in a political outcome document containing clear and practical measures for implementing sustainable development. The political outcome document, titled “The future we want”, reaffirmed commitments made under the Declaration of the United Nations Conference on the Human Environment, adopted at Stockholm on 16 June 1972, and principles of the Rio Declaration on Environment and Development (United Nations, 2012: Para 15-16). Section B of ‘The future we want’ addressed new and emerging challenges and gaps regarding sustainable development, which were not addressed under the MDGs, namely: uneven progress; the need to accelerate growth in areas of development, particularly in economy, equity and environment; recognition of diversification amongst development actors and stakeholders; and insufficient participation from all countries (United Nations, 2012: Para 19).

Paragraphs 245-251 of 'The future we want' speaks directly to the introduction and implementation of the new SDGs. It is acknowledged that the MDGs were in fact "a useful tool in focusing achievement of specific development gains as part of a broad development vision and framework for the development activities of the United Nations". The general Assembly then resolves to "establish an inclusive and transparent intergovernmental process on sustainable development goals that is open to all stakeholders, with a view to developing global sustainable development goals to be agreed by the General Assembly", thus the SDGs were presented.

b. The SDGs

In September 2015, the UN General Assembly adopted the Resolution titled: "Transforming our world: the 2030 Agenda for Sustainable Development" (Agenda 2030), at the UN Summit for the adoption of the post-2015 development agenda (United Nations, 2015). Agenda 2030 was developed as a plan of action for 'plant, people and prosperity' thus addressing the 3 E's of sustainability. Agenda 2030 built on the MDGs by introducing the 17 SDGs with 169 accompanying targets with sought to bring sustainable development to the forefront of the universal agenda. Agenda 2030 was incorporated to provide guidelines for UN member states when seeking to implement sustainable development practices on a national level (United Nations, 2015: Para 21). The SDGs provided a common set of targets, goals and objectives, for each nation to focus on when seeking to achieve sustainable development while building on global partnerships for implementation (United Nations, 2015: Para 39).

The 17 SDGs are as follows:

1. End poverty in all its forms everywhere
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
3. Ensure healthy lives and promote well-being for all at all ages
4. Ensure inclusive and equitable quality education and promote lifeline learning opportunities for all
5. Achieve gender equality and empower all women and girls
6. Ensure availability and sustainable management of water and sanitation for all
7. Ensure access to affordable, reliable, sustainable and modern energy for all
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation
10. Reduce inequality within and among countries
11. Make cities and human settlement inclusive, safe and resilient and sustainable

12. Ensure sustainable consumption and production patterns
13. Take urgent action to combat climate change and its impacts
14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reserve land degradation and halt biodiversity loss
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17. Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development

It can be seen, by comparing the MDGs and SDGs, that the SDGs themselves build on the principles outlined and introduced in the MDGs. Many, if not all, of the SDGs provide more detail and specified targets based on elements of the MDGs. For example, MDG 8: ensure environmental sustainability, has been addressed in SDGs 6-7 and 13-15. The SDGs themselves function as a collection of sustainable development target areas based on a collection of sustainable development principles that have been composed over a number of years. The SDGs are by no means the only tool for achieving sustainable development but rather function as a checklist or point of reference for achieving universal sustainable development that is measurable and commonly understood.

c. Can the SDGs Guarantee Sustainable development?

Sustainable development, as a concept and a practice, has been formulated and development for many years prior to the introduction of the SDGs, as described above. From its definitions in the Brundtland Report to a number of variations since then, sustainable development has been conveyed and carried out in countless forms at both a national and international level. The SDGs themselves do not guarantee sustainable development, purely through formulation of its goals and targets, however it does provide a measure to determine levels of sustainable development implementation at a national level (Wackernagel etal., 2017: 3). The SDGs provide a platform for individual nation states to introduced sustainable development mechanisms internally that meet the overarching goals and targets provided in the SDGs.

The SDGs can be formally and rationally implemented into national policies and frameworks through sustainable development legislation, thus solidifying the sustainable development intentions of a nation within its resources and means. The SDGs seek to identify economic, environmental and equity concerns regarding sustainability, which nations should consider when implementing strategies and

frameworks for sustainable development internally (Gupta and Vegelin, 2016: 444). In short, the SDGs are simply that: goals. They are the set of goals that UN member states wish to achieve, however on their own they do not guarantee sustainable development as member states are free to utilise whatever tools they see suitable to ensure sustainable development. It is with this in mind that I form the argument that if sustainable development is to be practically achieved, there should be model law introduced. This model law would be a template for legislative reform that countries can implement to truly achieve sustainable development at a national level.

2. Sustainable Development Legislation

Before delving into the formulation of a sustainable development model law, it is important to acknowledge nations which have implemented forms of sustainable development legislation. This legislation is a practical and accountable means for directly ensuring sustainable development and not mere commitments to goals. It is not sufficient to commit to goals without committing to accountability for inaction at a national level, and this is followed in specific countries. In analysing sustainable development legislation, the following acts and countries were chosen:

i. Malta Sustainable Development Act, Chapter 521 enacted 10 July 2012 ("Malta SD Act");
ii. Zanzibar Environmental Management for Sustainable Development Act 2 of 1996 ("Zanzibar SD Act"); and
iii. Australian Capital Territory Planning and Development Act of 2007 ("Australian PD Act").

A direct comparison of these legislative instruments is useful in outlining the tools and legislative mechanisms adopted by each country to achieve sustainable development (Houston, 2020). These tools and mechanisms can be the basis for a sustainable development model law. It should be noted that each of these sustainable development acts were written and implemented prior to the SDGs and span a period of 16 years, thus indicating the extended expansion of sustainable development, as a concept. This direct comparison provides a simplistic picture of Sustainable Development legislation and in no way a represents all development legislation. The legislation provided is a sample of present and potential sustainable development legislative instruments. In order to formulate a wholistic picture of sustainable development legislation, the direct comparison will review the legislative instruments in their entirety thus outlining similarities and differences among these.

a. Definitions

Section 3 of the Malta SD Act defines sustainable development utilising the definition provided by the Brundtland Report, namely: "[D]evelopment that meets the needs of the present without compromising the ability of future generations to meet own their needs." Similarly, section 2 of the Zanzibar SD Act opts to utilise the definition provided by the Brundtland Report. Section 9 of the Australian PD Act,

however, provides a more in depth definition of sustainable development, stating: "sustainable development means the effective integration of social, economic and environmental considerations in decision-making processes, achievable through implementation of the following principles: (a) the precautionary principle; (b) the inter-generational equity principle; (c) conservation of biological diversity and ecological integrity; (d) appropriate valuation and pricing of environmental resources." Based on the elaborations of sustainable development provided by the Australian PD Act, it is clear that sustainable development legislation provides an opportunity for nations to create a unique perspective of sustainable development that is in line with national agendas and objectives. By differentiation definitions, sustainable development thus meets particular needs within the nation.

b. Objectives

Building on unique interpretations of sustainable development, each legislative instrument contains a unique set of objectives relative to the needs of the country or community it seeks to administer. Section 2 of the Malta SD Act provides: "(1) The purpose of this Act is to create a framework through which Sustainable Development is to be mainstreamed across Government. (2) Within the context of the private sector and civil society, this Act seeks to enable the raising of awareness of the principles of sustainable development, such that these may be adopted on a voluntary basis." Objectives listed under the Malta SD Act are based, initially, on governmental mainstreaming and then civil society participation. A strict governmental focus encourages accountability and ensures a government centred approach to development.

Section 4 of the Zanzibar SD Act proposes an environmentally centred approach to sustainable development. Within the outlined purpose of the Act, reference is made to 'ecological processes; environmentally sound and healthy quality of life; natural resources; preservation of biological and cultural diversity; and strengthening institutional capabilities for protecting the environment'. Sustainable development is thus environmentally focused and requires adherence to environmentally accepted standards for sustainability to be achieved.

The objective of the Australian PD Act, as in section 6, "is to provide a planning and land system that contributes to the orderly and Sustainable Development of the ACT— (a) consistent with the social, environmental and economic aspirations of the people of the ACT; and (b) in accordance with sound financial principles." Contrary to previously mentioned objectives, the Australian PD Act is centred around land use and land development regarding sustainable development. Development, as provided in Section 7(1) of the Australian PD Act, is understood to consider land development in terms of building; earthworks; structures; land use, etc.

c. Developmental Principles

Developmental principles, as highlighted below, refer to specific principles concerning development that have been previously related to development and sustainable development (Schrijver and Weiss, 2004: 1-152).
The Malta SD Act, in Section 5(h), references Sustainable Development principals however there is no explicit indication of what these principles are. However, the Malta SD Act includes, rare mention of, Future Generations. Part IV of the Malta SD Act affords that a Commission, composed under the Act, must act as the Guardian of Future Generations and is responsible for "safeguarding inter-generational and intra-generational sustainable development in Malta." The consideration of future generations, within the Malta SD Act, places a proactive focus on long-term generational inclusion.

Section 7 of the Zanzibar SD Act, although making indication to natural resource use, still fosters current Sustainable Development discussions. Being the oldest Act in reference, it is worthy to note, the inclusion of a right to a clean and healthy environment and a duty to maintain such a right. Determining such a right makes environmental protection and Sustainable Development rights-focused. A rights-based approach to climate change and sustainability has been of great attention in recent years, given climate change litigation cases, highlighting the need for environmental protection for all.

Section 9 of the Australian PD Act makes explicit reference to certain developmental principles in the definition of sustainable development, namely: the precautionary principle; the inter-generational equity principle; conservation of biological diversity and ecological integrity. The reference to these developmental principles is straightforward and are to be considered throughout the legislative framework.

d. Committees and Authorities that implement the National Development Plans, Policies and Strategies

There is one common element across all legislation frameworks, namely, the use of national and regional plans that foster development. These plans provide and outline development strategies and objectives outside of the act and are necessary to supplement sustainable development agendas, as outlined in the act. The national development plan of each country is nation specific and as such each plan will contain its own objectives, policies and principles. Each plan, due to national specificity, differs greatly from the next and would require more detailed analysis than currently provides. Rather, what is common with all the development plans is that each plan is specifically allocated to an accountable committee, administration or body that must report on the progress of this report to the authorities provided under the act.

e. Mechanisms and Entities ensuring Sustainable Development on a National Level

In addition to the development plans and national policies outlined above, each country may implement mechanisms and entities ensuring the effective management, administration, transparency and accountability needed to fulfil the respective legislation. Such entities may either be established in order to fulfil the act in its entirety or could be crucial to specific sections, procedures and programmes. The mechanisms and entities referenced may consist of frameworks; policies; plans; assessments; reports; programmes and protocols, in short it refers to any and all mechanisms that the legislation introduces, in addition to development plans and policies, which supplement sustainable development targets under this legislation.

3. Sustainable Development Model law

The outline and understanding of sustainable development and the direct comparison of the legislation above provides an outline and background to the formulation of a Model Law. Consideration is then needed on: what a model law is, how it can be utilised, what elements should be included, and finally how the model law can be shaped to consider the environmental; social and economic differences among nations which opt to utilise the model law.

According to Godfrey (2013:417): "The Model Law contains non-mandatory provisions that provide a model for policy-makers to adopt into national legislation at their discretion." As it can be seen, a model law is a non-binding and optional legislative framework. It is therefore up to the nation itself to determine if they wish to adopt the model law in its entirety or in part into its own national legislation. When a drafter is drafting legislation, there is nothing more beneficial than having a draft to compare and apply, and that is the function of a model law (Whisner, 2014: 131). In providing a Model Law on Sustainable Development for policy makers to utilise, there is then an opportunity for policy makers to, without excuse, to adopt the vision of Sustainable Development practices into national legislation.

A model law is exactly that, a model of what the law should look like and or what it should include. In this way, a model law provides flexibility to nations to shape and mould their national legislation to include additional mechanisms and developmental elements that cater to national needs. The flexibility of a model law allows for adaptation and implementation that is unique. This flexibility also allows for specificity in formulation and provides policymakers leeway to form national legislation in the most effective way. However, despite the flexibility of the model law, there remains some elements of sustainable development legislation that must be present for the law to successfully meet sustainable development.

Sadooni (2014: 105-109) indicates that in order for Sustainable Development legislation to be successful it should include:

> [A] clear definition of Sustainable Development such as that provided by the Brundtland Report; a Sustainable Development council consisting of representatives from different sectors; a Sustainable Development committee; an independent and impartial Sustainable Development commission; a Sustainable Development strategy or timeline; sector duties to mainstream Sustainable Development strategies across various Public Bodies; and a Legislative hierarchy that outlines at what level and under whose supervision the legislation is to be implemented.

In formulating legislation, Bosselmann (2015) suggests that there are three phases: the developmental phase; the writing phase; and the monitoring and implementation phase. In formulating a sustainable development model law, there is particular focus on the developmental phase. During this phase there must be clear stakeholder engagement and participation; cross departmental consultations and support from the legal and judicial community (Sadooni, 2014: 105-109 and Jones, 2006: 127). In allowing consultations and contributions from various levels and stakeholders policymakers encourage a sustainable development legislation that caters to equity and people-centred (Sadooni, 2014: 97).

Based on the direct comparison above there are selected key provisions that should be included in any sustainable development legislation. Below is an example of what provisions should be included and is in no way a finite list of provisions, these provisions should be reviewed as a starting point for consideration and inclusion. The headings utilised to identify these provisions function as a means to group the provisions together and are not expected to be the headings within the legislation itself.

a. Preamble

A preamble functions as a means to outline a clear picture of the complete understanding of the sustainable development legislation and functions as an introductory provision to the legislation and highlights the main focus of the legislation. In earlier sustainable development legislations there has been diverse focus areas, namely: addressing past under-development; seeking environmental, social and economic sustainable development;[1] addressing Sustainable Development in terms of land use agendas.[2]

[1] Section 4 Zanzibar Environmental Management for Sustainable Development Act 2 of 1996.

[2] Section 6 Australian Capital Territory Planning and Development Act of 2007.

b. Definitions

The following terms, as identified in previous sustainable development legislation, should be considered for inclusion and definition: sustainable development;[3] Precautionary Principle;[4] Biological diversity, Ecosystem, Environment, Natural Resources, and Pollution;[5] Inter-generational Equity principle;[6] Development;[7] Right to Clean and Healthy Environment;[8] Social, economic and environmental impacts; Future Generations;[9] and Duty to Mitigate.[10] Definitions included are subject to the focus of the legislation itself therefore this list of definitions is suitable, as a point of departure, for a Model Law that addresses environmental, economic and social needs as well as the needs of future generations.

c. Application of the Act

In order for it to function successfully, there must be a clear indication as to whom the legislation directly applies and whom will be responsible for the implementation of the legislation itself. Implementation may be left to a specific Ministry or Governmental Department; a designated authority;[11] or civil society at large.[12] This section is specifically vital for determining who benefits from the legislation and who is to be held accountable for its fulfilment.

d. Objectives of the Act

Often seen as a directed and comprehensive version of the preamble, the objectives of the Act provide and include clear goals and visions that the legislation should set in motion to achieve. Specific

[3] Section 3 Malta Sustainable Development Act, Chapter 521 enacted 10 July 2012; Section 2 Zanzibar Environmental Management for Sustainable Development Act 2 of 1996; Section 5 Australian Capital Territory Planning and Development Act of 2007; Section 5 Canadian Federal Sustainable Development Act S.C. 2008, c. 33; Section 2 Welsh Well-Being of Future Generations Act 2015 anaw 2.

[4] Section 2 Canadian Federal Sustainable Development Act S.C. 2008, c. 33.

[5] Section 2 Zanzibar Environmental Management for Sustainable Development Act 2 of 1996; Section 9 Australian Capital Territory Planning and Development Act of 2007.

[6] Section 9 Australian Capital Territory Planning and Development Act of 2007.

[7] Section 7 Australian Capital Territory Planning and Development Act of 2007.

[8] Section 6 Zanzibar Environmental Management for Sustainable Development Act 2 of 1996.

[9] Part IV Malta Sustainable Development Act, Chapter 521 enacted 10 July 2012.

[10] Section 6 Zanzibar Environmental Management for Sustainable Development Act 2 of 1996.

[11] Section 4 Malta Sustainable Development Act, Chapter 521 enacted 10 July 2012; Chapter 3 Australian Capital Territory Planning and Development Act of 2007.

[12] Section 2 Malta Sustainable Development Act, Chapter 521 enacted 10 July 2012.

sustainable development legislation focuses on sustainable development and achieving a countries national development agenda.[13] Should the objectives be more environmentally focused this ought to be stipulated within the objectives.[14] In instances where development is taken to achieve to a specific developmental vision, i.e. land planning and land use systems, objectives must clearly stipulate such in order to prevent misunderstandings of Sustainable Development agendas and accompanying responsibilities.[15]

e. Committees and Authorities that implement the National Development Plans, Policies and Strategies

Where national governments have formulated national development plans or other plans and frameworks to implement development strategies, the sustainable development legislation should attempt to provide clear linkages between the plan and the legislation.[16] In offering provisions that address the national plans there is no ambiguity regarding the legal position of the national plan and where it belongs in the greater development agenda.

f. Administrative Bodies established under Sustainable Development Legislation

Sustainable Development, especially at a national level, cannot be achieved without focused and specialised attention from administrative bodies. These administrative bodies are crucial for well-organized allocation of developmental tasks and necessary to fulfil key roles in sustainable development governance. These bodies include: A Sustainable Development Office;[17] Sustainable Development Advisory Council;[18] A Committee on Climate Change;[19] and A Future Generations Commissioner.[20] Establishment of these administrative bodies, is in accordance with the duties this placed on public bodies to ensure the well-being of all citizens and prolonged sustainable development.[21]

[13] Section 2 Malta Sustainable Development Act, Chapter 521 enacted 10 July 2012.

[14] Section 4 Zanzibar Environmental Management for Sustainable Development Act 2 of 1996.

[15] Section 6 Australian Capital Territory Planning and Development Act of 2007.

[16] Part IV Zanzibar Environmental Management for Sustainable Development Act 2 of 1996; Chapter 5 and 6 Australian Capital Territory Planning and Development Act of 2007

[17] Section 7 Canadian Federal Sustainable Development Act S.C. 2008, c. 33.

[18] Section 8 Canadian Federal Sustainable Development Act S.C. 2008, c. 33.

[19] Section 32-38 United Kingdom Climate Change Act 2008 Chapter 27.

[20] Section 17-28 Welsh Well-Being of Future Generations Act 2015 anaw 2.

[21] Section 2-6 Welsh Well-Being of Future Generations Act 2015 anaw 2.

g. Mechanisms and Entities ensuring Sustainable Development on a National Level

Based on the legislative needs and the objectives there are additional mechanisms that can be useful in ensuring the successful fulfilment of sustainable development aspects. Specific mechanisms, procedures and protocols provide clarity, uniformity and accountability. These mechanisms include: Permits and applications for development tasks;[22] Environmental Impact assessments;[23] Systems for achieving ecological sustainability;[24] Specialised mediators, prosecutors and assessors;[25] Provisions addressing procedures for review, variations and revisions;[26] Mechanisms for monitoring, reporting and evaluating progress;[27] Enforcement strategies;[28] and Penalties and Offences for failure to uphold provisions of the legislation.[29]

4. Conclusions

As indicated above sustainable development, as a concept, has developed over the years to adapt and change to meet the needs and times. From definitions provided by the Brundtland Report to specific definitions formulated by specific authors, the understanding of sustainable development is not recent or fixed. Sustainable development has been formulated long before the modern understanding of sustainable development presented today. From a pure understanding of development and sustainability to the SDGs, there has been multiple formulations of the concept of development and how it can be attained.

The SDGs, the succeeding agenda of the MDGs under the UN, function as a guideline and framework of target areas to achieving sustainable development however, the SDGs on their own do not guarantee sustainable development. There is no guaranteed way of ensuring sustainable development however there is a way of ensuring that sustainable development is treated as a priority and addressed at a national level. The SDGs on their own, are a mere guideline and governments cannot be held accountable for

[22] Section 64 and 69 Zanzibar Environmental Management for Sustainable Development Act 2 of 1996; Part 7.2-7.3 and 9.11 Australian Capital Territory Planning and Development Act of 2007.

[23] Part V Zanzibar Environmental Management for Sustainable Development Act 2 of 1996; Part 7.2-7.3 and 9.11 Australian Capital Territory Planning and Development Act of 2007.

[24] Section 4 Queensland Planning Act 2016.

[25] Section 112-114 Zanzibar Environmental Management for Sustainable Development Act 2 of 1996.

[26] Part 5.3, 9.6 and Chapter 13 Australian Capital Territory Planning and Development Act of 2007.

[27] Section 14 Malta Sustainable Development Act, Chapter 521 enacted 10 July 2012; Part V Zanzibar Environmental Management for Sustainable Development Act 2 of 1996.

[28] Chapter 12 Zanzibar Environmental Management for Sustainable Development Act 2 of 1996; Section 107 Australian Capital Territory Planning and Development Act of 2007.

[29] Part VIII Zanzibar Environmental Management for Sustainable Development Act 2 of 1996; Section 5 Australian Capital Territory Planning and Development Act of 2007.

failure to consider or implement them. If nations are set on committing to sustainable development then it is simply not enough to commit to sustainable development. Nation states should formalise their commitment in a way that they can be held accountable to citizens and pledge to measurable and attainable goals. This can be done through sustainable development legislation and model law.

As discussed above, sustainable development legislation, with the assistance of a sustainable development model law, can provide a number of varied and unique mechanisms; policies and frameworks specific to each nation. The paired flexible nature of a model law and the intervention of national policymakers make for a formidable basis to establish national sustainable development legislation that caters to the specific and varied needs of each nation.

It is necessary to consider the environmental, social and economic differences among nations and these differences will be uniquely addressed as each nation moulds and establishes their own sustainable development legislation utilising the model law as a model. The model law itself, and by its very nature, supports national sovereignty and countries may choose whether to apply it and in what capacity. It would not be sufficient to provide a blanket sustainable development agenda without providing guidance, on a legislative level, to support achievement of developmental targets. Law creates a solid foundation for accountability and transparency and this is especially relevant when seeking to attain the global goal of sustainable development.

Sustainable development looks and feels different for every country and each country requires different areas of sustainable development to be addressed. Some countries require greater focus on environment while others may need to emphasise economy, and others still require greater social consideration. The utilisation of a sustainable development model law sheds a light on considerations in each of these areas and allows countries to build on or dismiss these considerations when formulating national legislation. Model laws can be a useful basis for legislative reform that encourages creativity while trying to reflect uniformity and structure. This being the case, a sustainable development model law would in fact be the next best tool for sustainable development.

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Identifying synergies and trade-offs for regional sustainability in Jämtland Härjedalen

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Abstract

Agenda 2030 unifies ecological, social, and economic sustainability, with the Sustainable Development Goals (SDGs) at its heart. The integrated nature of the SDGs leads to complex relationships that can be divided into synergies (progress in one goal favour progress in another) and trade-offs (progress in one goal hinders progress in another). These interlinkages are important to consider in policy planning and implementation of the SDGs to enhance progress across all the 17 goals. The Swedish government has declared the regional level as being especially important in the fulfilment of Agenda 2030 on a national level, as many of the basic welfare assignments lie within their responsibility. This paper uses the Swedish region Jämtland Härjedalen as an example of how knowledge of synergies and trade-offs can be used in the work with Agenda 2030 by identifying interactions between 15 targets relevant for the region. The assessment of interlinkages between targets are supported by a literature review aimed at finding relevant information based on the geographic context and the specific targets chosen. Synergies and trade-offs were identified using a seven-point typology for scoring. The results are presented in a cross-impact matrix that visualizes interaction between targets and identifies which targets have the most and the least positive influence on the network. The analysis shows that most of the interactions are synergistic which means that progress in one area often makes it easier to fulfil other targets simultaneously. The results also highlight a few important trade-offs, related to land-use and the use of natural resources, that are important to consider to avoid irreversible effects. Displaying interactions between targets alone does not offer any guidance on how to enhance synergies or manage trade-offs but it is an important first step to enhance progress across all SDGs. Knowledge of how different targets relate to each other can offer guidance for where specific attention is needed and where cross-sectorial collaboration is merited. Overall, it can lead to better informed decision-making.

Keywords: Sustainable Development Goals, Agenda 2030, SDG interactions framework, Policy priorities

1. Introduction

Achieving sustainability can be found as a policy goal in all levels of society; internationally as well as nationally, regionally, and locally. The Sustainable Development Goals (SDGs) are described by the UN as inseparable, meaning that none of the goals can be achieved at the expense of another and that success is required within all areas to achieve sustainable development (Sveriges Kommuner och Regioner [SKR], 2020). But while advocates describe it as an 'indivisible whole', studies aimed at examining the interlinkages of the SDGs, provides a more complex image with the occurrence of both synergies and trade-offs (Allen et al., 2018; ICSU, 2017; Lyytimäki et al., 2020; McCollum et al., 2018; Nilsson et al., 2016; Pradhan et al., 2017; Weitz et al., 2018). Generally speaking, synergies arise when progress in one goal favours progress in another while trade-offs are signified by progress in one goal that hinders progress in another (Pradhan et al., 2017). The inability to overcome persistent trade-offs have been found to seriously threaten the achievement of the Agenda 2030 (Kroll et al., 2019), but there are several attempts of using the knowledge on synergies and trade-offs as a means for policy support to enhance progress across all 17 SDGs (Allen et al., 2018; Weitz et al., 2018). Disentangling interactions amongst the SDGs can support effective and coherent implementation of policies across sectors (Weitz et al., 2018).

Sweden's decentralized model of society means that many of the basic welfare assignments lies on regions and municipalities which means that a great deal of the responsibility for achieving Agenda 2030 falls on them (Swedish Government, 2019c). There are some studies investigating the topic in a Swedish context, such as Engström et al. (2019) that looks at interactions between water-and-land related SDGs (goal 2, 6, 7, 11, 13, 15) and Weitz et al. (2018) that examines interactions between 34 targets relevant for Sweden. Exactly how targets interact with each other will be different in different contexts (Nilsson et al., 2016) which implies the need for an investigation from a regional perspective.

There are examples of how regions and municipalities have taken on the work with the Agenda (SKR, 2019) but information regarding what conflicts might exist within the Agenda and how this affects regional actors is limited. There is a risk that the challenge of fulfilling the Agenda is simplified and that local actors fail to consider trade-offs, which might lead to the fulfilment of some goals at the expense of others, threatening the achievement of the Agenda on a global level (Sternad-Fackel, 2018). This study address this research gap by investigating interlinkages of Agenda 2030 in a case study from the region Jämtland Härjedalen, located in the middle of Sweden.

The purpose of the study is to identify interactions between relevant SDG-targets and to contribute with an understanding of how knowledge of synergies and trade-offs within Agenda 2030 can be used to assess and prioritise targets in the work with sustainable development on a regional level. The objectives are:

- To assess where synergies and trade-offs can be found between the selected SDG-targets.
- To identify which targets require specific attention from a policy perspective based on identified synergies and trade-offs.

2. Background

The work with Agenda 2030 has had a breakthrough in Swedish municipalities and regions. A report conducted by the State Office (Statskontoret, 2019) showed that 70 percent of municipalities and almost all regions are using the agenda as a tool in their work with sustainable development. Despite this, their investigation shows that the work with Agenda 2030 so far has had little effect on the overall work with sustainability. The actor's way of working and their priorities has not shifted in any significant way within most of the regions or municipalities. Further on they describe how the implementation of Agenda 2030 in steering and action has proven difficult for regions and municipalities. Insecurities in how the work should be performed in order to fulfil the national commitment of the agenda has resulted in requests for further support on how to work with the goals. The Swedish Government might need to clarify the connection between the SDGs and other national goals (such as the environmental objectives) and offer guidance on how authorities should prioritize between goals (Statskontoret, 2019). The joint organisation for Sweden's municipalities and regions (SKR, 2020), emphasizes the importance of integrating Agenda 2030 and the goals into the steering-and-management of municipalities and regions to achieve the goals on a national level.

Being responsible for regional development and growth (Kullander, 2020) Region Jämtland Härejdalen is obliged to develop a Regional Development Strategy (RDS) according to Swedish law (Swedish Parliament, 2017). This is an important steering tool that is the foundation for other regional strategies and programmes and sustainability should be an integral part of this (ibid.). In the process of revising their old RDS, Region Jämtland Härjedalen commissioned Oxford Research AB to perform an analysis of the old RDS to clarify how it was connected to the SDGs (Oxford Research, 2019). They assessed that a majority of the goals found in the RDS had bearing against the SDGs. Goals concerning education, work and economic growth, sustainable industry, infrastructure, and sustainable cities along with health and wellbeing was the focus of the RDS. They also concluded that goals concerning equality and environment- and climate needed to be more directly implemented. Goals concerning equality were completely missing from the strategy.

Table 1. *The 15 targets chosen for Region Jämtland Härjedalen with official descriptions.*

Target	Short description	Official description
1.2	Poverty	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
2.4	Food production/ agriculture	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
3.4	Non-communicable diseases	By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being
4.4	Technical/vocational skills	By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship
5.5	Women's participation	Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life
6.6	Water-related ecosystems	6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
7.2	Renewable energy	By 2030, increase substantially the share of renewable energy in the global energy mix
8.9	Sustainable tourism	By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products
9.1	Infrastructure	Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
10.1	Economic equality	By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average
11.2	Transport	By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons
12.5	Waste	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
13.2	Climate change/ policy planning	Integrate climate change measures into national policies, strategies and planning
15.2	Biodiversity	Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species
16.7	Decision-making	16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels

3. Methods

The interactions between the SDG-targets were assessed in a cross-impact matrix based on two systematically selected literature sources per target. In addition, a screening for relevant policy documents in Region Jämtland Härjedalen with regards to the chosen targets was performed. 15 SDG-targets based on Weitz et al. (2018) and RKA (2020) were included in the analysis, resulting in a total of 210 interactions to be analysed, see Table 1. Based on the SDG interactions framework developed by Nilsson et al. (2016, 2018), with an adaption by Boman (2018) used in this study, the targets were organised into a cross-impact matrix of 15x14 interactions with the SDG-targets as headings along all rows and columns. The framework characterizes relationships with a seven point scale. Horizontally the question is: If progress is made on target x (rows), how does this influence progress on target y (columns)? The seven possible types of scores ranges between (+3) and (-3), where positive scores represent synergies, while negative scores represent trade-offs, see Table 2.

Table 2. *Criteria for scoring. Adapted from Nilsson et al. (2016) and Boman (2018).*

Score	Meaning
+3	Progress on one target creates very good conditions for achieving progress on another target. The literature describes a positive connection between progress of the analysed target and target X and explains the connection
+2	Progress on one target leads to a synergy between that and another target. The literature describes a positive connection between progress of the analysed target and target X and explains the connection.
+1	Progress on one target leads to a possible synergy between that and another target. The literature is limited or contradictory
+/- 0	There is no significant link between two targets' progress found in the literature
-1	Progress on one target leads to a possible trade-off between that and another target but the literature is limited or contradictory
-2	Progress on one target leads to a trade-off between that and another target. The literature describes a negative connection between progress of the analysed target and target X and explains the connection.
-3	Progress on one target makes it very difficult to achieve progress on another target. The literature describes a negative connection between progress of the analysed target and target X and explains the connection

4. Results

The cross-impact matrix is the result of the analysis of 210 interactions and shows the influence that targets exert on each other, see Fig. 1. The analysis will give further examples on what information can be drawn from the cross-impact matrix and how this can be used for policy-making. Mainly positive or neutral connections have been identified, which means that targets in general exert more positive than negative influence on each other. This also means that progress in one area often makes it easier to fulfil other targets simultaneously. Only eight percent of the connections are red, but they mark important exceptions as this indicates conflicts of aims. The matrix can be examined from different perspectives, where the numerical row-sum indicates the net influence of a target on other targets. A target with a

high row-sum can be seen as a synergetic one as this implies that successful implementation of a target makes the realization of other targets easier. A negative or low row-sum suggests that implementation of a target generally makes it more difficult to achieve other targets. The column-sum shows us how a target is influenced by the progress of other targets. Here, a high number suggests a predominant positive influence by other targets, while a negative or low column-sum implies that successful implementation of other targets makes it more difficult to reach the target. However, the numerical sums (row and column) in isolation does not show if the net influence is due to a large number of weak or contradictory influences on several targets or a few strong ones, nor does it show the distribution between positive and negative connections.

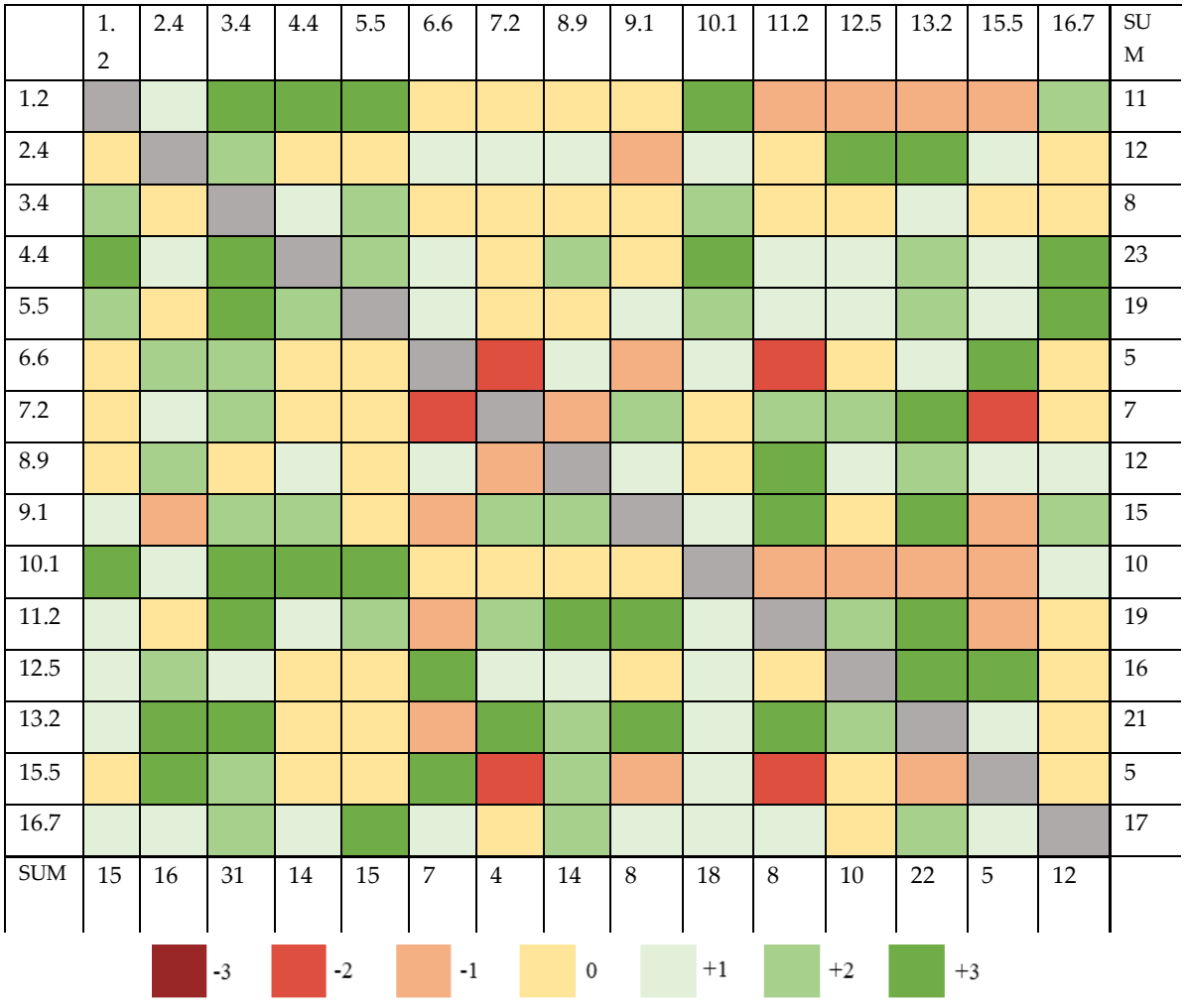

Figure 1*. Cross-impact matrix of 15 targets and their interaction. Colour according to scale where dark red is -3/very difficult and dark green is +3/very good conditions. The row sum represents the net influence form a target on all other targets and the column sum represents how the target is influenced.*

4.1 Summary of row-and column sums

Several targets only exert positive influence, such as 4.4 *(Technical/vocational skills)*, 5.5 (*Women's participation*), 16.7 (*Decision-making*), 12.5 (*Waste*) and 3.4 (*Non-communicable diseases*). Some of these targets also have the highest row-sum. In the top we find target 4.4 (sum 23) followed by target 13.2 (*Climate change policy/planning*) (sum 21) and thereafter target 5.5 and 11.2 (*Transport)* (sum 19). Both target 13.2 and 11.2 exerts negative influence on other targets despite the high row-sum.

The other end of the spectrum shows targets with the least amount of positive net influence of other targets. The lowest row-sum is held by target 6.6 (*Water-related ecosystems)* and 15.5 (*Biodiversity)*, which both have a sum of five. Following that is target 7.2 (*Renewable energy*) (sum 7) and 3.4 (*Non-communicable diseases*) (sum 8). There are however important differences behind these results. Target 15.5 exerts a negative influence of -6, leading it to be the target with the least positive influence on other targets. Target 6.6 and 7.2 both have a negative influence of -5, while target 3.4 has no negative influence but is given a low number due to its many neutral connections.

Looking at the column sums, which indicates how a specific target is influenced by other targets, we find target 3.4 (*Non-communicable diseases*) (sum 31), 13.2 (*Climate change policy/planning*) (sum 22), and 10.1 (*Economic equality)* (sum 18) in the top. Out of these, only target 13.2 are negatively influenced by other targets (-3 in total). On the bottom end we find target 7.2 (*Renewable energy*) (sum 4), followed by target 15.5 (*Biodiversity)* (sum 5) and target 6.6 (*Water-related ecosystems*) (sum 7). However, looking specifically at the negative influence from other targets, it shows that both target 15.5 and 11.2 (*Transport*) receive the same amount of negative influence from other targets (-6), followed by target 6.6 and 7.2 that both receive a negative influence of -5.

4.2 Policy implications

The analysis performed by Oxford Research on the old version of the RDS can be used to demonstrate the implications of using the SDG-interaction framework for policy implications. Target 10.1 on economic equality is not found in the former RDS. Taking a closer look at the analysis of how this target is connected to the network, we find that targets that they are already prioritizing such as health, education, infrastructure and sustainable transport will have a positive influence. This indicates that progress will be made in this target even if it is not a priority, but it also suggests that the potential negative influence might take place as well whether measures are aimed at making progress in target 10.1 or not. It also shows the potential of positive reinforcement that target 10.1 can have on other areas of the SDGs which might be lost if measures aimed specifically at this target are not pursued.

An analysis of this kind can also provide useful information when it comes to policies in terms of which departments would benefit from deeper cooperation. Figure 2a shows which other targets affect the ability to make progress on target 10.1 and whom they need to foster good collaboration with. Figure

2b shows how target 10.1 affect other targets and where it might meet resistance or where the need for negotiation might be greater.

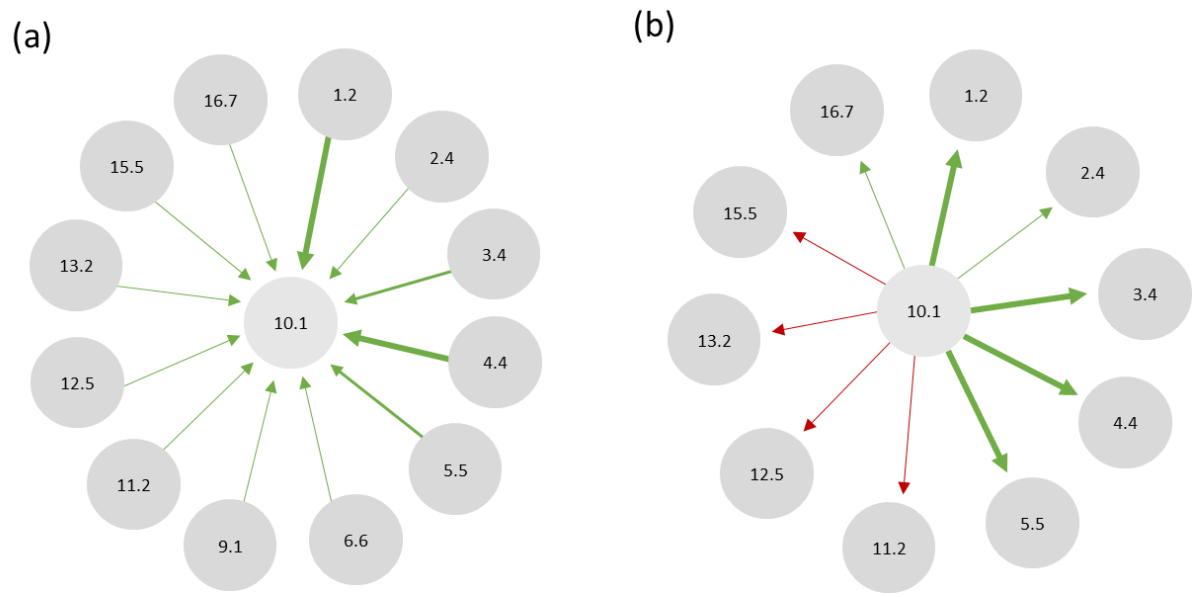

Figure 1. a) Network of interactions based on target 10.1: influence from other targets. The thickness of arrows represents the level of influence (-3 to +3). Negative influence in red, positive in green. b) Network of interactions based on target 10.1: influence on other targets. The thickness of arrows represents the level of influence (-3 to +3). Negative influence in red, positive in green.

5. Discussion

5.1 Method discussion

Using the SDG interaction framework as a method to analyse synergies and trade-offs between the SDGs entail both stronger and weaker aspects. The framework has since it was created been used in a number of studies and is therefore a proven concept (Allen et al., 2018; ICSU, 2017; Lyytimäki et al., 2020; McCollum et al., 2018; Nilsson et al., 2016; Weitz et al., 2018). However, the scoring process in previous studies has been based on the judgement of different expert groups. As this was not possible within this thesis due to practical limitations and time restrictions, the adaptation to the original typology was seen as necessary. The ambiguity of the goals resulted in sometimes contradictory statements in the literature which made it difficult to assess the connections according to the original seven-point scale. The degree of insecurity is therefore a part of the evaluation in this study. Because of this the method gives an indication both of the strength of interaction but also of how certain the scoring is. This has different consequences for the result. It can be argued that the results are not as clearly conveyed as in the previous mentioned studies or that the results are not as reliable. It can however be

noted that the results are in line with previous findings from Sweden (Weitz et al. 2018) which implies that the change did not have serious implications. That the results are not as clearly conveyed cannot be overlooked but presenting the insecurities this way gives a fair picture of reality since many of the goals are complex. It is important to be able to view the targets and their interactions from different perspectives when working with them. The choice of not using a judgement-based scoring was primarily due to limited options. This has however had some positive effects on the methodology, as one potential weakness with the judgement-based exercise is that the identification of connections is highly dependent on the assumptions made by the evaluator (Lyytimäki et al. 2020). This was partly avoided by using a literature base for the scoring which can be seen as a strength in the study.

5.2 Discussion of results

The findings are in line with earlier studies performed in the same contextual area, which suggests that most of the relationships within the SDGs are synergistic ones (Lyytimäki et al., 2020; Weitz et al., 2018). This means that activities aimed at reaching one goal or target generally improves opportunities to reach other goals or targets as well. None of the interactions were seen to make it very difficult to make progress in another target. The analysis shows that progress in targets 4.4 (*Technical/vocational skills*), 13.2 (*Climate change policy/planning*), 5.5 (*Women's participation*) and 11.2 (*Transportation)* generates the most positive influence on other targets which suggests that efforts to make progress here should be prioritized as it will have positive ripple effects that drive progress on the 15 SDGs overall. These can be good starting points to achieve maximum synergistic effects.

Targets with the least positive influence on other targets are target 15.5 (*Biodiversity*) and target 6.6 (*Water-related ecosystems*), followed by 7.2 (*Renewable energy*). This means that making progress in these targets will make it more difficult to achieve other targets and therefore special attention needs to be directed here to mitigate the problem. This result highlights the ongoing debate about how we should use the forest which is related to its differing benefits for climate (Bergström et al., 2020).

Targets 3.4 (*Non-communicable diseases*), 13.2 (*Climate change policy/planning*) and 10.1 (*Economic equality*), receive the most positive influence from progress in other targets. At first hand it might look like these targets would not need as much targeted support or that they might not need to be made priorities in strategies such as the RDS. However, Weitz et al. (2018) points out that progress in other goals should not be assumed. If anything, this result indicates a high dependency on other targets which may make these targets progress more uncertain as they are highly influenced on what happens in other areas. It indicates that close collaboration is needed with the actors that holds the key to their development. It should however be noted that several of the scores on target 10.1 are +1 scores and that additional information is needed to confirm the total score. Target 15.5 (*Biodiversity*) receives the most negative influence by other targets followed by target 6.6 (*Water-related ecosystems*) and 7.2. (*Renewable energy*). This means that progress in other areas will make it harder to achieve these goals.

For the people in charge of these goals it could be of special interest to collaborate with actors that have the potential of making progress in their areas more difficult.

Both low and high row- and column sums suggest that special attention should be directed to the implementation of the target in question (Lyytimäki et al., 2020). It is, however, important to note that synergies or trade-offs between targets may exist despite of the total sum being high or low. It is therefore important to use figure 3 as a starting point for further analysis and discussions on policy implications. Looking in detail at the connections in figure 4 and 5 can be a useful way to move further and to highlight where cooperation is most needed. Although only eight percent of the interactions indicate trade-offs, they call for careful consideration. Especially since some of these trade-off's risk leading to irreversible problems. Both target 13.2 and target 11.2 are a good examples of this, where the net influence is positive but without careful consideration the use of more biofuels could have a negative effect on restoration and protection of forests as well as biodiversity connected to forest.

Many of the identified connections are paired with an uncertainty (scores -1 and +1) that stems from limited or contradicting information from the literature. One example is the effect of protection of biodiversity (15.5) on climate measures (13.2). There are several synergetic effects, such as how protection of natural environments can help increase carbon storage and mitigate climate change. On the other hand, this can interfere with climate measures aimed at replacing fossil energy with bioenergy. These types of uncertainties are not just a result of a lack of literature, rather it is connected to the complexity of many of the targets and shows how important it is to have a systems perspective when implementing measures. The risk is otherwise that certain efforts will backfire in another part of the system that is unexpected. Some targets are paired with more insecurities than others. Target 16.7 stands out as having the most uncertain scoring (nine connections are marked +1). This is related to limited information on the connections rather than any contradictions. Higher participation seems to have an overall positive effect on other targets, but more information is needed on the matter before any definite conclusions can be drawn.

One of the main principles of Agenda 2030 is that of indivisibility, meaning that none of the goals can be achieved at the expense of another (Statskontoret, 2019). As mentioned earlier, the Agenda has undergone critique for entailing inconsistencies, particularly between the socio-economic development and the environmental sustainability goals (ICSU and ISSC, 2015). The fact that trade-offs exist within the SDGs is established and this study is yet another proof of that. The result and analysis show that there is a risk of losing the principle of indivisibility if careful consideration is not given to the impact on other goals. This leads to dilemmas when it comes to simultaneously fulfilling all targets.

5.3 Measures to reduce trade-offs and enhance synergies

The seven-point typology is useful for detecting potential synergies and trade-off's, but it does not offer any guidance on how to deal with these findings. This must be dealt with on a case-to-case basis. Looking elsewhere there are different views on how trade-offs can be mitigated. Ekener et al. (2019b) describes how the negative connections in many cases can be avoided if there is a sustainability-creating policy framework in place that can reduce the risks of progress in one area of society taking place at the expense of progress in another. One example from this investigation is how development of tourism is seen as a way to increase the possibilities of local food production (target 2.4), although this can only be seen as a synergy if increased agriculture is performed in a sustainable matter. What measures are put in place is important for the overall turnout.

Bergström et al. (2020) instead finds it unrealistic to expect full goal fulfilment for different competing goals. They conclude that synergetic effects are not something that will come automatically, it needs to be planned. Going back to the discussion about forests, climate adaptation can lead to both synergies and trade-offs between goals. There are however suggestions on how to overcome this particular conflict. A report published by a number of authorities representing different sectors shows great potential to extract sustainable bioenergy that does not have negative effects on the forests carbon storage and that can even lead to positive effects on biodiversity. The key is using clear instructions, appropriate incentives and special consideration when felling (Black-Samuelsson et al., 2017). This shows that the correct use of technique in combination with planning can avoid trade-offs and enhance synergies.

Investing in interdisciplinary research, strengthening knowledge and competence regarding Agenda 2030 and its connections and providing support to all actors on all levels of society to absorb this information is another key part in reaching the goals (Ekener et al., 2019a). Another important factor to avoid trade-offs and enhance synergies is cooperation. In the final report from the Swedish Agenda 2030-delegation (Swedish Government, 2019a), they present suggestions for the continued implementation of Agenda 2030. The need for cooperation between different sectors and authorities as well as between different levels (local, regional, national) is emphasized as keys for being able to achieve the targets. The need for leadership that acts long-term is also highlighted.

Regardless of one's belief concerning the possibilities to reach full goal fulfilment there is agreement on the importance that awareness is needed of how different goals relate to each other to be able to manage conflicts and to enhance synergies (Bergström et al., 2020; Ekener et al., 2019b).

5.4 Implications for Region Jämtland Härjedalen

Oxford Research (2019) concluded that goals concerning equality and the environment needed to be more directly implemented in the new RDS. Apart from the added value of making these goals a priority it can also be wise from a policy perspective since target 5.5 on women's participation and target 13.2 on climate policy is found as highly synergetic. Among the environmental targets (6.6 and 15.5) there are some important trade-offs to handle, and these might be given more attention if the goals are prioritised in the new RDS.

When it comes to using the seven-point typology specifically to work with Agenda 2030, there are both positive and negative aspects. The target level-analysis is beneficial because it is more precise, but with the SDG framework being so extensive it could lead to obstacles on where to start and which ones to focus on. The goal of the framework could be to provide decision makers with an understanding of where there are arguments for focusing specific attention on implementing certain goals or targets and where there are risks of significant harmful effects that need to be taken into account. The negative aspects can be summarized with time and money. The framework is time consuming and to achieve the best effect officials from different departments would have to be involved which would also result in high costs. The time spent could however result in great possibilities. Using the framework would give a better overview of the regions work with sustainability and could increase cooperation between different sectors, which in itself is seen as an important factor for achieving the goals. It would also increase the chances of using the possible synergies and be a way of acknowledging trade-offs which is a first step towards dealing with them. Overall, it is likely to lead to better informed decision-making.

This report has focused on what a potential progress across the investigated SDGs would lead to and less on what would happen if progress is not achieved. This scenario could bring even bigger conflicts and lead to increased costs for society as a whole. One example of this is lack of education which can cause a downward spiral leading to unemployment (Kvist, 2020), premature death (SKL, 2013) and poverty (Mood & Jonsson, 2019). The consequences of climate change risk far-reaching negative consequences for ecosystems around the world, as well as for human societies and livelihoods (IPCC, 2014). The risks for serious and irreversible effects are expected to increase the longer we wait to take action, and so are the costs for society (ibid.). Another example relates to inequality, where it has been shown that economic inequality tends to lead to increased social tension and anxiety, increased criminality as well as growing intolerance and extremism (Swedish Government, 2019b). This needs to be taken into account when working with the SDGs and is a reminder to not let potential conflicts slow down the work towards the goals, all while the risk of conflicting aims cannot be overlooked.

6. Conclusions

The interactions found reveal mostly synergetic effects between the SDG targets, only eight percent of the connections are associated with trade-offs. Several targets only exert positive and neutral influence on others (target 3.4, 4.4, 5.5, 12.5, 16.7). Out of these, target 4.4 (*Technical/vocational skills)* and 5.5 (*Women's participation*) stands out as having the most positive influence on other targets, which implies that efforts to make progress here will maximise synergistic effects. In this category we also find target 13.2 (*Climate change policy/planning*) and 11.2 (*Transportation),* although they have some negative influence that needs to be considered. Target 13.2 also stands out as being highly dependent on other targets which means that close collaboration with actors in charge of the targets that holds the key for its progress should be developed. The positive ripple effects that come with progress in these targets can however provide guidance on where to focus specific attention. Target 15.5 (*Biodiversity)* has the least positive influence on other targets followed by target 6.6 (*Water-related ecosystems*), and target 7.2 (*Renewable energy*). Progress in these targets is associated with difficulties to make progress in other areas and the risk for harmful effects calls for careful consideration from a policy perspective. Having knowledge on potential trade-offs does not make the obstacles of solving them any easier and there is no blueprint on how to achieve full goal fulfilment in all areas of the SDGs. It can however be concluded that awareness of how different targets relate to each other is an important first step to be able to manage conflicts and to enhance synergies and can lead to better informed decision-making.

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Empowering local governments and stakeholders in managing island and coastal ecosystems

Legal framework for blue financing

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Abstract

Financing is a critical factor for promoting sustainable island and coastal ecosystem management. Blue finance is perceived as a new catalytic funding mechanism. Yet, such a mechanism needs to be aligned with the legislative measures for ecosystem managements. It is also vital to institutionalize stakeholders' involvement, decision-making and actions under the policy and legal framework. Some recent case studies present key success factors in designing the legal and financial architecture for sustainable management of island and coastal ecosystems that are susceptible to the increasing changes of the coastal and marine environment and climate change. Peculiarity of the conditions also pose challenges to the replicability of successful cases.

Keywords: Blue economy, Blue finance, Willingness to pay, Payment for ecosystem services

1. Introduction

Ocean is an important part of the planet as it covers more than 70 per cent of its surface and forms 95 per cent of the biosphere (UN, 2021). The coastal area is also important as the 40 per cent of the world population lives within 150 kilometres of the coast (Ocean Panel, 2020a). The heads of states of the 14 countries released a set of policy recommendations to promote sustainable ocean economies as they advocate the 100 per cent approach by which they assert the need to sustainably manager the 100 per cent of the ocean and coast in order to promote a sustainable economy based on the ocean and coastal natural resources (Ocean Panel, 2020b). In promoting a sustainable ocean economy, sustainable ocean finance or blue finance is said to be one of the critical drivers. To forge blue financing, it is considered vital to develop enabling legal, regulatory and institutional frameworks and promote stakeholder engagement (Wabnitz, et al, 2019). In this article, it is intended to distil and examine key factors in blue financing in some empirical cases. Then, it is contemplated to apply a set of enabling factors to the analysis of a case study on financing for island and coastal ecosystem management in Taketomi, Okinawa Prefecture. Through the analysis presented in this paper, it is aimed to present the success factors and challenges in promoting and replicating blue financing in the context of fostering a sustainable blue economy.

2. Methods

Based on the case studies conducted as a part of the blue economy research works, key factors are extracted from the studies of the blue financing cases in Ecuador, Seychelles and Palau. From the three case studies, a set of success factors is developed as a blue finance matrix to assess the blue financing success factors (Blue finance matrix). Then, an analysis is conducted on the application of legislative measures to promote financing for island and coastal management in Taketomi-town, Okinawa Prefecture, Japan. By undertaking comparative analysis based on the blue finance matrix, it is intended to draw prescriptive assessment on the ways to overcome challenges in promoting blue financing in Taketomi Town and also examine the feasibility and challenges of success factor replications in the context of blue financing.

3. Results and Discussion

3.1 Mangrove conservation in Ecuador

Mangrove is an important coastal ecosystem as it stores carbons and provides habitats for many coastal and marine living organisms such as shrimp, fish and shellfish (Hamilton and Lovette, 2015). However, shrimp cultivation started growing in 1970's – 1980's in the destruction of mangrove forests. Shrimp farming boosted and has become the second largest foreign earning after fossil fuels. To arrest the decline of mangrove forests and their conversion to shrimp farms, the national protection decree was issues in 2013. Scientists have asserted that mangrove forests provide multiple ecosystem services such as food production, scenic beauty, wildlife habitats, water and air purification, coastal protection and carbon storage. The scientists also explained that the destruction of mangroves causes adverse landscape impacts, biodiversity loss, carbon releases and coastal erosion and vulnerability. A legislation, "Secondary Environmental Law" was enacted in 2003 and Article 54 prohibits the construction of new shrimp farms in the mangrove ecosystem and its buffer zone. However, a governmental agency, the Aquaculture Sub-Secretariat estimated that in 2013, 66 per cent of the shrimp farms in one of the provinces were illegal. The existing legislation was not sufficient to restrain the destruction of mangrove for constructing shrimp farms (López-Rodríguez, 2018). As a result, mangrove destruction continued as the shrimp farms expanded (Fig.1). In Ecuador, rural communities are engaged in subsistence economy with the traditional use of mangrove ecosystem by extracting molluscs and crustaceans and fuel woods. The executive decrees No.1391 of 2008 and No.852 of 2016 prescribes that the shrimp enterprises established after 1999 are barred from establishing the shrimp farms within the state owned land or the protected areas. It is understood that the decrees avoids the land tenure issues between the state, local inhabitants and shrimp farming enterprises by setting 1999 as the cut-off year. The enterprises established after 1999 are disqualified to claim the land tenure in the state owned land and protected areas by the decrees. On the other hand, the decrees extended the concession period from

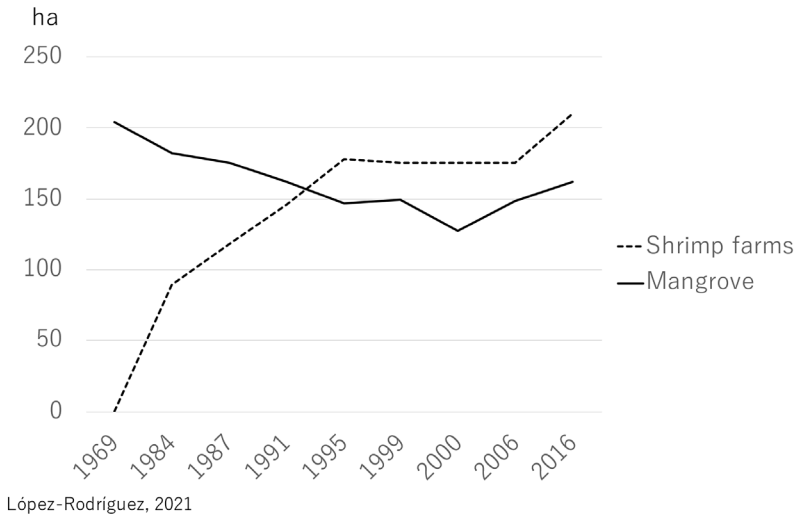


***Figure 1**. Changes in shrimp farms and mangrove areas (1969-2016)*

to 20 years. The decree also obliges the concession holders to plant mangrove in the areas where mangrove forests were cleared until 2015. The Ministry of Environment also adopted the resolution in 2017 to establish fines up to US$89,273 per hectare for cutting down mangrove. With the increased enforcement of the decree of 2008, 40 shrimp farms were evicted from 2010 – 2012 that occupied 2,496ha for shrimp farming.

In addition to the legislative and regulatory measures, community based organizations and NGOs supported the ancestral and traditional users of mangrove. The government also promoted the listing of mangrove sites under the Ramsar Convention that protects wetlands including lagoons, mangrove areas and seagrass beds. Out of 18 Ramsar sites in Ecuador, 5 sites include mangrove areas. The join evaluation was conducted by the Ministry of Environment, Conservation International and International Union for Conservation of Nature (IUCN) regarding the sustainable use and custody agreement of mangrove forests. The assessment proved that the planned management activities of the mangrove forests in the traditional use were undertaken in the full compliance with the plans to promote sustainable mangrove management. International partners have been supporting the national efforts to conserve mangrove and the livelihood of local inhabitants. The German Technical Cooperation and the Conservation Strategy Fund, an NGO based in the USA have supported the Ecuador's Socio Bosque Program (SBP or Forest Partners Program in English) and presented the document on the decision-making and implementation process of local communities for protecting mangroves (CSF, 2014). The SBP was launched by the Government of Ecuador in 2008 to protect 3.6 million ha of native forest and other ecosystems and improve the livelihood of 1 million rural people. The SBC covers 1.6 million ha as of 2019. The government with the support of international partners provide incentives to those rural community people who voluntary participate in SBC and hold land tenure based on the 20 year contracts. Biannual payments are contingent on complinance with the forest and mangrove management plans. US$10.5 million worth incentive payments were already made in total as of 2019. The Government of

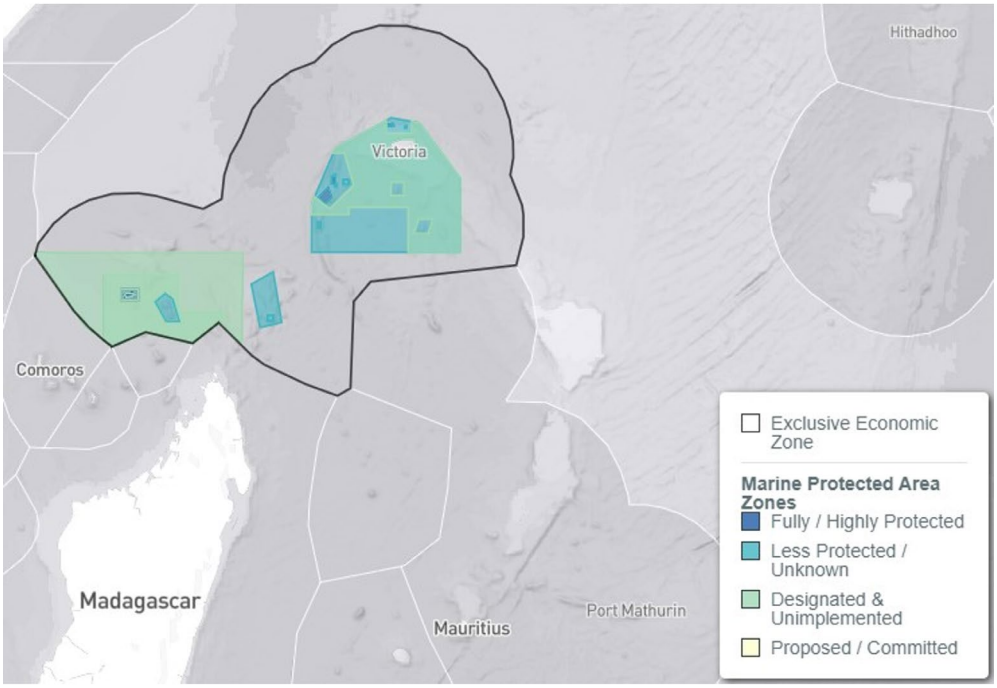
Ecuador provides funds to protect forests and mangroves and the total investment by the Government accounts for US$100 in total over 10 years since the inception of SBC in 2008 (EcoAdvisors, 2020).

The mangrove conservation in Ecuador have been structured by the enabling legislative and regulatory measures coupled by the long term government's funding to support the livelihood of local people who are acting as custodians of the mangrove.

3.2 Debt swap and blue bond for island and marine conservation in Seychelles

The Republic of Seychelles is a small island country in the western part of the Indian Ocean. The Seychelles is known now as a pioneer for blue financing, an innovative financing scheme for protecting the ocean and supporting the conservation and sustainable use of marine resources. The Seychelles fell in the default in 2008 as US$333 million became in arrears (Rojid et al, 2013). The Paris Club cancelled the 45 per cent of the debt in 2009. The Government of Seychelles declared in 2015 that 30 per cent of its ocean be designated as marine protected areas and started the consultation on the debt sway for nature with the support of the Nature Conservancy (Blended Finance Task Force, 2020). A national organization called "Seychelles Conservation and Climate Adaptation Trust (SeyCCAT)" was newly established to promote the protection of climate change adaptation and the protection of coastal areas, coral reefs and mangroves. The Government of Seychelles agreed to issue two promissory notes worth US$21.6 million in total SeyCCAT as a part of the debt swap transaction. President Danny Faure of the Republic of the Seychelles announced on 26 March 2020 that he has signed the legal instruments to designate 13 new areas of the Seychelles' ocean as marine protected areas under the National Parks and Nature Conservation Act. The newly designated MPA encompass 410,000 km^2 (Seychelles State House, 2020). The Seychelles issued the blue bond in 2018, the first of the world in its kind as a government bond focused on marine conservation. The bond was worth US$15 million and the World Bank guaranteed up to US$5 million. The Global Environment Facility also provided concessional loans of US$5 million (World Bank, 2018).

One of the unique features of the debt swap and the blue bond of the Seychelles is the establishment of SeyCCAT. SeyCCAT calls for applications to the grant to undertake activities that aim at climate change adaptation, island and coastal ecosystems and the livelihood improvements who depend on marine and coastal natural resources. The SeyCCAT manages the Blue Grant Fund. The grant can be in a range of SCR 100,000 – 2 million (US$6,100 – 1.4 million) per project and the total endowment available for the grant in 2021 was said to be SCR 23 million (US$1.4 million). The eligibility of the grant application is restricted to the Seychelles based organization, but the overseas partners can collaborate with the local organizations (Seychelles Nation, 2021). The project proposal are required to address any of the four strategic objectives namely: (i) support new and existing marine and coastal protected areas and sustainable use zones, (ii) empower the fisheries sector with robust science and



Marine Conservation Institute https://mpatlas.org/countries/SYC/map

***Figure 2**. EEZ boundary and marine protected areas of Seychelles*

know-how to improve governance, sustainability, value and market options, (iii) develop and implement risk reduction and social resilience plans to adapt to the effects of climate change, and (iv) trial and nature business models to secure the sustainable development of Seychelles' blue economy. Small scale grass root level funding is expected to empower local stakeholders and provide incentives to get engaged in field work that can make different in their daily lives and expect direct benefits from the conservation and sustainable use of coastal and marine resources.

Tourism has been a major industry in the Seychelles and the fishery sector is secondary. While Madagascar and Mauritius, neighbouring countries report the fish catch in the quantity of over 10,000 tons and 2,000 tons respectively, the Seychelles fish catch reported in 2018 was less than a ton. It is deemed as a possible contributing factor to that the government have come to an agreement with the local stakeholders to designate 30 per cent of the ocean as marine protected areas and such a policy direction helped the government in concluding the international partners to make arrangements for the debt swap and the blue bond arrangements.

3.3 Tourism tax in Palau

The Republic of Palau is located in the north of the equator of the Pacific. Over 700 islands surrounded by the Ocean is popular for tourists around the world. The inscription of the Rock Island Lagoon to the UNESCO World Heritage Site in 2012 helped boosting the inbound tourists (IUCN, n.d.).

Palau is know as a leading country in advancing marine protection. In 2015, Palau adopted the legislation, the Palau National Marine Sanctuary (PNMS) Act that stipulates the gradual restriction of

fishing zones to 20 per cent of the Palau's EEZ that was supposed enter into full effect in 2020. PNMS was a legislative measure to designate the 80 per cent of the Palau's EEZ as protected areas (Palau Government, 2015). With the five year implementation of the PNMS, Palau amended the PNMS relocating the fishing zone from the areas around the main island to the northwest of the Palau's EEZ (Palau Government, 2019a). The Nippon Foundation has provided a patrol vessel and boats, built a new office building for the Marine Law Enforcement Office and refurbished the berth that were handed over in 2018 (Palau Government, 2018). The Government of Australia also provided Palau with a patrol vessel in September 2020 (Australian Defence Magazine, 2020).

One of the distinctive features in the Palau's resource mobilization is the introduction of a green fee that was raised to US$100 per tourist and renamed as the Palau Pristine Paradise Environmental Tax in January 2018. The inbound tourist number has increased from 85,000 in 2010 to 164,000 in 2015, almost doubled. Nonetheless, the inbound tourist number decreased by 42.5 per cent (Palau Government, 2019b). Due to the COVID-19, tourism was suspended as precautionary measures. The revenue from the Palau Pristine Paradise Environmental Tax turned to be nil.

It was worth noting the drought that affected Palau from 2016 – 2017. There is a blackish water lake where jellyfish that do not attach humans is popular to tourists. The jellyfish population that was estimated to be from 10 – 20 million with a peak of 30 million in 2005 disappeared after the 2016 drought. Multiple factors were suspected for the cause of the jellyfish disappearance such as the stratification of the water columns due to the shortage of the runoff shortage. Increase water temperature, increased acidity, reduction in nutrient inflows, and sunscreen impacts from tourist were also raised as the possible factors. In January 2019, Jellyfish returned to 630,000, still far less than the previous level

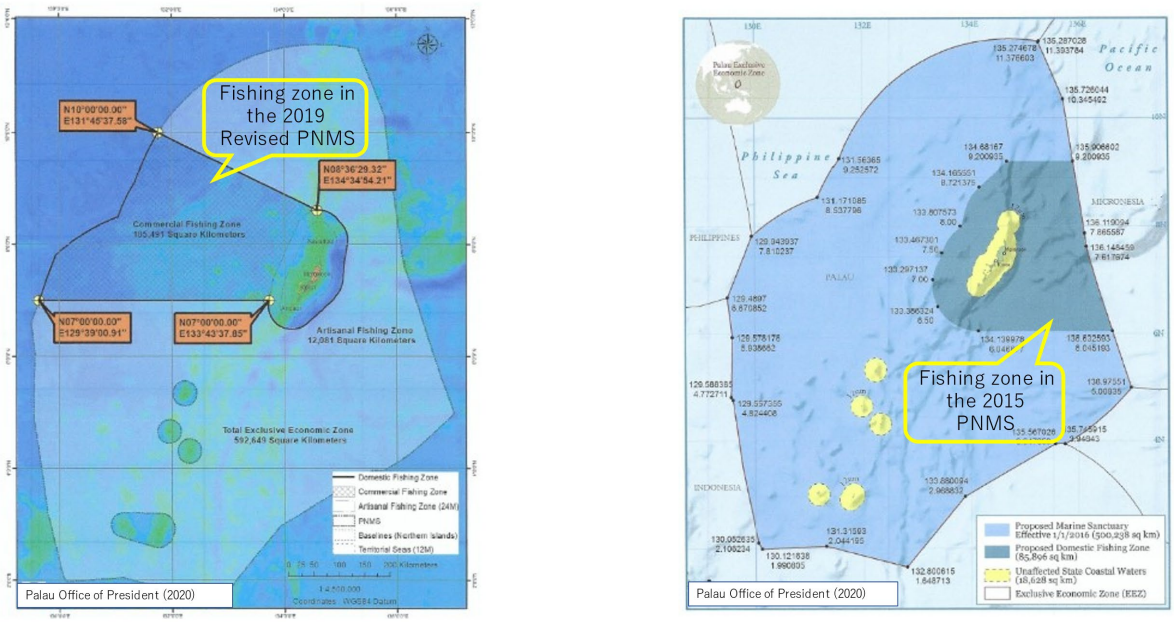


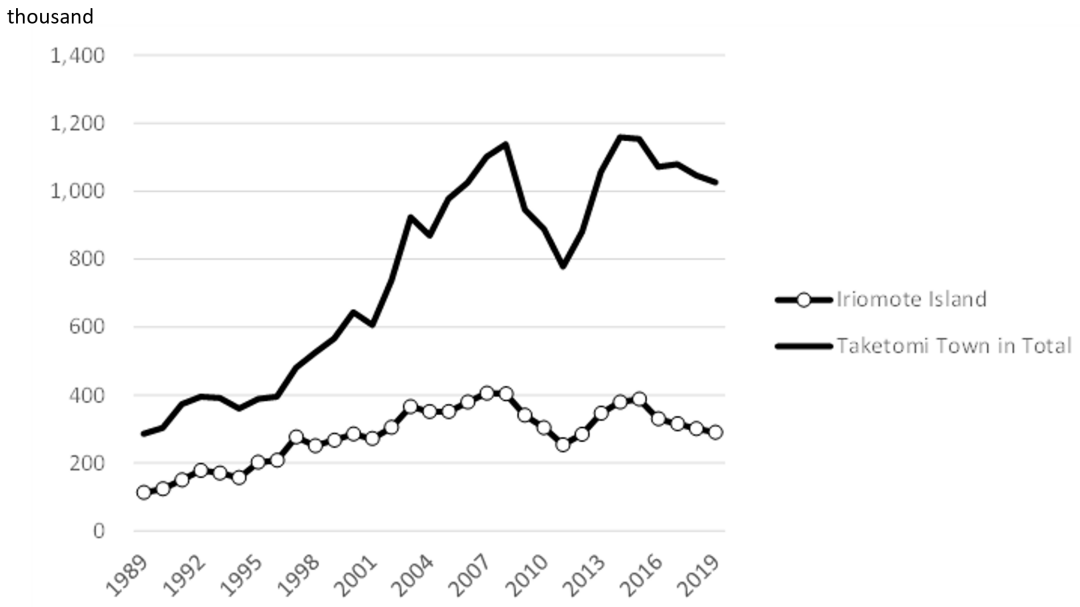
***Figure 3**. Fishing Zone of the Palau National Marine Sanctuary Act (2015 Act and 2019 Revised Act)*

of the population, but the Koror State opened the Jellyfish for tourism (CNN, 2019). There is a fee for a tourist permit for US$50 to enter the Rock Island and additional US$50 to enter the Jellyfish Lake. Prior to the 2016 drought, there used to 700 visitors per day. The loss of the permit sales from the closure of the Jellyfish Lake accounts for US$35,000 per day and over US$1 million per year.

The illustrated case of Palau demonstrate that the government strives to orient its major policy toward promoting conservation and tourisms and restricting fisheries. At the same time, the government pursued the synergies of marine environment conservation and tourism and using the revenue from the environmental tax type introduced on inbound tourists. The COVID-19 precautionary measures have affected the pattern of revenue mobilization from the environmental tax. The Koro State also suffered one point the loss of the revenue from the sales of tourist permits due to the impact of drought on the popular tourist destination, Jellyfish Lake. The Pacific island countries need to prepare for external shocks including the pandemic related economic downturns, climate change and other extreme climatic events.

3.4 Island entry payment in Taketomi-town, Okinawa, Japan

Taketomi town is in Okinawa, southern part of Japan. Taketomi-town consists of 7 inhabited islands and 9 uninhabited islands with the total population of 4,300 in 2020. Taketomi-town was one of the first that developed the local government's basic plan for ocean policy. Taketomi town developed the plan in 2011 following as the national government's adoption of the Basic Act for Ocean Policy in 2007 and the Basic Plan for Ocean Policy in 2008. Mangrove conservation and ecotourism are highlighted as key components of the Taketomi's Basic Plan for Ocean Policy (Taketomi Town, 2011). The Plan



Developed by the author from the information provided by Taketomi Town at https://www.town.taketomi.lg.jp/administration/toukei/kankonyuiki/1531308472/

***Figure 4**. Number of tourists visiting Taketomi Town and Iriomote Island (1989 - 2019)*

was revised in 2018 and it underlined the importance of multistakeholder partnership and a plan-do-check-action (PDCA) cycle approach (Taketomi Town, 2018).

The tourist arrivals to Taketomi Town have grown from 286,000 in 1989 to 1,026,000 in 2019, by 3.59 times for the past 30 years (Fig.3). The Leman Shock in 2008, swine flu pandemic in 2009, and Great East Japan Disaster in 2001 adversely affected the tourist arrival. The tourist number resurged in 2013 as a new airport was opened in Ishigaki Island in 2013 adjacent to the islands of Taketomi Town and a low cost carrier started services from Osaka and Tokyo.

It was however perplexing that there was a reduction in the number of tourists to Iriomote Island, a major tourist destination island in Taketomi Town. It is presumed that the tourists coming to Ishigaki Island stay there and make a day trip to Taketomi Town.

In connection with resource mobilization, Taketomi Town has introduced a system to invite tourists to make an island entry payment in September 2019. This system was introduced in pursuance with the national act called "Local Nature Asset Act" of 2014 that allows the local authority to receive payment on the ground of protecting nature in pursuance with the nature conservation plan to be developed by a consultative council. It is a voluntary payment suggested for the tourists under the pretext of making financial contribution to support nature conservation in Taketomi Town (Taketomi Town, 2019). It is JPY 300 (USD 2.89) per person. The payment is voluntary and not obligatory. The revenue can be used to obtain land as a nature trust. As of September 2020, it was reported that only 10 per cent of the island visitors make an island entry payment (Yaeyama Nippo, 2020). The impacts of the ordinance and island entry payment system needs to be further monitored and examined.

3.5 Blue finance matrix of blue financing for sustainable island and coastal ecosystem management.

Based on the studies of the three cases namely mangrove conservation in Ecuador, debt swap and blue bond for island and marine conservation Seychelles, and tourism tax in Palau, key factors are distilled to produce a blue finance matrix. Then, the matrix analysis is applied to the case of the island entry payment, Taketomi Town, Okinawa, Japan (Table 1).

Legislative measures played an important role in setting policy and institutional framework for nature conservation, resource mobilization and disbursement. In Ecuador, policy effectiveness was enhanced by extending the land tenure period from 10 – 20 years and increased penalty. At the same time, the study on the ancestral and traditional use of mangrove proved that the compliance of local people with the mangrove management plan. The biannual payment to the local people for conservation of mangrove restrict the violation or infringement of the management plan and help stabilizing the conservation efforts. The ambitious target setting for marine protected areas by Seychelles was a testimony of the Seychelles government policy for marine conservation that catalysed the international support to debt swap and blue bond. The Blue Grant Fund is expected to empower local stakeholders.

Table 1. *Blue finance matrix*

	Targeted conservatoin	Legislative measures	Scientific assessment	Institutions	Revenue collection	Financing measures	Key factors	International partners	Internatioanl Agreement
Mangrove conservation in Ecuador	Mangrove	Secondary Environmental Law, Executive dicrees to restrict mangrove conversion to shrimp farms, Extended tenure, Increased penality	Experts were involved	Community organisations	Tax	Biannual payment to local residents for protecting mangrove	Stabilizing land tenure, Penalty, Protecting ancestorial and traditional livelihoods	TNC, CI, WWF, CSF, GIZ	Ramsar Convention
Debt swap and blue bond for island and marine conservation Seychelles	Marine and coastal ecosystems	National Parks and Nature Conservation Act	Experts	Seychelles Conservation and Climate Adaptation Trust (SeyCCAT)	Debt swap, Blue Bond, Blue Grant Fund	Grants to be provided for field works	30% MPA designation, Debt cancelation and swap, World Bank guaranttee for the Blue Bond	Paris Club, TNC, World Bank, GEF	SDG14
Tourism tax in Palau	Marine ecosystems	Palau National Marine Sanctuary (PNMS) Act	Palau International Coral Reef Research Center, Overseas research institutes	President Office, Ministry of Environment, Natural Resources and Tourism	Departure tax, Palau Pristine Paradise Environmental Tax, Fishing license/Vessel Days Scheme	Integration of revenues in the national budget	80% MPA, 20% fishing zone managed with the permits by the Minister	Nippon Foundation, Australian Govenrment	UNESCO, SDG14
Island entry payment, Taketomi Town, Okinawa, Japan	Island and coastal ecosystems	Japan Basic Act for Ocean Policy, Japan Basic Plan for Ocean Policy, Taketomi Town Basic Plan for Ocean Policy, Local Nature Asset Act	Experts	Consultative council	Island visit payment (voluntary), Limited collection	Intention to finance conservation work	Awareness raising, Collection method	n.a.	UNESCO

Developed by the author based on the information provided by the respective government and related organizations.

In Palau, a green tax that was converted to the Palau Pristine Paradise Environmental Tax was expected to be a robust revenue source. However, it was hindered by the unprecedented global pandemic and tourism suspension.

In the case of Taketomi Town, the policy and legislative measures were in place. However, the beneficiaries and incentives for the payers need to be further articulated and their relationship needs need to be institutionalized. In Taketomi Town, mangrove is an important natural asset. Yet, its ecosystem services and a merit of protecting mangrove have not yet been fully explained to the tourists and brought to acquire their sympathy. Legislative and institutional arrangements need to be reinforced to raise the percentage of the island entry payment payers ratio against the tourist. If only 10 per cent of the tourists make the island entry payment, there is less incentives for tourists to pay to bear the cost of nature conservation. Equity and collective sharing of cost for nature conservation among tourists need to be reinforced in the current system to collect the island entry payment. For the three of the cases in Ecuador, Seychelles and Palau, international partners play instrumental roles. There is a merit of pursuing such partnership with likeminded organizations based in Japan or overseas. The networks of partnership and information sharing need to be further expanded.

4. Conclusions

Financing is a critical component of realizing sustainable island and coastal ecosystem management. However, it must be a part of the overall institutionalization for promoting the conservation and sustainable management of island and coastal areas with the proper legislation, compliance and enforcement measures, penalty and incentives, partnership and networks. The same can be said about the legislative measures as they are unable to achieve their objectives without having proper enabling institutional and financing frameworks. The financing mechanism needs to evolve to enhance self-reliance for the long term. The legislative and financing measures need to reflect conditions peculiar to the local communities. Nonetheless, there can be common features that can be considered as success factors for legislative and financing measures aimed at the conservation and sustainable management of island and coastal areas. It is useful to promote exchange of information and stakeholder empowerment on the success factors of legislative, policy, financial and institutional frameworks. It should be further encouraged to undertake pragmatic stakeholder driven research and to advance interdisciplinary discussions to share knowledge, insight and expertise. The research institutes, universities and academic society are expected to play a role in forging a platform for intellectual and pragmatic information sharing and human resource development at the national, regional and international levels with the view to forging legislative, policy, financial and institutional frameworks for the conservation and sustainable management of island and coastal areas.

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Sustainable Development and Nuclear Power

An unsustainable approach of nuclear-free homeland 2025 in Taiwan?

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Abstract

In 2016, the Taiwan government launched the agenda of energy transition and nuclear-free homeland with the target of 20% renewable energy and 0% nuclear power by 2025. Aside from subscribing to the UN's 17 Sustainable Development Goals (SDGs), Taiwan set up an 18th one of becoming nuclear-free by 2025. However, later there were a lot of controversies on the increase of coal-fired power plants and conflictive land use and environmental issues resulting from the development of large scale photovoltaic and wind power units. With Taiwan facing such conflicts, they motivated me to evaluate the compatibility between its unique 18th SDG and sustainable development.

The concept of nuclear-free homeland was introduced in Article 23 of the Basic Environment Act of 2002. However, due to the lack of substantive definition in the provision, every ruling party could claim pursuing such a goal without the massive change of the existing nuclear power policy. Particularly, the existing three nuclear power plants (six reactors) could run until the expiry of the 40-year generation license. Different ruling parties considered such an approach to be one of pursuing a nuclear-free homeland. Therefore, the main purpose of this article is to discover the concept of nuclear-free homeland from legal aspects and from the discussion of legal or policy documents "in the past almost 20 years" and to evaluate if such a concept is compatible with the rest of the SDGs.

Our preliminary finding is that there is a serious conflict between Taiwan's SDG 18 and several of the existing 17 SDGs. For instance, under SDG 7, SDG 18 may be helpful in achieving its clean energy goal but may jeopardize affordable energy due to setting an unreasonably high subsidy for the renewable one. Replacing nuclear power with more fossil fuel fired plants may jeopardize SDG 13 (climate change) as well. Not to mention, the lack of law and due process to deliberate the fate of nuclear power and even against the results of the nuclear phase out referendum in 2018 may violate the meaning of SDG 16. The original delayed progress towards the 2025 nuclear-free homeland goal got a further setback with the outbreak of Covid-19, which held back the development of renewable energy projects.

Keywords: Keyword 1, Keyword 2, Keyword 3, Keyword 4, Keyword 5 **[Maximum of five words]**

1. Introduction

In 2016, the Taiwan government launched the agenda of energy transition and nuclear-free homeland with the target of 20% renewable energy and 0% nuclear power by 2025 (Energia Plus, 2020). Aside from subscribing to the UN's 17 Sustainable Development Goals (SDGs), Taiwan set up an 18th one of becoming nuclear-free by 2025 (Lin Chia-nan, 2018). However, later there were a lot of controversies on the increase of coal-fired power plants and conflictive land use and environmental issues resulting from the development of large scale photovoltaic and wind power units (Lien, 2021). With Taiwan facing such conflicts, they motivated me to evaluate the compatibility between its unique 18th SDG and sustainable development.

The concept of nuclear-free homeland was introduced in Article 23 of the Basic Environment Act of 2002, which stipulated that "The government shall establish plans to gradually achieve the goal of becoming a nuclear-free country. The government shall also strengthen nuclear safety management and control, protections against radiation, and the management of radioactive materials and monitoring of environmental radiation to safeguard the public from the dangers of radiation exposure" (Basic Environment Act, 2002). However, due to the lack of substantive definition in the provision, every ruling party could claim pursuing such a goal without the massive change of the existing nuclear power policy. For instance, in 2011 after the Fukushima accident, the former ruling party announced the plan to continue using nuclear power plants until the licensing life of 40 years and completion of the construction of the fourth plants (Yueh-hsun, 2014). This new policy was considered to conform with the nuclear phase-out goal, as even the fourth nuclear power plant would not run forever. In 2016, the then new ruling party claimed to adopt a more ambitious approach to nuclear phase-out by providing that the existing three nuclear power plants (six reactors) could run until the expiry of the 40-year generation license. The current ruling party also considered such an approach to be one of pursuing a nuclear-free homeland. Therefore, the main purpose of this article is to discover the concept of nuclear-free homeland from legal aspects and from the discussion of legal or policy documents "in the past almost 20 years" and to evaluate if such concept is compatible with the rest of the SDGs.

Our preliminary finding is that there is a serious conflict between Taiwan's SDG 18 and several of the existing 17 SDGs. For instance, under SDG 7, SDG 18 may be helpful in achieving its clean energy goal but may jeopardize affordable energy due to setting an unreasonably high subsidy for the renewable one. Replacing nuclear power with more fossil fuel fired plants may jeopardize SDG 13 (climate change) as well. Not to mention, the lack of law and due process to deliberate the fate of nuclear power and even against the results of the nuclear phase out referendum in 2018 may violate the meaning of SDG 16. The original delayed progress towards the 2025 nuclear-free homeland goal got a further setback with the outbreak of Covid-19, which held back the development of renewable energy projects.

2. The Evolution of the Concept of Nuclear-Free Homeland in Taiwan

After the change in government in 2000, the opposition and the green party took power and started to follow Germany's approach in promoting the idea of "Nuclear Phase out." The Executive Yuan announced the suspension of the construction of Nuclear Power No. 4 at the end of 2000, which suspension led to an issue of political and constitutional law. Even though the issue was dealt with by the Grand Justice of Taiwan, the ambiguous judgment could not resolve this political chaos. There seemed no clear judgment as to whether the suspension decision of the Executive was right or wrong. This issue also led to tension between the Executive Yuan and the Parliament. The functioning of the national machine came to a standstill. In order to resolve this impasse, there were intensive discussions between the ruling party and the opposition party in the Parliament. Finally, a consensus was reached in February 2001 to continue the construction of the Nuclear Power No. 4 plant while pursuing the idea of a "nuclear-free homeland" ("Nuclear-Free Consensus"). It resulted in serious nuclear-free homeland activities in the coming years. However, as there was no concrete context and definition for this new term—Nuclear-free Homeland—a lot of effort was put into developing this idea.

2.1. Proposal of Nuclear Phase-Out Bill in 2001

In order to pursue the goal of a nuclear-free homeland, in February 2001, the Executive Yuan adopted a bottom-up approach to develop this objective. It ordered the MOEA to consult with the AEC and propose energy-related bills to implement the idea of a nuclear-free homeland, which would be submitted to Parliament for its deliberation. Furthermore, the MOEA was also to consider stopping the operation of the existing three nuclear power plants on the condition that it would not affect the electricity supply security of Taiwan (Executive Yuan, 2001).

In view of this call, the MOEAEC started to interpret the idea of a nuclear-free homeland, and proposed the Nuclear Phase-out Bill to the MOEA. The MOEA then approved it immediately in July 2001 and delivered it to the Executive Yuan for its deliberation.

In this bill, the idea of a nuclear-free homeland was only mentioned in the Explanatory Note (the foreword) of the bill. The MOEAEC interpreted the concept of this term as "nuclear phase out." The bill specified the condition for the phasing out of the existing four nuclear power plants in Art. 5. The follow is the essence of this bill, notwithstanding its very unclear and ambiguous conditions:

1. From the date of phase out, the annual electricity reserve capacity is able to be maintained at an excess of 15% for the next seven years.
2. From the date of phase out, the electricity price does not exceed 15% within seven years.
3. The compensation to Tai-Power as a result of the phase-out decision would not cause a "significant" financial burden to the government.
4. The phase out would not cause any infringement of international treaties signed by the government.

This bill is unique in Taiwanese energy law from the following two aspects. First, bearing in mind the usual sequence in which policy comes first, then the law, this was the first time in history that the legal instrument came before the policy, as at that time, the energy policy document promoting nuclear power in Taiwan was still in effect. Second, in terms of nuclear development laws, this was also the first time that Taiwan sought to develop a legal regime that "discouraged" the development of nuclear power. However, in the prevailing political climate, the Executive Yuan seemed to consider this bill, particularly the conditions, too weak, too ambiguous, and too difficult to achieve the objective of nuclear phase out. The bill was insufficiently discussed; further, the minister without portfolio at the level of the Executive Yuan began to notice the "German" phase-out approach and decided to adopt a top-down approach, promoting the "Nuclear-free Homeland Bill" idea.

2.2. Integration into Environmental Basic Act in 2002

The bill related to the nuclear-free homeland idea took some time. Yet, the administrative sector was quite eager in promoting the idea of a nuclear-free homeland. As the concerns related to nuclear energy development were also relevant to the environment-related legislations, the concept of the "nuclear-free homeland" was integrated into the final version of Art. 23 of the Environmental Basic Act and approved by the Parliament on November 19, 2002. Even though the nuclear-free homeland is an empty and open concept in Art. 23, it was helpful in encouraging serious action on the proposal of a Nuclear-free Homeland Bill, the holding of a National Nuclear-free Homeland Conference, and the adoption of a Nuclear-free Homeland Action Plan, etc.

The emptiness of this wording is reflected in the following aspect. In comparison with the Nuclear-free Consensus, Art. 23 does not deal with the issue of whether construction of the Nuclear Power No 4 plant should continue. Second, unlike the phase-out bill dealing with the fate of Nuclear Power No. 1–3, this aspect is unclear in the Environmental Basic Act.

A closer look at the development of this concept in the Basic Act reveals its stealthy nature during the legislative process. If the Nuclear-free Consensus were the influence or the inspiration for Art. 23, according to the past legislative practice it should have been mentioned in either the Explanatory Note of the overall bill or in giving the legislative reason for it. Yet, none of that happened in this Act. My guess is that as Art. 23 is the only provision that deals with nuclear issues, the "nuclear-free homeland" wording was surreptitiously introduced into this Act. The mentioning of this concept thus led to the further development of this idea.

2.3. Proposal of Nuclear-free Homeland Bill of 2003

The Nuclear-free Homeland Bill of 2003 can be seen as a "shadow" of the German phase-out mechanism. Following an official visit to Germany in February 2003 led by the Minister without portfolio, steps were taken to integrate the German element into an Explanatory Note, and provide

legislative explanation of the Nuclear-free Homeland Bill, such as the commercial operation of 32 years as an index to electricity production. This draft bill was then approved by the Executive Yuan on May 7, 2003, and submitted to Parliament for its deliberation on May 11, 2003. The bill underwent several discussions in the Parliament but was not approved. Even though the bill was formally noted as a "priority bill" of the Executive Yuan, it was ignored in that parliamentary term.

The bill has 20 provisions. The issues of future energy mix adjustment, nuclear plant phase outs, clean energy, public participation in nuclear power policy, safety monitoring of nuclear power plants, energy education, etc., are all mentioned in this bill. Yet, it should be noted that the scheme to phase out nuclear power plants remains the core of this bill, while the other elements are merely "decorative." In this regard, three provisions regulate the fate of future nuclear power development. Generally, Art. 4 urges the government to adjust the Taiwanese energy mix and gradually reduce nuclear electricity with a view to eliminating gradually the use of nuclear power. Then, more especially, from the implementation date of this Act, there would be no construction license issued (Art. 5). In this regard, the development of Nuclear Power No. 5 or the expansion of nuclear power plants at the existing sites of Nuclear Power No. 1–4 is no longer possible. Finally, the German phase-out concept of "scheduling a fixed total electricity amount" and "transferring the remaining electricity among different nuclear power facilities" is stipulated in Art. 6. The nuclear power reactors should stop operation permanently, once they reach the "scheduled fixed total electricity amount." According to Art. 6(2), plant operators are allowed to transfer the unused electricity to other plants after the approval of the Executive Yuan. This mechanism was considered for the less safe and older type reactors of Nuclear Power No. 1 and 2, and allows the safer reactors to run longer. Finally, this mechanism would prevent any compensation claim from the nuclear plant operators, which was also a very important element of the German-style phase out.

The Explanatory Note of this bill defines the nature of this bill as Basic Law. Yet, a closer investigation reveals that the development of nuclear power plants would be subject to many limitations, similar to a regular legal regime. For the existing reactors (No. 1–3 plants), it seems unlikely they would operate until the normal decommission date (i.e., in 40 years); not to mention, their life extension for another 20 years. For those reactors under construction (No. 4), their construction would be allowed to continue, but their operation would be limited by this bill as well. The expansion of nuclear generators at the existing sites was clearly prohibited as well. In sum, this bill sets up an inescapable dragnet to avoid potential loopholes. Compared with the previous generation nuclear phase-out bill of 2001, this bill's phase-out conditions are more concrete and workable. Yet, these workable and concrete measures also made the bill difficult to pass in the Parliament, where the opposition part y is in the majority.

Table 1 Transition of the concept of a nuclear-free homeland in major policies and legislation

Contents	Nuclear-free Homeland Consensus (2001.2.13)	Nuclear Phase-out Bill 2001	Nuclear-free Homeland Policy (2002)	Environmental Basic Act of 2002	Nuclear-free Homeland Bill (2003)	Nuclear-free Homeland Action Plan (2003.9)	Energy Policy White Paper 2005
Continuing the construction of Nuclear No 4	O	O	O	O	O	O	X
Overall energy supply and demand	O	O	O	O	O	O	X
Renewable energy development	X	X	O	O	O	O	O
Dealing with the phase-out issue of existing Nuclear Power Nos 1–3	X	V	O	X	O	O	X
Nuclear safety	X	X	O	O	O	O	X
Radioactive protection	X	X	O	O	O	O	X
Any nuclear weapon	X	X	O	X	O	X	X
Nuclear waste management	X	X	O	X	O	O	X
New nuclear power installations (construction of Nuclear No 5 or expansion at existing sites)	X	X	?	X	O	?	X

Extending the life of the existing Nos 1–3 power plants	X	?	?	X	O	?	X

Source: Compiled by the author

Note:

O: The issue is clearly dealt with.

X: The issue is not dealt with.

?: It is unclear whether this issue is dealt with or not.

2.4. Proposal of the Nuclear-free Homeland Bill since 2012

After the Fukushima accident, the leader of the opposition party (i.e., the party in power at the time the nuclear-free homeland was being promoted) again proposed the Vision of A Nuclear-free Homeland of 2025 (Chao, 2011). Despite losing the presidential election in 2012, the anti-nuclear party proposed the Nuclear-free Homeland Bill in 2012 (Legislative Yuan, 2012a). In response, the ruling party proposed the Energy Security and Nuclear-free Homeland Bill in March 2013 (Executive Yuan, 2013). Apart from these two main versions, there were also the other three versions proposed by the non-ruling parties, namely the Nuclear-free Homeland Bill by Taiwan Solidarity Union (Legislative Yuan, 2013), Nuclear-free Homeland Implementation Bill by 21 DPP MPs (Legislative Yuan, 2012a), and No-Nuclear Power Homeland Promotion Bill by the People First Party (Legislative Yuan, 2011). Of the five versions, the government version set criteria before phasing out all nuclear power plants. Furthermore, it provided no fixed timeline for the nuclear phase out, and reserved the possibilities of extending the life of the Nos 1–3 nuclear power plants and issuing a license to the No 4 nuclear power plant.

Table 1 Comparison of different versions of the Nuclear-free Homeland Bills in the post-Fukushima era

	The government	**DPP**	Taiwan Solidarity Union	21 DPP MPs	People First Party
Pre-conditions for nuclear phase out	Yes	No			
Timeline of a nuclear-free homeland	No	2025			No
Prohibition of life extensions or issuing a new license	No	Yes			Yes (but excluding the fourth nuclear power plant)

(Source: Compiled by the author)

2.5. After 2016: The Concept of a Nuclear-free Homeland in the Taiwan Electricity Act Amendment: Toward a Liberalized and Green Energy Market (January 23, 2017)

2.5.1. Zero Nuclear Power Generation by 2025

The legislation for a nuclear-free homeland disappears after 2016. After the MOEA's New Energy Policy was implemented in 2016, Taiwan began tackling the soon to be four nuclear power plants. In contrast to the deliberations on whole legislative bills that focused on a nuclear-free homeland during the previous few years (Law Bank, 2003), the DPP took a unique approach. First, the idea of a nuclear-free homeland was integrated into the Amendment (2017) as Article 95. Second, instead of explicitly stating "nuclear-free homeland," Article 95 only provided the operational deadline as follows: "The nuclear energy-based power-generating facilities shall wholly stop operating by 2025." Third, instead of using the word "decommission" (which was in the previous draft about a nuclear-free homeland), it stated, "wholly stop operating." These conceptual changes led to a legal concern about the Amendment's relationship to the legal regime of current atomic energy. The draft Amendment to promote a nuclear-free homeland referred to further revisions of the Nuclear Reactor Facilities Regulation Act (2003); thus, to avoid conflicts, Article 95 would relate to application issues such as whether the three nuclear power plants could meet the "stop operations" requirement while applying for life extension (OGEL, 2019).

Previously, under the "Nuclear-free Homeland Draft Act," a comprehensive approach would handle all aspects of decommissioning the nuclear power plants. For example, in one version of the Energy Security and Nuclear-free Homeland Bill in 2013, an evaluation mechanism would be created to determine whether the phase-out would influence the overall electricity supply. However, a thorough and thoughtful approach is missing from the current Article 95 (Electricity Act) because many unresolved issues remain.

2.5.2. Fate of the three nuclear power plants

Under Article 95 of the Amendment, the entire electricity system gradually moves to a nuclear-free system. However, in mid-2017, the central government approved the operation of two new nuclear reactors: the first reactor of the second nuclear power plant and the second reactor of the third nuclear power plant. Then, on August 15, 2017, due to operational negligence of a gas valve, a chain reaction led to system failure and Taiwan experienced an unprecedented electricity blackout that affected 6.68 million households (Focus Taiwan, 2017). About one year later in mid-2018 (just months ago), the government approved a restart of the controversial second reactor at the second nuclear power plant (Focus Taiwan, 2018a). Apparently, the beginning of Taiwan's journey toward a nuclear-free homeland was not very smooth. Instead, it began with a dramatic increase in nuclear power in Taiwan's electricity mix.

Fate of the fourth nuclear power plant

The fate of the nearly complete fourth nuclear power plant was less positive. Despite the lack of clarity about it in Article 95, the government took deliberate action against it, circumventing the law. Because of the lack of legal measures to deal with sunk assets, the government asked Tai-Power to return the fuel rods to the United States. Tai-Power had already sent back several fuel rods in mid-2018 (Focus Taiwan, 2018). Some readers might wonder why Tai-Power was so compliant, but this state-owned company could not challenge the government's implicit order.

Dealing with the fourth nuclear power plant has been problematic. The plant is comprised of two advanced boiling water reactors (each 1,350 MWe net). General Electric is the reactor supplier, and the turbines and generators are supplied by Mitsubishi Heavy Industries. The nuclear power plant cost about USD 9.4 billion. As discussed above, the DPP government stopped budgetary funding as a political tactic to halt its construction in 2000 while continuing construction and injecting funding after consensus was reached on a nuclear-free homeland. After the Japanese Fukushima nuclear power plant accident in 2011, the DPP, then the opposition party, again raised the issue. In 2014, the DPP launched a major protest against continuing with the construction, which pressured the KMT government to halt construction of the fourth power plant. Construction of the plant was deferred (Wise, 2014).

As noted, in mid-2018, the government began to return the fuel rods, although many people opposed that action because it could be perceived as a symbol to abandon investment in nuclear power plants.

To avoid a dramatic increase in electricity tariffs caused by the sunk costs of this nuclear power plant, the government tried to have Tai-Power not reflect these costs in their accounts. Perhaps it is understandable that in 2014, the construction works differed although the regular maintenance of the power plants remains. Likely, construction will be completed and the plant will go online. However, the recent step of returning the fuel rods seems to signal the end. It is very difficult to imagine that Taiwan, a country under the rule of law, has no legal remedy for dealing with the USD 9.4 billion in sunk costs. A major debate in parliament on this issue is not necessary for such an important decision, which only relies on Tai-Power's decision to return the fuel rods and sink the assets. Further, it seems unnecessary for the government to persuade the public to accept higher electricity prices after abandoning this power plant project.

2018: Referendum to Revoke Article 95

In December 2017, the Referendum Act was largely revised (Law & Regulations Database of the Republic of China, 2018). The major change concerned easing the burden of the threshold for the number of proposers by reducing it from about 1 million to around 280,000 people (Referendum Act, 2018). In March 2018, pro-nuclear groups used this as an opportunity to propose "go green with nuclear power," because municipal elections were set for November 2018 that could include a referendum vote (Freschi, 2018). Thus, in mid-2018, they launched a referendum to remove the nuclear-free homeland clause from Article 95. This referendum was launched by the alumni and a professor of National Tsing-Hua University, Taiwan, on https://www.green-nuclear.vote/.

The proposer documents had to be submitted by mid-September for the referendum to be included on the November 24, 2018 ballot. However, after accepting 315,000 signatures by September 6, the government refused to accept a second attempted delivery of 24,000 signatures on September 13 (Shellenberger, 2018). Shih-Hsiu Huang, cofounder of Nuclear Myth-Busters and the chief organizer of the referendum, staged a hunger strike outside the office of the Central Election Commission (CEC) for several days. The hunger strike ended, but the CEC still refused to accept the signatures. As expected, on October 16, 2018, the referendum failed to pass CEC review because the number of qualified public endorsements for the proposal did not meet the legally required threshold, falling short by 2,326 signatures (Focus Taiwan, 2018).

In mid-September, the organizer of the referendum brought the CEC's refusal to accept the signatures before the High Court to request a provisional injunction to order the CEC to accept them. On October 17, the Administrative court ordered the CEC to accept supplemental signatures for a pro-nuclear power referendum proposal (Focus Taiwan, 2018b). Finally, the CEC approved the referendum on October 24, 2018 (Shellenberger, 2018).

After the vote on November 24, 2018, close to 6 million citizens voted for the revoke of Article 95 of the nuclear-free homeland clause. The clause was officially revoked on May 22, 2019. Even so, the nuclear-free homeland policy continues as there is no life extension of the existing three power plants. The first (No 1) nuclear power plant was issued a decommission license in July 2019. The two reactors of the second nuclear power plant are scheduled to cease operations in 2021 and 2023, while the third is scheduled to cease operations in 2025. As the fuel rods of the fourth nuclear power plant have been sent back to the United States, test operations remain unlikely. However, on December 13, 2019, the CEC approved a proposal to hold a referendum on the revival of the contested fourth nuclear plant (Strong, 2019). August 28, 2021 has been named as the earliest possible date the vote might be held. Thus, the government's response to the coming referendum in 2021 remains to be seen.

3. Table 2 Results of the nuclear referendum in 2018

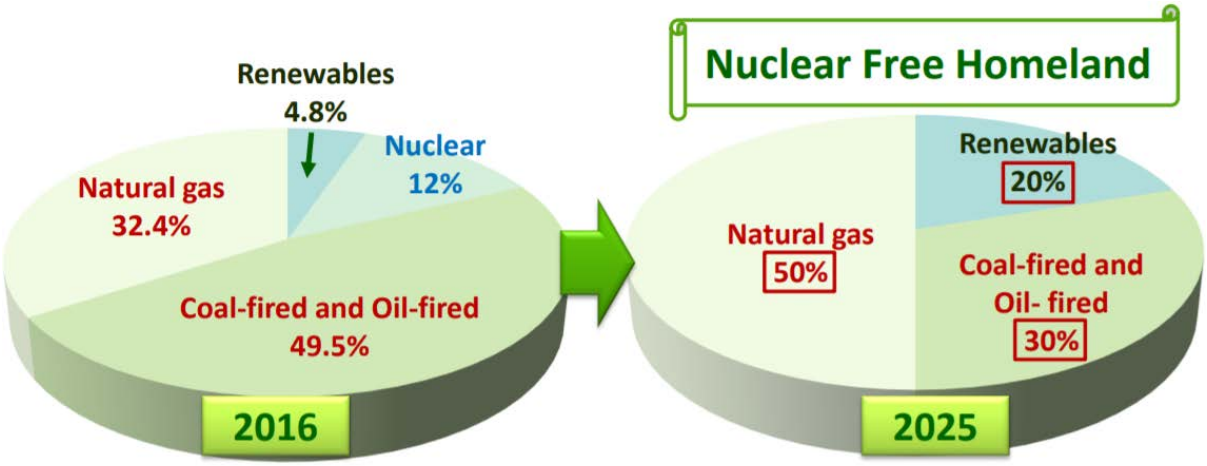
Referendum results									
Question	For		Against		Invalid/ blank	Total	Registered voters	Turnout	Outcome
	Votes	%	Votes	%					
Repealing the planned end of nuclear power stations	5,895,560	59.49	4,014,215	40.51	922,960	10,832,735		54.83	Adopted

4. Source: https://web.archive.org/web/20181124220825/http://referendum.2018.nat.gov.tw/pc/en/00/m00000000000000000.html

3. Compatibility of nuclear-free homeland with SDGs

Taiwan is an isolated island with 98% energy being imported and is classified as having an independent electricity system like Japan and South Korea, which is also much different from the nuclear phase-out

pioneer countries like Italy and Germany. To support the export of products from high technology industry, the reliance on fossil fuel base and nuclear power generation are inevitable. At the end of 2016, the total installed capacity of electricity in Taiwan was 49.06 GW, which came from coal-based thermal (34.73%), gas-based thermal (32.32%), nuclear (10.49%), renewable energy (9.10%), fuel-based thermal (8.06%) and pumped storage hydro (5.3%) (Energy Market Company, 2017). The installation mix would not reflect the reality of such high reliance on traditional electricity sources. From the electricity production mix of 2016, the role of renewables was reduced to 4.8% and the rest account for 95.2% (Wang, 2017). Thus, how to change such a mix to replace all of nuclear power plus a certain extent of fossil fuel generation by 2025 would be a huge challenge for Taiwan, particularly within such a limited time line.



Source: (Wang, 2017) Current Thrusts to 2025 Renewable Energy Targets in Taiwan, http://www.cieca.org.tw/v_comm/inc/download_file.asp?re_id=2998&fid=34830

After four years of efforts in implementing such an energy transition plan, in 2020, 45% of Taiwan's electricity generation came from coal, 35.7% from natural gas, 11.2% from nuclear plants, and 5.4% from renewables (https://en.wikipedia.org/wiki/Energy_in_Taiwan), and there was only a 0.6% increase from 2016, while the reliance on traditional electricity remained. However, the expansion of coal and gas fired plants and renewable have already led to concerns of air pollution/carbon emission (coal fired and gas fired) and land use conflict. (PV, onshore and offshore wind). This article would like to elaborate on these as follows:

3.1. Decision-making Process of Nuclear Free homeland

Needless to say, nuclear power has the advantage in achieving SDG 7 and 13; Goal 7: Affordable and clean energy and Goal 13: Climate action from its low carbon, and relatively cheap features. However, this power is also controversial for its nuclear legacy, which makes it less "clean" under the SDG7.

To promote a nuclear free homeland, "just" measures would be necessary to fulfil the requirement of Goal 16: Peace, justice and strong institutions or the due process or rule of law concerns of a democratic society. However, it is not the case in Taiwan.

In 2018, before holding the referendum, the government played tricks to send back the fuel rods to the US and also used a lot of tricks to delay the referendum signatures process. After citizens voted for not setting 2025 as the deadline, the government tried to interpret narrowly to include the abolition of Art 95, Electricity Act of 2017, but passively decided not to set up the life extension schedule. For the fourth nuclear power plant, the government continued to send back the fuel rods. For these milestone decisions affecting billions of sunken cost of investment, usually a formal legislative discussion and decision is necessary, but not for the case of nuclear-free homeland policy.

Also, such an approach cannot answer a basic and logical question: If nuclear power were to be so dangerous and uncontrollable, how come the current ruling party decided not to switch off all nuclear power but to squeeze it to the last minute of mid-2025 (the operation licence of the second reactor of the Third Nuclear Power Plant in Taiwan)? Interestingly, most environmental NGOs also buy out such an idea, and it would be interesting to see such SD perception in the world.

3.2. Renewable development and SDGs

The original government objective was to replace nuclear power with renewables. Thus, there was a large jump of renewable "installation" capacity over the past four years, particularly solar PV (from 1,245.06 in 2016 to 5,817.21MW by the end of 2020). For the rest of the Renewable Energy System (RES), there was only a slight increase (onshore wind: 682.09→ 725.71; offshore wind power: 8.00→ 128.00); such a big increase of PV would contribute to the SDGs of 7 and 13. Perhaps, it is also helpful for the creation of decent work and economic growth (Goal 8) and contribute to Goal 11: Sustainable cities and communities. Certain energy intensive industries or high technology companies could also plan to install solar panels on their roofs, which would meet Goal 12: Responsible consumption and production.

Yet, the large expansion of PV also affects the existing land use and certain SDGs in a negative way. For instance, compared with other type of RES, PV is relatively expensive. Thus, such a large number of PVs would lead to the affordability concerns of SDG 7. Secondly, the changing land use to install PVs also affect life on land or below water (Goal 14: Life below water; Goal 15: Life on land), as the they occupy a lot of land or pond space (Taipei Times, 2019). Thirdly, the PV also affects citizens, such as installation in fish farming area upsets the life of original fish farmers (Focus Taiwan, 2021). This

would lead to concerns about farmers having to sacrifice for energy transition (Goal 10: Reduced inequality). Finally, it is still doubtful whether the large expansion of such land use would be the basis for Sustainable cities and communities (Goal 11:). Several communities oppose such big PV parks in their vicinity in south Taiwan (Ming-sho Ho, 2020).

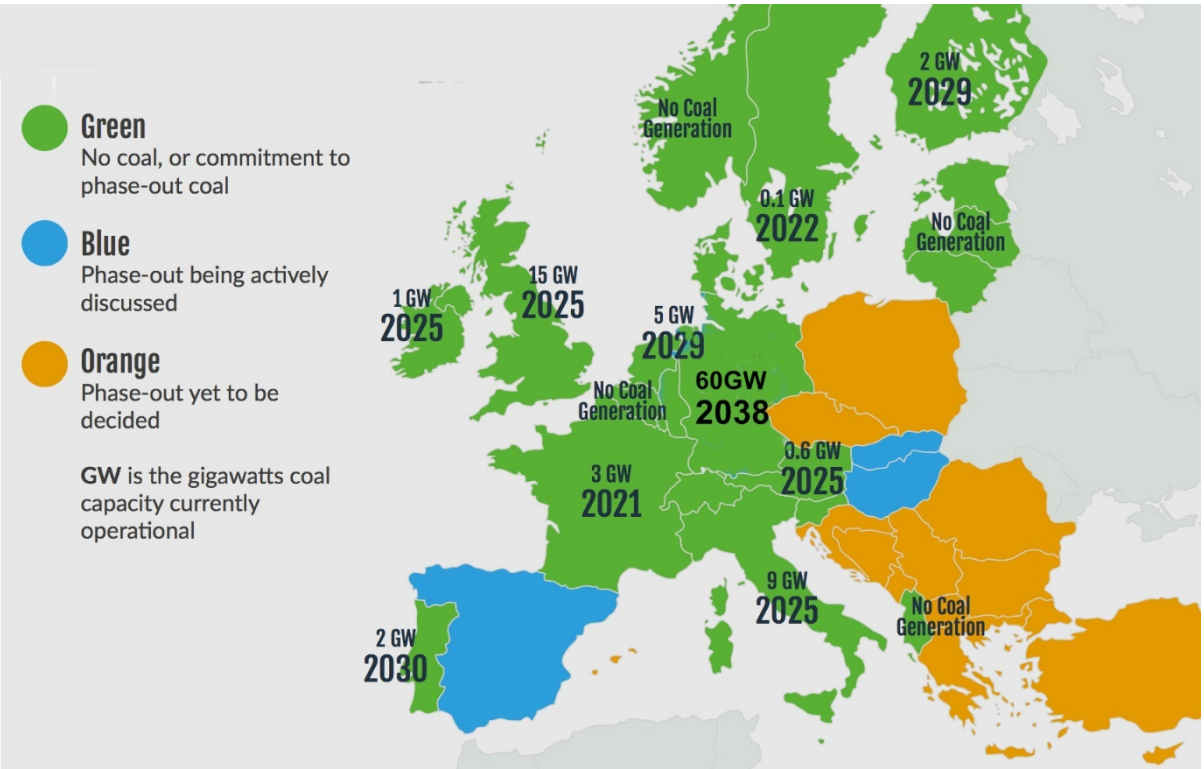
3.3. Third LNG terminal turmoil and its replacement

In spite of the official statement of replacing nuclear power with renewables, facing the opposition and slow development in RES lead to the reliance on traditional fossil fuel. To strike a balance among different types of fossil fuel, gas was chosen as the main one and to become the dominant (from the current No 2) electricity source by 2025. Unlike the ease of importing gas via undersea or land pipelines as European countries or the US do, Taiwan has to build third LNG terminals to import gas to replace nuclear power. Environmental groups have argued that construction would harm the algal reef and endangered species in the area. Rescue Datan's Algal Reefs Alliance initiated a referendum on "Do you agree that CPC Corp., Taiwan's LNG terminal should be relocated from its planned site near the algal reef coast of Datan and its surrounding waters?" It is scheduled to be held in August (Focus Taiwan, 2021) if this LNG terminal project is vetoed in the referendum, it could be beneficial to SDGs 13, 14 and 15. However, there is also a worry that the government may change to coal-fired power plants to replace nuclear energy. This may again affect and worsen SDGs 13, 14 and 15.

3.4. Lack of coal phase out schedule

Around the world, the mainstream of energy transition policy focuses more on coal phase out, instead of the nuclear one. Not to mention, Taiwan's nuclear-free homeland is not nuclear phase out in nature but has a normal operation life of 40 years. Of course, there is usually a trade-off between nuclear and coal power in different countries. For instance, in France, the UK and Sweden, the coal phase out schedule can be done earlier. Yet, for nuclear phase out countries like Germany, the schedule is quite stretched but at least there is a committed timeline of 2038. There is a legislation in place to achieve the vision: Act to Reduce and End Coal-Powered Energy and Amend Other Laws of 2020 (https://perma.cc/GQR7-JM8G; https://energycentral.com/c/ec/german-coal-phase-out-law-overview). Yet, in Taiwan, there has never been such a commitment, and only a 2025 vision to reduce coal fired power plants to 30%. Yet albeit the current LNG terminal controversy, it seemed unlikely to meet such targets and may instead see an increase. There is no legislation to push forward such coal phase out agenda as well. In this way, several SDGs like 3, 6, 7, 13, 14 and 15 would be negatively affected.

Figure 1. Current coal phase-out commitments in Europe



Source: https://onclimatechangepolicydotorg.wordpress.com/2019/06/18/europes-phase-out-of-coal/

3.5. No plan and law to deal with nuclear legacy

A responsible nuclear-free homeland requires not only a regime for setting up a nuclear power decommission schedule, but also one for both Low-level radioactive waste (LRW) and high radioactive waste (HRW). For instance, in 2011 Germany committed to phasing out nuclear power by 2022. A Site Selection Act for controversial HRW was adopted in 2013 (BGR, XXXX), and revised in 2017 (BMJV, 2017). However, this responsible attitude is not evident in Taiwan.

Even if Tai-Power has already fulfilled its legal duties to submit a plan for LRW and HRW, a deadlock is evident. In terms of LRW, it is the unresolved passive attitude of holding a referendum by the local government. According to Article 29 of the Nuclear Materials and Radioactive Waste Management Act, it is the responsibility of nuclear operators to plan for final disposal (Nuclear Materials and Radioactive Waste Management Act, 2002). Tai-Power proposed the first version of the final disposal plan for low radioactive waste LRW in 2004 (Atomic Energy Council, 2004). The plan has been subject to revision several times: in 2007, 2014, and 2015 (Atomic Energy Council, 2007). However, based on opposition from the local county during the site selection process, Tai-Power was ordered in December 2016 to propose an alternative programme for final disposal of LRW. A centralized LRW storage site is planned (Atomic Energy Council, 2017), which will be used to store it before the final disposal site is available. To continue evaluating technical aspects of the final disposal of LRW, Tai-Power also conducted related

research. The research report (Atomic Energy Council, 2017) can be viewed as a soft approach to proceeding with the site selection process.

For HRW, no definite legislative timeline was set for selecting a site, and the current draft bill is badly drafted. The multi-level veto and broader local referendum could be expected to worsen site selection for HRW more than for LRW. The resolution to both deadlocks requires the determination of parliament, the president, and cabinet. Otherwise, the only way out seems to be the continued use of existing LRW and HRW sites.

4. Conclusions

Taiwan's approach in becoming the world's third nuclear power free country is problematic from different aspects, particularly under the eye of just transition and the harmonization among different targets of SDGs.

From the just transition aspect, the lack of a thoughtful deliberation process to make this decision and ignorance to the referendum results render this initiative unjust. Not to mention the lack of rule of law in abolishing billions in sunk investment. Finally, the irresponsible attitude of the ruling government in tackling nuclear waste would be unjust as well. It continues to argue that there is no toilet to store nuclear power waste to justify its nuclear power legacy. However, it still wants to switch to nuclear power and continue to produce waste before 2025. Such irresponsible attitude is sure to be an unjust energy transition.

A just energy transition plan would meet SDGs as well. Renewable energy or cleaner natural gas usually play the role of replacing nuclear or coal fired power plants. Yet in Taiwan, the standstill of renewable electricity evident in the power mix and the controversial third LNG terminal leading to the increase of coal fired plants would cause an unjust and unsustainable development by moving back to more polluted and climate change unfriendly traditional fossil fuel electricity.

Taiwan has no chance to become the world's first country to go nuclear power free, but from the analysis of this article, it is sure to be eligible for the title of irresponsible, unrealistic, unjust, against people's majority and unsustainable nuclear-free country.

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Criminal Offender With Disable Abilities: Call For Fair Treatment In Pre-Trial Process

Subtitle as needed

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Abstract

World Health Organization has reported that 10% population of each country are persons with disable abilities. In Malaysia, it was reported about 497,390 persons are registered as persons with disabilities in 2018. Even though the amount is quite big, they are treated as a normal person when it involves the pre-trial process for criminal offences. This is not in line with the sustainable development goals as they aim to reduce the inequalities and to provide peace, justice and strong institutions which is referred to judiciaries institution. Therefore, this paper intends to examine and analyse the issue of fairness while treating criminal offender with disable abilities in Malaysia during the pre-trial process. The doctrinal analysis is adopted by analysing the current primary and secondary materials which include case law, statutory provisions, and other legal and non-legal literature. Furthermore, the comparative analysis refers to the system of the judiciary for treating persons with disable liabities in United Kingdom, New Zealand and Australia. Consequently, the criminal pre-trial process in Malaysia is found to be conducted without any difference between a normal offender and offender with disable abilities. Because of the special characteristic of the offender with disable liabilities, there is a possibility that lead to injustice process and judgement. Therefore, it is suggested that the Government of Malaysia should have a standard operation procedure in dealing with disable offender in the process of pre-trial to cater the special needs and treatment for such offender.

Keywords: Criminal Offender, Disable Abilities, Reduce Inequalities, Pre-Trial Process, Standard Operation Procedure.

1. Introduction

Standard operating procedures (SOP) define how a task should be completed and the activities that should be taken in a consistent and uniform manner. In general, a ‘standard operating procedure (SOP)' is a written and documented work instruction and specific recommendations for a task. It also seeks to reduce misconceptions and failures by adhering to industry, business, administrative, and other regulations.

A standard operating procedure (SOP) is a set of written and documented instructions for completing a task or following a rule. These SOPs are intended to define how a task or rule should be

carried out, as well as the activities that should be completed in a uniform and consistent manner. Furthermore, the SOP serves as a set of comprehensive and written instructions or work orders that must be followed in order to establish uniformity in the execution of a job based on the objectives to be met. SOPs must be well written in order to meet compliance standards. A well-designed SOP enables us to manage documents such as plans, regulations, compliance, and policies, all of which are employed in a company.

People with disabilities (PWDs) are a part of our daily lives in today's world, and we can't avoid engaging with them, either directly or indirectly. People with Disabilities (PWDs) are members of a community who should not be isolated from the passage of time due to their limitations Azman Ab Rahman, 2018).

2. Definition of Person with Disable Abilities (PWDs)

According to the World Health Organization (WHO, 2011), PWDs are defined as "Persons with Disabilities who meet criteria in the definition such as having a physical or mental disability, long-term or short-term, and do not have equal rights in the fields of health, education, and employment opportunities." According to the United Nations (UN), a person who is unable to determine for himself how to achieve all or part of an individual's normal needs and/or is unable to live fully in society owing to a physical or mental handicap, whether it occurs at birth or later, is referred to as a PWD. A disabled person, according to the Texas Department of Health and Human Services, is someone who has limited mobility and requires specially constructed facilities, such as buildings, equipment, and fittings, as well as outdoor arrangements, to overcome their limitations (Reuter, 2001).

According to the Americans with Disabilities Act of 1990, there are five aspects to the category of Persons with Disabilities (PWDs), including mental aspects, physical aspects, Attention Deficit Disorder (ADD) and Attention Deficit/Hyperactivity Disorder (ADHD), HIV/AIDS, and a minority group of people with disabilities. Furthermore, according to the World Health Organization (WHO), people with disabilities (PWDs) are separated into three categories: physical disabilities, mental impairments, and sensor defects.

The disabled make up 1.3% of a country's population, according to the WHO (2011). According to the World Health Organization (WHO), 10% of a country's population is impaired. Malaysia is thought to have 2.8 million disabled persons, according to this assessment. Malaysia has a population of 25 million people, with 250,000 of them being disabled (PWDs). In Malaysia, a total of 497,390 individuals with disabilities (PWDs) registered with the Department of Social Welfare through the Information System for People with Disabilities in 2018.

People with Disabilities (PWDs) are fully integrated members of society. They also enjoy the same rights and chances as other members of society when it comes to living their lives. The Convention

on the Rights of Persons with Disabilities, which was ratified by the United Nations on December 13, 2006 and opened for signing and ratification on March 30, 2007, clearly states the human rights of individuals with disabilities.

3. Literature Review

According to an examination of the SOP definition dispute, several authors provide their own definition of SOP. SOP is a set of established standards based on operations conducted repeatedly in an organisation, according to the EPA (2001). Meanwhile, according to FEMA (1999), a standard operating procedure (SOP) is a detailed guide that specifies how a process should be carried out. In addition, Lingappan (2000) defines a standard operating procedure (SOP) as a set of rules for resolving an issue.

To establish uniformity in the execution of particular functions, SOPs are detailed in the form of written instructions. Compliance standards can be met with well-written SOPs. According to Sailendra (2015), a standard operating procedure (SOP) is a document that tries to ensure that an organization's or company's work and operations operate smoothly. In addition to this description, Moekijat (2008) defines SOP as a series of steps (or work executions) that include how the work is done, when it is done, where it is done, and who performs it.

SOPs are designed to ensure that each unit can complete a task accurately, rapidly, effectively, and efficiently while avoiding errors. SOPs are standards used to ensure that an organization's or company's operating activities run consistently, effectively, efficiently, systematically, and well managed, according to Arini T Soemohadiwidjojo (2004). Meanwhile, M. Budiharjo (2014) defines SOP as the level of a routine, fixed, and unchanging work process or procedure that is documented in the form of a written document.

Furthermore, an examination of the argument over the definition of PWDs revealed that the phrase is used to indicate the importance of this specific group in receiving the attention and protection they deserve. PWDs, according to Zinaida Ariffin (2006), are those who are unable to determine some of their own needs or who are unable to function completely socially owing to a physical or mental deficit and require assistance from others to continue their lives. PWDs, according to Rosmawati (2008), are defined as people who have limited mobility (movement), whether physical (limbs), mental (mild, moderate, or heavy), eyesight, or hearing.

Persons with disabilities (PWDs) are also known as disabled people, disabled persons, special groups, children of heaven, or people with special needs in general (Azman Ab Rahmah et.all 2018). This term refers to a group of persons who are not typical human beings and require a particular support system in order to survive. PWDs, according to Wan Sabri et al. (2013), are people who differ in terms of neurological features, sensory ability, communication capacity, behavioural and emotional

characteristics, as well as physical features. Finally, the disabled in Malaysia can be split into two social groups. Special children or children with special needs make up the first group, while special groups of adults and the elderly make up the second (Ab. Aziz et al. 2009). PWDs can also be defined as a minority group in society with physical and mental disabilities, including vision, hearing, and physical limitations, as well as mental and intellectual abilities, sensory issues, communication abilities, and behavioural disorders. The term "social" refers to those who are impaired (Azman, 2018).

Furthermore, according to Alijah, Norlidah, and Saedah (2013), disability is a condition in which a person's function or capacity is reduced when compared to typical human measurements. Furthermore, PWDs refers to a person with a mobility limitation, which can be physical or mental limbs; light, medium, and heavy; sight, and hearing (Mohd Hafiz Abd Rahman, 2009). According to Putri Miftahul Jannah (2019), disability can be caused by three different factors:

i. Disabilities due to accidents - victims of war, victims of riots, victims of road accidents, victims of accidents at work,
ii. Birth defects- including hereditary disorders,
iii. Disability due to diseases- polio, leprosy, diabetes, venereal diseases and so on.

The Persons with Disabilities Act of 2008 also emphasises the importance of physical, social, economic, and cultural environment accessibility for health and education, as well as information and communication, in enabling PWDs to participate fully and effectively in society.

The existence of this group of disabled people is also acknowledged on a global scale. The Convention on the Rights of Persons with Disabilities (CRPD), which was adopted by the United Nations on December 13, 2006 and opened for signature and ratification on March 30, 2007, explicitly states the human rights of people with disabilities.

The provision of facilities for the disabled, according to the Department of Social Welfare, is not a waste because this group has a "economic worth" that contributes to the national economy. Despite their small number, Hazlin Falina, Wan Amizah, and Maizatul Haizan (2015) argue that the parties involved should be concerned and should carry out obligations to meet the needs of this specific group in accordance with their professional position.

However, there are still others who look down on the disabled and treat them badly, as if they do not deserve to be treated well and fairly. They may experience emotional distress as a result of the poor care they receive, which will have a detrimental impact on them. Despite the fact that they are a minority, their rights in society should not be overlooked. The necessity to respect the rights of the disabled and the necessity for diverse measures to improve the disabled's living standards are two topics that frequently come up in debate.

The concept of equality un the Persons with Disabilities Act of 2008 is consistent with the concept of equality established in Article 8 of the Federal Constitution, particularly when it comes to broad principles or protections.

The perpetrators of criminal activities and offences include not just the general public but also the disabled. Every criminal will have to go through the legal system. Article 5 of the Federal Constitution, as well as various articles of the Malaysian Criminal Procedure Code and the State Syariah Criminal Procedure Enactment, will direct the arrest and detention of ordinary people suspected of committing crimes. Suspects who have been arrested must be informed of the basis for their detention, and they are entitled to legal representation.

Pre-trial imprisonment, often known as remand confinement, is frequently employed and linked to the performance of investigations. According to Al-Sharidiy (2005), pre-trial detention is an investigative procedure that entails a competent authority's order to detain a person in a location owing to a crime he has committed. To put it another way, this technique is required for the purposes of the investigation. This custody is enforced to prevent the accused from pestering witnesses or tampering with evidence. Indeed, it prevents the accused from fleeing while awaiting the outcome of a judicial decision against him (Umar, 1993).

The government has made positive steps in the subject of autism-related criminality, with the Royal Malaysian Police (PDRM) launching a special SOP to manage detainee cases involving individuals with autism on March 25, 2019. Although this process involves people who are disadvantaged, it is solely for people who have autism or Down syndrome (PDRM, 2019).

If a report is filed, the police will use the same arresting, custody, and interrogation procedures as they would for normal people, as there are currently no particular SOPs for people with disabilities. At the police level, however, they emphasised that the arrests were done in accordance with standard police processes for inquiry and justice for all sides, and that the officers had not broken any laws (Nor Azizah Mokhtar, 2018). Many others, however, urged the police to take all necessary and reasonable precautions during the arrest, detention, and investigative procedure.

In the legal context, parties involved should follow established criteria when dealing with matters involving people with disabilities (PWDs), such as those with autism. The police have responded in line with the SOP based on the complaints they have received, but because the perpetrators are classified as disabled, there is still opportunity for discretion and a feeling of empathy in treating the situation. Next, in order to avoid further traumatising them, the method in which they were arrested, detained, and interrogated while in custody must be revisited (Airunnisa, 2018).

The arrest has not yet established a person's guilt or necessitated a court appearance. Instead, it is determined by the facts of the case (Siti Norjihan Saleh, 2014). In addition, ACP Lily Choo (2019), Deputy Director of the Bukit Aman Police Headquarters' Sexual Crime, Women and Children

Investigation Division, backed efforts to develop particular SOPs for people with disabilities who are investigating crimes committed abroad.

It should be emphasised that the idea of creating a standard operating procedure (SOP) for enforcement purposes is not new. The existence of a prosecutorial and enforcement policy can help people understand the law better. The findings of this study are supposed to serve as a source of reference and guidance for the Malaysian government and courts in providing the best services to disabled criminal offenders. As a result, past research strongly supports attempts to develop customised SOPs for people with impairments.

4. Law in Malaysia for Treatment of Disable Liabilities During Pre-Trial Process

The Persons with Disabilities Act 2008 governs the problem of persons with disabilities in Malaysia. This Act is a legal law that governs the registration, protection, rehabilitation, development, and welfare of people with disabilities, as well as the founding of the National Council for Person Disability. However, this Act is silent on the procedure to be followed if this impaired individual is suspected of committing a criminal or civil offence.

Nevertheless, the Act is still subject to the concept of equality as stated in Article 8 of Federal Constitution which provides:

> Article 8(1): *All persons are equal before the law and entitled to its equal protection*.
>
> Article 8(2): *Except as expressly authorized by this Constitution, there shall be no discrimination against citizens on the ground only of religion, race, descent, gender or place of birth in any law or in the appointment to any office or employment under a public authority or in the administration of any law relating to the acquisition, holding or disposition of property or the establishing or carrying on of any trade, business, profession, vocation or employment.*

In a criminal proceeding, whether the offender is disabled or not, they have the right to receive equal treatment under the law, as stated in Article 5 of the Federal Constitution. Article 5 enshrines a number of basic fundamental human rights, namely:

1) No person may be deprived of life or personal liberty except in accordance with law.
2) A person who is unlawfully detained may be released by the High Court (right of habeas corpus).
3) A person has the right to be informed of the reasons of his arrest and to be legally represented by a lawyer of his choice.
4) A person may not be arrested for more than 24 hours without a magistrate's permission.

Aside from that, the offender is susceptible to the consequences of their specific Act breach. The offender will be charged with criminal misbehaviour under the Penal Code. The perpetrator is

bound by the Criminal Procedure Code in terms of pre-trial, trial, and punishment procedures (Act 593). The report receipt, arresr, investigation, and charge processes are all part of the court's pre-trial process, while the trial process involves the presentation of evidence and witnesses before the judge sentences the offender or acquits the offender if the judge finds there is insufficient evidence to convict the offender.

The basis for the arrest must be explained to the suspects, and they have the right to be represented by a lawyer. Pre-trial imprisonment, sometimes known as remand confinement, is frequently employed in the course of investigations. According to Sharidiy (2005), pre-trial detention is an inquiry method that entails a competent authority's order to detain a person in a specific location owing to a crime he has committed. For the benefit of the investigation, this step is required. The purpose of detention is to keep the accused from pestering witnesses or tampering with the evidence. It also prevents the accused from fleeing while awaiting the outcome of his case in court (Umar, 1993).

Because there are still no specialised SOPs for individuals with disabilities, if an allegation of criminal action is made against them, the police will perform an arrest, detention, and questioning procedure similar to what is done for regular people. At the police level, however, they emphasised that the arrests were done in accordance with standard police protocols for the purposes of investigation and justice for both sides, and that the officers had not broken any laws (Nor Azizah Mokhtar, 2018).

5. Comparative Analysis with the Law in United Kingdom, New Zealand and Australia

In Australia, the WA Police Disability Access and Inclusion Plan 2018-22 ensures that persons with disabilities, their families, and carers have access to the agency's services, information, and facilities by providing professional and appropriate services. Every Western Australian police officer, employee, contractor, and agent is subject to this policy (Western Australia Police Force, n.d).

The Guidance on the Safer Detention and Handling of Persons in Police Custody was established in the United Kingdom, and it includes special procedures for people with mental, learning, and physical disabilities. To preserve the judicial system, all police officers must follow certain protocols while dealing with criminals (National Policing Improvement Agency & Association of Chief Police Officers, 2012).

In New Zealand, the Care and Welfare of Persons in Police Custody (Standard Operating Procedure), which went into effect in 2013, is one example. The guardian for any disabled person who is the subject of a police inquiry must be notified and present at the police station before any investigation may commence, according to this SOP (Scottish Police, 2013).

As can be seen, these three Commonwealth countries attempt to execute justice in their own countries in a comprehensive manner. People with impairments are not excluded from enjoying this equal right because of their impairment. People with disabilities are not denied their rights, even if they

have been accused of committing a crime. Depending on their limitations, the pre trial, trial, and post trial procedures are carried out in a suitable manner. In order to promote life equality, the government strives to provide sufficient facilities for them and their families.

6. Conclusion and Recommendations

In the legal context, parties involved should follow established criteria when dealing with matters involving people with disabilities (PWDs), such as those with autism. The police have responded in line with the SOP based on the complaints they have received, but because the perpetrators are classified as disabled, there is still opportunity for discretion and a feeling of empathy in treating the situation. Next, in order to avoid further traumatising them, the method in which they were arrested, detained, and interrogated while in custody must be revisited. It's important to remember that an arrest does not necessarily mean a person is guilty or that the case will be prosecuted in court. Instead, it is determined by the facts of the case.

This SOP is a "discretionary" method used by enforcement personnel while making criminal arrests. Apart from this SOP also act as an administrative instruction and used a platform for prosecutors to exercise their judgement in writing.

As the administration of justice must be seen to respect justice and be effective in enforcing it, its officers must be well-trained and, above all, legal literate. There will invariably be issues in terms of interpretation and application of the law if the provisions of the law are not well understood. As a result, the availability of policies, rules, and manuals to aid in the administration of criminal justice is critical in maintaining the rule of law.

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Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis

Mid Sweden University
Virtual Conference, Sweden

Mittuniversitetet
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MODELING WATER GOVERNANCE WITH EMPATHY, COMPASSION, AND CARE

Facts

Water is the **most essential element** for life

Water acts as a **powerful medium** of living beings and places.

Water governance must ensure that humans are responsibly and collectively contributing to a **healthy water system**.

Regulatory and Material Challenges

Top-down **regulatory approaches have failed** to meet any of the global environmental goals (i.e. Paris agreement, Agenda 2030).

Thus, we increasingly face water-related challenges such as:

- **scarcity;**
- **contamination;** and
- **inequitable distribution.**

Objective

Develop a **collaborative water management and governance model** (CWMG) responsive to the challenges

1. with a structure that revisits the participatory rights for water through **empathy, compassion,** and **care**
2. built on **community-based research**
3. embedded in the vision of the **integral ecology**

The ABC of Water Governance

A for… Access rights for… Compassion: ability to enter in communion with others

C for… Community based research: research that involves communities; Care: ability to take restoring actions; Compassion: ability to feel together

E for…Empathy: ability to enter in communion with the emotions of others

G for… Governance: a polycentric actor-inclusive concept

M for … Management: coordinated tasks for achieving a common goal

I for…Integral Ecology: unifying human and non human elements

V for….Vulnerable: vulnus refers to the wound to be restored and re-storied

UNIVERSITÀ DEGLI STUDI DI TORINO
DM DIPARTIMENTO DI MANAGEMENT

Illustrations:

Salmon, Valentina Russo, Mucho Amor, 2020

La Nostra Terra Sorridente, for ECO_CARE, V. Russo, Mucho Amor, 2020

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Assessing the effects of Directive 2014/95/EU on Nonfinancial Information Reporting: Evidence from Italy and Spain

Introduction

Directive 2014/95/EU has led to a new European scenario for corporate reporting where nonfinancial information (NFI) reporting changes from voluntary to mandatory. This paper investigates the effects produced by the new regulation focusing on two European countries, Italy and Spain. Specifically, this study aims to answer the following research questions:

(1) How did the new regulation influence companies' disclosure levels in Italy and Spain?

(2) What are the sustainability indicators that companies of both countries are currently using to meet the Directive's demands compared with those used previously for reporting?

Methodology

Content analysis is performed to verify the level of NFI disclosed by Italian and Spanish companies over three years, namely, the year before the publication of the Directive, the year before its adoption into national legislation and the first year of its entry into force. Our sample consists of the 35 Spanish companies included in the IBEX 35 Index, and 31 Italian companies belonging to the FTSE MIB Index. Changes in disclosure levels are examined by constructing a disclosure index based on the quantity of Global Reporting Initiative (GRI) indicators disclosed by the sampled companies in their sustainability, integrated and nonfinancial reports.

Results

The comparative analysis shows that, before the Directive, Italian companies were less active in publishing sustainability reports than Spanish companies, among which 95% had already disclosed NFI. We also find different trends in the disclosure index of Italian and Spanish companies, suggesting different responses to the new regulation. Specifically, we find a progressive reduction in the Italian companies' disclosure levels differently from the Spanish ones for which an expansion of the disclosure is detected (see Fig.1). Moreover, our results reveal a decrease in the wide gap previously observed between the quantity of information reported in the two analysed countries.

Discussion

The Italian response to the new requirements can be interpreted in different ways. It might result from a process of rationalisation supporting more effective communication; from a prudent approach to disclosure induced by the provision of mandatory assurance of NFI; from a "tick-box" mentality under which companies exhibit an apparently responsible behaviour. The increase in Spanish disclosure levels, on the one side, could be the expression of the positive attitude toward compliance that generally drives companies operating in countries with prior regulation. On the other side, given the ineffectiveness of the previous regulation, it might represent an attempt to fill the information gap still existing in Spanish reports. The reduced gap between the quantity of NFI reported by Italian and Spanish companies indicates that regulation can produce harmonisation.

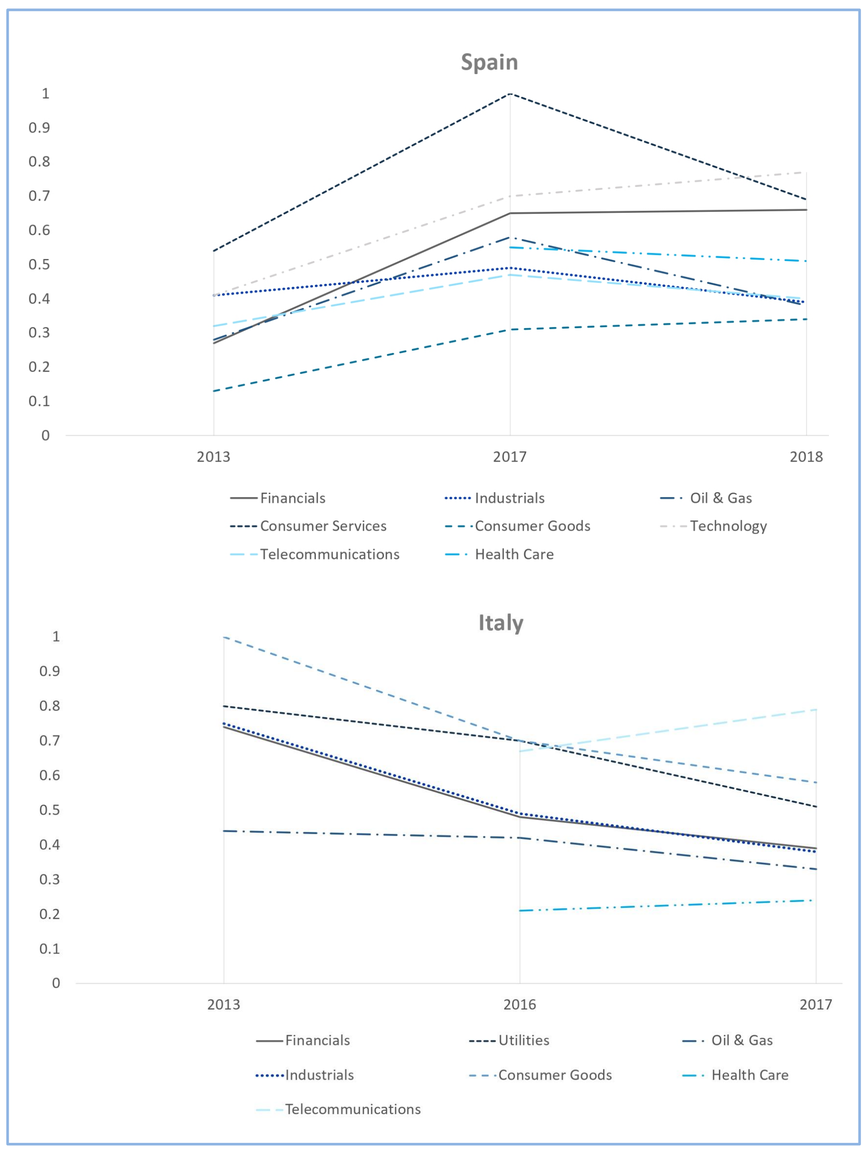

Fig.1 Total disclosure index by industrial sector in Spain and Italy

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Criminal Offender With Disable Abilities: Call For Fair Treatment In Pre-Trial Process

Introduction

World Health Organization has reported that 10% population of each country are persons with disable abilities. In Malaysia, it was reported about 497,390 persons are registered as persons with disabilities in 2018.

Research Objectives

1.To examine and analyse the issue of fairness while treating criminal offender with disable abilities in Malaysia during the pre-trial process.

2.To compare the jurisdiction in Malaysia relating to the system of the judiciary for treating persons with disable liabities in United Kingdom, New Zealand and Australia.

Problem Statement

People with Disabilities (PWDs) are fully integrated members of society. Despite the fact that they are minority, their rights in society should not be overlooked. Unfortunately, they are treated as a normal person when it involves the pre-trial process for criminal offences. This is not in line with the sustainable development goals as they aim to reduce the inequalities and to provide peace, justice and strong institutions which is referred to judiciaries institution. At the police level, however, they emphasised that the arrests were done in accordance with standard police processes for inquiry and justice for all sides, and that the officers had not broken any laws (Nor Azizah Mokhtar, 2018).

Research Methodology

The research is a qualitative research. The doctrinal analysis is adopted by analysing the current primary and secondary materials which include case law, statutory provisions, and other legal and non-legal literature. Furthermore, the comparative analysis refers to the system of the judiciary for treating persons with disable liabities in United Kingdom, New Zealand and Australia.

Recommendations

It is suggested that the Government of Malaysia should have a standard operation procedure in dealing with disable offender in the process of pre-trial to cater the special needs and treatment for such offender.

Finding

Consequently, the criminal pre-trial process in Malaysia is found to be conducted without any difference between a normal offender and offender with disable abilities. Because of the special characteristic of the offender with disable liabilities, there is a possibility that lead to injustice process and judgement.

Autralia - WA Police Disability Access and Inclusion Plan 2018-22

United Kingdom - Guidance on the Safer Detention and Handling of Persons in Police Custody

New Zealand - Care and Welfare of Persons in Police Custody (Standard Operating Procedure) 2013.

Contribution

The findings of this study are supposed to serve as a source of reference and guidance for the Malaysian government and courts in providing the best services to disabled criminal offenders.

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10. Special Themes

10a. Sustainability and Africa

Abstracts

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Towards sustainable energy development in Sub-Saharan Africa: Challenges and opportunities

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MA Justyna Tomala

Abstract

Sub-Saharan Africa is considered a region with enormous economic and demographic potential. Many economies are on the path of dynamic economic growth. Sub-Saharan Africa is also characterized by high population growth and young society. This, in turn, contributes to the intensification of processes such as industrialization and urbanization. At the same time, it should be emphasized that the economic and population potential of the region can be used efficiently. With the progress of urbanisation and industrialisation, the demand for energy is constantly increasing. One of the main challenges, included in the "Agenda 2063: The Africa We Want, implemented by the African Union", is to provide the access to electricity. Currently, 600 million inhabitants of the African continent do not have access to electricity, which is a significant limiting factor for further economic growth and socio-economic development. Moreover, the measures taken by individual Sub-Saharan African countries appear insufficient in face of rapid population growth. The aim of the article is to analyze the opportunities and challenges of energy sector development in Sub-Saharan Africa. This raises the following research question: to what extent a sustainable energy transition can be achieved in sub-Saharan African countries to ensure access to electricity? The study will be based on statistical data from the energy sector. It should be emphasized that the Sub-Saharan African region is exposed to the effects of climate change, which also affects the development of the energy sector and ensuring access to electricity. The study will contribute to assessing the adaptive capacity and transformative potential of the energy sector in the Sub-Saharan Africa. This is particularly important for achieving the seventh Sustainable Development Goal, which relates to building more robust and efficient cable systems, as well as implementing decentralised versions of energy from renewable sources. This research is crucial to bridge the energy access gap and build a resilient and sustainable economy in Sub-Saharan Africa countries.

Key words: Sub-Saharan Africa, access to electricity, energy sector, economic resilience, development economics

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APPRAISAL OF SOCIO-ECONOMIC AND POLITICAL IMPLICATIONS OF COVID-19 PANDEMIC ON THE NIGERIAN CITIZENS; A STUDY OF KOGI STATE

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Abstract

COVID-19 pandemic determines public health, presenting the biggest threat since the Second World War. All continents, except for Antarctica, are active in battling the pandemic. As other socio-economic and political problems are arising from this crisis, the pandemic cannot only be attributed to health issues. Every nation affected by this pandemic has the potential to witness a devastating social, economic and political backlash that will leave deep, long-standing scars. The World Bank has projected a decline in remittances of $110 billion and 800 million people will not be able to meet basic needs this year, with the International Labour Organization (ILO) forecasting that over 195 million people will lose their jobs. The paper adopted the documentary/library research approach and was thus of a highly qualitative type. From the findings, it was discovered that in managing this pandemic, there is a need for strategic planning by a government organization through the development of long-lasting policies that will help minimize the impact on individuals and nations. Previous experiences of outbreaks such as Ebola, HIV, SARs, TB and Malaria will therefore be valuable in the development of policies that can help to mitigate the socio-economic and political impact. The solution may lie in contacting the most vulnerable through crowdsourcing to provide them with food, in particular life necessities. Expanded social security may also be an important step in that direction for the disadvantaged and the disabled. Business Continuity Insurance should also be introduced for the most vulnerable in this precarious period. It is possible to introduce creative ideas to young people to allow them to tap into their potential and eventually tackle the current threat. The use of voluntary networks can also be an important tool that reinforces the sense of volunteerism. In addition, to promote the movement of remittances, business and political leaders should be encouraged to create a universal basic income.

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Looking Africa beyond 2030: Utilizing the gap of Africa issues through sustainable development goals

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Abstract

Introduction: Sustainable Development Goals (SDGs) were created by the United Nations (UN) in September 2015. It contains 17 SDGs, consisting of 169 indicator targets, replaced the Millennium Development Goals (MDGs) for 2000-2015 due to lack of Sustainability. SDGs are ambitious and universal, encompassing social, economic and environmental aspects of development in an integrated way. Achieving them in Africa beyond 2030 will require considerable institutional and policy investment at all levels of governance—local, national, regional, and international. This study considers how African countries can leverage science, health, innovations, Sustainable policy, and ideas to achieve the SDGs and the related aspirations of the African Union (AU) as articulated in its Agenda 2063. The study examines strategies to implement national, regional, continental, and international policies and programs to solve issues through SDGs beyond 2030 in Africa. Africa's challenge is how to translate Science, innovations and policies into practical actions, and to effectively implement programmatic initiatives such as those of the AU.

Method

The research study related to previously published peer-reviewed articles. A literature search was conducted on Google Scholar, AU, SDGs cities and Researchgate for articles published from 2015 to 2020, and search results showed 3,210 and 14 articles respectively. Search keywords are Africa, Africa

issues, Africa policy, and Sustainable Development Goals. Articles that contained two or more of the keywords in its topic or abstract and also aligned with the objective of the study were selected. Only 23 articles out of about 4,000 articles that met the inclusion criteria were included in the review.

Results/Conclusion

African countries must improve the quality and relevance of their national SDG policy frameworks to sharpen focus on social and environmental dimensions of sustainable development. In 2016, fewer than half of African countries had adopted SDGs policies, including Algeria, Angola, Botswana, Burundi, Ethiopia, Egypt, The Gambia, Ghana,

Kenya, Lesotho, Malawi, Mozambique, Namibia, Nigeria, Rwanda, Tanzania, Tunisia,

Senegal, South Africa, Swaziland, Uganda, Zambia, and Zimbabwe. But most of them do not consider sustainable development imperatives holistically. Instead, they tend to focus on funding scientific research with less emphasis on technology development, procurement, and innovation. This may stimulate the production of knowledge for short-term economic growth but fails to spur social inclusion and environmental sustainability that are necessary to long term sustainable development.

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Envisioning African Extended Producer Responsibility (EPR) - How can EPR tackle transboundary movement of e-waste?

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Abstract

The latest research on the transboundary movement of e-waste shows Nigeria as one of the top destinations where European used electric and electronic equipment (UEEE) and waste electric and electronic equipment (WEEE or e-waste) are exported. Some experts argue exported UEEE bridges the digital divide that is crucial to the attainment of sustainable development. Others point out how UEEE exports create a loophole for WEEE exports, challenge the quality of exported UEEE and highlight their social and environmental cost. Regardless, sound management of e-waste is vital for sustainability. Like most African countries, Nigeria lacks the capacity for sustainable management of UEEE and WEEE.

In 2019, the Nigerian government in partnership with the United Nations initiated a discussion to create an Extended Producer Responsibility (EPR) system for electric and electronic equipment. To envision robust EPR systems withing the African context capable of dealing with UEEE and WEEE imports, this project adapted a Delphi study with e-waste experts in Africa. The study was conducted in three rounds. The first two round took stock of the phenomenon of UEEE and WEEE imports and created three different scenarios based on the input.

These scenarios representing various levels of circularity/sustainability ambitions of the EPR were discussed in the third round. By looking at the imports of UEEE and WEEE, domestic EEE usage, national and local policies, existing EPR like structure and informal sector in the different scenarios, we argue that EPR can be a solution-oriented tool for sustainably managing e-waste. Based on the results, we argue for the need of designing internationally oriented EPR to manage the imported UEEE and WEEE. The study points how an EPR system focused on value retention, value maintenance and involves the informal e-waste management sector in the EPR scheme can play a role in sustainable transition.

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Artisanal Refining and Sustainable Development Paradox in the Niger Delta Region of Nigeria: The 'Livelihood Dysfunction Trap Hypothesis'

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Abstract

The oil rich Niger Delta region of Nigeria is known to be disproportionately impacted by oil spillages and gas flaring activities which has resulted in wanton destruction of the primary livelihoods of over 70% of the region's population who largely rely on subsistence farming, fishing and mangrove forest extraction for survival. This has necessitated communities to develop strategies to cope with the associated livelihood insecurities, and key amongst these is the invention of artisanal crude oil refining in the region. In response to this problem, this study explored the advent of artisanal refining and its implication on sustainable development of the region. Anchored on the socio-ecological resilience theory and the qualitative approach, the study was conducted in Rivers, Bayelsa, and Delta States, representing the Core Niger Delta.

It relied on In-depth Interviews (IDIs), Focus Group Discussions (FGDs) and observational technique as the primary methods of data collection while the thematic analysis technique was utilized for data analysis. Findings from the study revealed that as a result of dwindling livelihood opportunities arising from large scale environmental pollution, coupled with the poor development realities across the region, communities are adopting artisanal refining as an alternative means of livelihoods. However, the findings also revealed that artisanal refining is rather an unsustainable livelihood activity as it further constitutes environmental degradation and exacerbates livelihood insecurities in the region, thereby resulting in a vicious circle of what the study referred to as "livelihood dysfunction trap".

The study hence concludes that the current livelihood strategies, particularly the proliferation of artisanal refining activities is unsustainable and therefore paradoxically undermines sustainable development of the region. The study hence recommended that to break free from the "livelihood dysfunction trap" and entrenching sustainable development, all polluting activities must be halted while ensuring rapid human and infrastructural development in the region.

Keywords: Artisanal Refining, Sustainable Development, Livelihood Dysfunction Trap, Niger Delta

Relatedness to SDGs: The abstract converges with the Sustainable Development Goal 12, target 2 which advocates efficient use of natural resources. Illegal bunkering and artisanal refining are not sustainable approaches to utilizing crude oil resources in the Niger Delta, hence the widespread environmental pollution across the region and its ripple effects on livelihoods and well-being of the Niger Delta people.

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Assessment of climate change mitigation impact on income inequality in Sub-Saharan Africa: a spatial econometrics analysis.

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Abstract

The effort to reduce climate change impact in developing countries includes actions that reducing greenhouse gas emissions from fossil fuel combustion, assuring energy efficiency, and avoiding wood

energy consumption. Those actions required could be achieved through renewable and clean energy adoption and could have a direct and indirect effect on poor livelihood. The direct effect such as avoided deforestation will limit poor access to firewood, clean energy adoption for cooking will affect household's income, and improve air quality will affect health.

The indirect can be observed through an economy-wide effect such as a change in income inequality, economic growth, etc. Despite the lowest participation in climate pollution, Sub-Saharan Africa (SSA) countries suffer the highest impact of climate change. So, they committed with Paris Agreement to adopt low carbon emissions technologies as a climate change mitigation policy through the achievement of sustainable development agenda for 2030. Thereby, renewable energy is seen as the key solution for both climate change mitigation and affordable, reliable energy access.

To date, there is a lack of study analyzing climate change mitigation policy impact on income inequality in Sub-Saharan African countries. This present studying aims to assess this impact by using spatial econometric modeling. The reason for the choice of this methodology is to see whether there exists spatial dependency among renewable energy generation and income inequality in select countries of Sub-Saharan Africa countries.

Renewable energy generation (REG) from IRENA renewable energy database will be us as a proxy for climate change mitigation policy and the GINI index from the Standardized World Income Inequality Database (SWIID) will be used to measure income inequality. Other variables such as GDP per capita growth, inflation, unemployment, etc. from the World Bank-World Development Indicators database will be considered as well in this work. The work period will cover 2000 to 2019 according to data availability.

We expect a positive impact of climate change mitigation policy on income inequality reduction in SSA. This positive impact could be explained by the fact that the potential effect of renewable energy generation (off-grid solar system) will be in rural areas where it will be used to increase income from agricultural systems.

The present work tackle four sustainable development goals (SDGs-targets) such as SDGs-1 No poverty, SDGs-7 Affordable and clean energy, SDGs-10 Reducing inequality, and SDGs-13 Climate action, but we will basically emphasize SDGs-7 and SDGs-10. With the reality of COVID-19, energy services were denoted as the key solution to redress the worldwide economy in the post-COVID. Promote affordable, reliable, and sustainable energy access for income inequality reduction is in line with the Conference topic "accelerating progress towards SDGs in times of crisis."

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Effects of financial inclusion on smallholder farmers' financial productivity in Busoga region of Eastern Uganda

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Abstract

Evidence from several studies show that rural communities are highly underserved by financial services. Financial inclusion is therefore likely to benefit disadvantaged groups such as women, youth, and rural

communities. It is concerned with providing financial services on lower costs to rural people and low section of society. Inclusive financial system plays an important role in the overall strategy to improve the productivity of smallholders, their livelihood and food security while promoting improved agricultural yields. Therefore, this study focused on the assessment of the Project for Financial Inclusion in Rural Areas (PROFIRA) of Uganda. The research questions and objectives are thus formulated to determine the effects of financial inclusion on smallholder farmers' financial productivity in the Busoga region of Eastern Uganda.

A simple random sampling technique was used to select 240 smallholder farmers who are members of the community-based Savings and Credit Cooperatives (SACCOs) in the region. Quantitative data were collected with a structured questionnaire, and the data were analysed using descriptive, inferential, and Ordinary Least Square (OLS) regression analysis. A test of the hypothesis was conducted using independent sample t-test for the significant difference between male and female smallholder farmers on financial inclusion. Using productivity function as stated by the Neo-classical production theory, the financial productivity of the smallholder farmers was expressed as a function of the financial inclusion and their other socio-economic characteristic, which determine the input factors of productivity.

The results of the analyses show that smallholder farmers in the study area enjoy the benefits of financial services from the community-based Savings and Credit Cooperatives society (SACCOs). The regression result indicates that amount of loan received, loan duration, farmland size, labour and farm income have significant positive effects on the smallholders' financial productivity. Also, there exists no significant difference in the financial inclusion of both male and female farmers who are members of the community-based savings and credit cooperatives. It is important to note that financial inclusion of the rural smallholder farmers through SACCOs does not only increase farmers' financial productivity but also have an impact on their livelihoods as the majority are able to gain financial literacy and education being a member of the saving group.

The study concludes and recommends that financial inclusion is an important driver of smallholder farmers' financial productivity. Community-based savings and credit cooperatives (SACCOs) group should, therefore, be assisted and backed up by the stakeholders by officially recognizing them as a group under financial institution dedicated to improving rural productivity. Also, stakeholders should strengthen the information dissemination to smallholder farmers on the usefulness and benefits of joining and establishing the SACCOs group in their community where there is no availability of banking services. This is important in rural areas because access to financial services has a significant effect on the productivity of smallholder farmers. Strategy to encourage financial education should also be developed to draw the attention of the entire rural population to fundamentals of the value of money, the knowledge of financial institutions, and the proper use of credit.

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The effects of community and social development agency on livelihood of rural communities of Akinyele and Egbeda local government in Oyo State of Nigeria

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Abstract

The rural communities are the poorest places in Nation. The livelihoods of inhabitants of rural communities of Akinyele and Egbeda Local Government in Oyo State of Nigeria has not witnessed significant improvements in recent years as a result of poor intervention services focusing on strengthening rural dwellers in the State. This study show case various efforts aimed at alleviating or reducing poverty among the people as well as improving the Livelihood and well-being of rural communities through the various fundable projects executed by the Community and Social Development Agency (CSDA). This study therefore, examines the impacts of the Community and Social Development Agency (CSDA) on the Livelihoods of Rural Communities dwellers of Akinyele and Egbeda Local Government in Oyo State of Nigeria.

Sustainable Livelihood theory, System theory and Pro-poor growth theory provided the framework. A cross-sectional survey was conducted among three hundred and thirty-five (335) respondents from two purposively selected local governments participating in CSDA intervention programme. The Local Governments areas purposively selected were Akinyele and Egbeda. Quantitative data were analysed using descriptive and inferential statistic at $\alpha_{0.05}$ and chi-square, t-test and regression analysis were used to analyse the research hypotheses.

Construction of a Primary Health Centre (PHC) was the commonest form of CSDA interventions reported by the participants (78%); less than half reported intervention projects such as – rehabilitation of Rural Roads (45%), Rural electrification (32%), Water boreholes (27%), erosion control (26%), Construction of box culverts/bridges (26%), Construction and Renovation of classroom (23%). These intervention projects; rural electrification, water boreholes, erosion control, construction of box culverts were insufficiently available, while the two projects that receive attention of developmental agencies were Primary health Centre and Road rehabilitation. The beneficiaries stated the provision of CSDA services most prominent constraints as; poor roads (17.6%) and financial constraints (17.6%). For human capital, their livelihood is only influenced by increase in number of safe deliveries [sig=0.002, sig=<0.05]. For economic and financial Capital also, their livelihood is not influenced by any of the financial capital intervention programmes. For physical capital, only household's connection to electricity significantly influenced their livelihood [sig=0.002, sig<0.05]. For social capital, increases in the number of people attending PTA meetings [sig=0.04, sig<0.05] and increase in social events [sig=0.00, sig<0.05] significantly influence their livelihood. Also, the difference in the effect of CSDA intervention between the beneficiaries and non-beneficiaries is significant [t = 3.457, df = 298, sig=0.001, sig<0.05].

Having seen that all the four components of CSDA considered in this research were significant to their livelihood, it became important that these four components should be a GUIDE for the agency in delivering their service to the people living in rural areas.

Key word: Communities and Social Development, Livelihood, Rural Dwellers, Oyo State

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Resilience capacity of rice farmers in Niger and Ogun States, Nigeria

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Abstract

Rice is important to the Nigerian population as a means of livelihood for the producers and as a major part of urban and rural food consumption and expenditure. In 2017, Nigeria produced approximately 9.86 million tonnes of rice paddy generating more income for Nigerian farmers than any other cash crop in the country. But with the global challenge of climate change particularly to agriculture and rural farmers, attention has been drawn towards the resilience of rice farmers in Nigeria because being in Sub-Saharan Africa, the region is listed as prone to adverse effects of climate change. This has led to the alarming prevalence of food insecurity.

For Ogun and Niger States in Nigeria, using data from the General Household Survey (GHS) of the World Bank, variables required to estimate the resilience pillars and the food security indicators were constructed and fed into the structural equation model for the resilience capacity index (RCI) using the Resilience Index Measuring Analysis (RIMA II).

Results (on a scale of 0 to 100) show that rice farmers generally have low Access to Basic Services (ABS). In 2010, it was 18.953 and 25.704; 7.121 and 21. 955 in 2012; and 28.438 and 27.465 in 2015 for Niger and Ogun states respectively. Social Safety Nets (SSN) were 46.471 and 46.503 in 2010; 7.471 and 6.045 in 2012 for Niger and Ogun states respectively. In 2015, it was 0.677 for Ogun state. Assets (AST) was shown to be indices of 2.924 and 0.175 in 2010; 1.090 and 0.307 in 2012 and 1.897 and 0.286 in 2015. Adaptive Capacity (AC) was 22.548 and 27.886 in 2010; 0.203 and 0.278 in 2012 while in 2015, it was

shown to be 31.939 and 34.623 in Niger and Ogun states respectively. Having electricity, independent household members, and higher monthly food expenditure significantly influenced resilience in all the three waves. Having a female household head influence the resilience in 2010; good housing and scholarships influenced resilience in 2012 and in 2015, owning land influenced the resilience of rice farmers in the study area.

This study identified areas for investments and interventions for building resilience of the livelihoods of rural rice farmers in the study area and recommended that programmes should focus on enhancing basic amenities and services, environmental conservation and sustainability, improving the management of natural resources of land and water and promoting equitable access to these resources by every member of the community.

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Poor Resource Governance, Excruciating Poverty and the Prospects of UNIDO Good Governance Standards for Sustainable Practices in Africa

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Abstract

The African continent with vast natural and human resources have continued to experience despicable poor resource governance leading to phenomenal economic wastages, gargantuan corruption and low capacity utilisations. The situation has continued to escalate and worsen excruciating poverty thereby making it difficult for the African continent to meet up past global sustainable development agenda 2015 and the on-going SDGs. Against the backdrops of the needs to urgently redress this unfortunate trend, one of the most recent initiatives is UNIDO Good Governance Standards for sustainable practices. Using Nigeria as a case study, the paper examines the prospect of UNIDO Good Governance Standards as a veritable instrument for enhancing resource governance in order to attain sustainable growth and development. The study is significant for two cogent reasons: First, it highlights the challenge of resource governance in Africa as a repugnant threat to attainment of sustainable growth and development. Secondly, it examines the UNIDO global proactive agenda for addressing resource governance distortion in national organizational contexts across Africa towards attainment of relevant sustainable development goals (SDGs in particular and holistic growth in general.

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Pathways to livelihood restoration for the endangered livestock herders and fischerfolks in Nigeria

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Abstract

The current deadly massacre of citizens across the length and breadth of Nigeria under the erroneous impressions and culpability of herdsmen calls for new directions guaranteed with effective resuscitation of livestock and fishery sub-sector in Nigeria. This paper traces the history of various agricultural development interventions in Nigeria that have neglected the livestock and fishery sub-sector, identified gaps that resulted in the current plights due to climate change devastation that impact negatively on livestock herders in northern states and fisherfolks in environmentally compromised oil producing communities. The study adopts qualitative approach in discussing and propounding solutions to the identified gaps that is threatening the growth of livestock and fishery sub-sector with attendant implications for the agricultural resources transformation pathways in hunger and poverty endemic Nigeria yearning for emancipation. It highlights the need for a conducive environment for the endangered herders and fisherfolks to maximise the potentials to expand the Gross Domestic Product of Nigeria from non-oil sector. The article proffers solutions to the prevailing crisis between herders and other citizens beyond ethno-religious coloration by the enemies of state which has blurred the future of livestock development in Nigeria and peace and unity of the country. On the whole the outcomes will undoubtedly contribute to accelerating progress towards SDGs in times of crisis in our dear country that efforts like this will mitigate poverty, ensure zero hunger and set affected and afflicted citizens in troubled states cope with the realities of climate change and on the overall engender peace and justice where strong institutional drivers are deployed to rebound the country as a leading light in human service system.

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Local Building Materials for Africa: Availability, Use and Challenges

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Abstract

The threats posed by the changing climate, environmental pollution and degradation, and loss of biodiversity have increased the importance of embracing sustainable practices across all sectors of the global economy. The construction sector, which is traditionally reluctant to embrace change and evolve swiftly, is now at the heart of global discussions due to the sheer size of its environmental impacts. Construction and operation of the built environment is indeed globally responsible for around 40% of final energy demand, greenhouse gas (GHG) emissions, resource depletion and waste generation.

So far, the rapid increase in urban floor area has relied on a globalised approach to construction with few, ubiquitous materials – such as concrete, steel, and aluminium for instance – being used in every corner of the globe irrespective of their belonging to the vernacular architecture or traditional construction methods of a country. With sustainability in sharper focus, however, there is growing tendency to re-evaluate the extent to which local building materials can support sustainable construction practices and mitigate the effects on climate change and resource depletion caused by materials such as cement, concrete and steel that are characterised by energy- and carbon-intensive supply chains. This is particularly true in a Global South context, where most of the projected population growth and urbanisation will occur.

Existing studies on local building materials, however, do not provide extensive analysis of their use. This paper, therefore, examines the challenges to the use and awareness of the availability and environmental performance of local building materials in South Africa. Based on a literature review, a questionnaire survey was developed and then used to collect primary data from stakeholders in the construction industry. Structural equation modelling was then employed to validate the causality between the constructs. The study found that the negative impacts of the challenges to the use of local building materials significantly reduces if stakeholders are aware of their environmental performance in the South African context. We conclude that the use of local building materials (LBMs) will increase with a corresponding increase in awareness of their environmental performance and availability. Further, the acquisition of the technical knowledge associated with the LBM-based construction and the recognition of the use of LBMs in building specifications and regulations also require parallel development to maximise their uptake and the corresponding environmental benefits.

Given the central role that sustainable urbanisation plays in mitigating several of the global climate crises (resource consumption, sheltering, energy demand and GHG emissions – to name but a few) this paper aims to contribute to the ongoing understanding of sustainable use of resources from in the African context. As such it contributes to several Sustainable Development Goals (SDGs) and their targets: SDG 9.4, SDG11.3, SDG11.6, SDG12.2, and SDG13.3.

10. Special Themes

10b. Sustainable development in Latin America

Abstracts

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Democratizing organizations: worker participation in strategic decision-making

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Abstract

Democracy is an essential element in building greater transparency and participation by the general population. Considered as elements belonging to society, organizations also combine political elements in the relations between the most diverse social actors, demonstrating the need for democracy in strategic decision-making. As a way of identifying which elements are preponderant for the identification of organizational democracy, a survey was proposed through questionnaires with 80 Brazilian workers using a form made available on social networks during the period from October to November 2020.

It can be considered that companies, as well as society, are organized through power and political relations to characterize decision making (Clegg, Kornberger, and Pitsis 2016). Cleeg et. al. (2006) demonstrates that organizational political models are constructed of political antagonisms that cannot be hidden, and it is necessary to identify the political performance of organizations in order to consider them as democratic or oligarchic.

Recent types of self-managing organization such as cooperatives (Borges, Scholz, and Cargnin 2015; Forcadell 2005) or participation in the production process (from Munck and Ferreras 2013) demonstrate that there are possibilities for new perspectives for organizational democracy, leading to the possibility of organizations apply such a model, regardless of the market in which they operate. However, there is no specific model of organizational democracy considering the power relations and the political character of organizations (Alvesson, Bridgman, and Willmott 2009).

Using the mentioned research from 23 variables obtained from the polyarchy model (Dahl 2002) and organizational political performance (Clegg, Courpasson, and Phillips 2006), six major factors responsible for the generation of organizational democracy were identified, being Expression (possibility internal debate and perception of individualization), Direct Participation (hiring by knowledge and decision by vote), Leadership (distance from the leadership and aspects of individual decision), Power (concentration of power by the immediate leadership), Empathy (if put in the other's place at the time of hiring) and Collective Participation (deliberate decision making).

Making decision-making within organizations more participatory offers the possibility of gaining more space for collective bargaining and associations, going beyond the union model currently employed, enabling the safeguarding of workers' rights, especially women, giving voice to the notorious strategic decision making dominated by men, being linked to the SDG+ Target: 8.8.2. Also enabling greater organizational democracy facilitates a more effective approach to sustainability by avoiding decision making based solely on the predatory profitability of the natural and / or social environment.

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Efficiency analysis applied to multimodal infrastructure investment projects for soy transportation in Brazil

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Dr. Fernando Vinícius da Rocha

Abstract

The demand for investments in transport infrastructure is evident in Brazil, especially in the agro-industrial sector. There is also a growing concern with the Brazilian territory's sustainable development to consider impacts in the economic, environmental, and social areas. The relationship between these three concepts of analysis is also an essential issue in the academic literature - in many cases, based on the application of multicriteria analysis methodologies. This work aims to analyze investment projects in multimodal transport infrastructure for soybean haul in Brazil - a total of 26 selected projects. The projects' impacts were simulated based on a model for minimizing transport costs in the soy transportation chain (Network Equilibrium Model), considering the transport operations between producing locations and consumer markets (domestic and international). The potential for cost reduction, the transport CO_2 emissions, the soybean physical losses during transport operations, the potential increase in the regional Human Development Index (HDI) due to cost reduction, and the area of influence of the projected infrastructure are some of the results obtained through the application of this model. Stretches of the Ferrogrão project have the highest potential for cost reduction and carbon dioxide emission reduction. The Malha Norte railroad expansion project and a section of the Ferrovia Norte Sul (FNS) project in the country's southern states have the lowest physical losses during the soybean transport operations. The Ferrovia Norte Sul has the most significant social impacts. Additionally, we used Data Envelopment Analysis (DEA) to compare the sustainability of the projected investments based on the economic (cost of the project, potential for cost reduction, and total cargo loaded by the projected infrastructure), environmental (CO_2 emissions and physical losses in transport operations), and social variables (project influence area and its potential impact in regional Human Development Index) - constant returns to scale (CCR) and variable returns to scale (BCC) models. The result of the BBC model shows that the most efficient projects among all the cases are: (1) the investments toward the expansion of Malha Norte railway until Sinop (Mato Grosso State) with an efficiency score equal to 100,00%; (2) the expansion of Malha Norte railway until Sorriso (Mato Grosso State) - 99,83% of efficiency; (3) the investments in the viability of a waterway stretch from Marabá (Pará State) to Barcarena Port - 99,04%; and (4) the joint investments in stretches of the FNS and the

Ferrovia de Integração Centro-Oeste (FICO) - 98,67%. The CCR model results highlight two scenarios related to the Paraense railway and the Marabá waterway as the most efficient projects - 100,00% and 92,14% of efficiencies. Those mentioned projects should be the priorities in developing an investment infrastructure transport plan for the Brazilian soy production and marketing chain. We highlight that such a combination of analysis methods (Network Equilibrium Model and Data Envelopment Analysis) is valid for the proposed evaluation. It adds crucial subsidies to the decision-making process of public agents.

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Selection of renewable energy source for Brazilian Navy´s organizations through the AHP-TOPSIS-2N multicriteria method

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Abstract

The Armed Forces are permanent national institutions, as provided for Article 142 of the Brazilian Federal Constitution (1988). So, their facilities also tend mostly to remain in the same places for prolonged periods. Considering the diversified Brazilian energy potential, it is evident that the country has conditions to explore the most diverse types of sustainable energy generation. Renewable energy sources have as a great advantage the use of recurrent phenomena of nature as an example the incidence of sunlight, winds and the flow of rivers, but in contrast, current technologies and the generation of electricity in high quantities have as their initial barrier the cost of installation. In this context, the objective of this article is to advise on the choice of a renewable energy generation system to be installed in the Military Organizations of the Brazilian Navy. Considering that sustainable development depends on three components - economic, social and environmental sustainability - and that they need to be arranged, this study considered the wide use and consequent budgetary impact of electricity consumption combined with the growing importance that the concept of sustainability gains in society, in addition to the benefits of renewable systems, presenting, as a result, the hierarchical options. Among the Multicriteria Decision Analysis (MCDA) tools, we applied the AHP-TOPSIS-2N method to analyze the alternatives. This method consists of the Analytic Hierarchy Process (AHP) and Technique for Order of Preference by Similarity to Ideal Solution-2 Normalization (TOPSIS-2N) techniques. The weights of criteria were attributed through research in specialized bibliography and interviews with civil and military Electrical Engineers. In the proposed analysis, we compared to wind and photovoltaic generation systems. After applying the AHP-TOPSIS-2N method, we obtained a projection of expenditures throughout the life cycle of the power generating system compared to the projection of expenditures on electricity in the current model. The importance of this study is justified by the fact that renewable energy sources are not properly exploited in Brazil, despite the energy wealth available in the country. As a result, the photovoltaic system was considered more relevant, presenting a payback after 5 years, and a profit of 5 times greater than the conventional system in the 25 years following the installation, while the non-option for the renewable system does not require an initial investment, but over the course of 30 years will only entail expenses. Notoriously, society will benefit through the national development of these technologies by gaining expertise and the possibility of serving as a model for other public or private institutions.

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Technical and economic feasibility study for the implementation of electric propulsion in passenger transport vessels of the Brazilian Navy

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Abstract

In the last decades, the economic development of the countries, especially the emerging ones, has been accompanied by the greater consumption of fossil fuels, considerably increasing the emissions of gases responsible for the greenhouse effect, thus intensifying the problems related to climate change and environmental pollution. Due to the growing concern about the impacts caused, these countries have been investing in the development of clean, renewable technologies and studying methodologies to incorporate the socio-environmental variable in making their economic decisions. In this context of economic development combined with the preservation of the environment, the adoption of electric propulsion in ships, whether combined with conventional diesel or implemented in a unique way, has been gaining relevance, establishing itself as one of the most attractive options in the naval environment. However, the decision to adopt new technologies to replace existing ones must be made cautiously, through studies that analyze its impacts in the environment where it will be inserted. Based on the above, in this paper, we applied the Analytic Hierarchy Process (AHP) and Simple Aggregation of Preferences Expressed by Ordinal Vectors - Multi Decision Makers (SAPEVO-M) multicriteria methods, to analyze the technical feasibility and cost-effective way to apply electric propulsion technology using lithium-ion batteries (Li-Ion) for energy accumulation in vessels that carry passengers for the Brazilian Navy. These vessels daily transfer students, civil and military servants to the Admiral Wandenkolk Instruction Center (CIAW), wherein normal routines there are about forty daily crossings and Sunday crossings (weekends and holidays), around fourteen, generating an average monthly consumption of four thousand five hundred liters of marine diesel oil. For the analysis, we collected technical data and operational characteristics of these vessels, requested commercial proposals from companies in the sector. Through interviews with the military personnel responsible for the vessels, we defined the main criteria for the analysis of the propulsive systems: Cost of Implementation, Cost of Operation, Social and Environmental Aspect and Total Gross Mass, being assessed in the light of the aforementioned multicriteria decision support methods. As a result, the study verified the technical and economic feasibility of equipping the proposed vessels with a purely electric propulsion system, which in addition to promoting a substantial reduction in operating costs, is in line with the socio-environmental development. The study may serve as a basis to promote this technology in other vessels in the various districts of the Brazilian Navy, as well as in other sectors and applications in the naval environment.

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The effects of environmental performance on competitiveness and innovation: A stochastic frontier approach

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Abstract

The main sources of input for an economy are environmental and natural resources, especially in biodiverse countries. Given this, such resources are associated with competitiveness and efficiency in that natural resources are a factor for production that affects productivity and growth. Moreover, changes resulting from natural resources becoming scarcer must be anticipated to prevent a decrease in competitiveness. Within this context, analysing competitiveness and its relationship to environmental performance is critical, especially for emerging economies with high levels of biodiversity, as a means to promote environmental care, prevent environmental damage and to improve competitiveness. This study evaluates the effects of environmental performance on competitiveness by applying a stochastic frontier approach, the World Economic Forum's global competitiveness index and various environmental variables, and in turn, it elucidates how environmental performance affects competitiveness in Colombian regions, which are characterised by economic and social disparities. The results of this study highlight the importance of environmental performance on increasing competitiveness. Improved environmental performance should lead to an increase in competitiveness. It is important to mitigate regional disparities through the use of political instruments that promote adequate environmental measures and that consider competitiveness and innovation to promote sustainable development and the responsible use of natural resources. The findings of this study will be critical to the design of adequate instruments that consider environmental performance and competitiveness as key elements in promoting sustainability, growth and welfare in Colombian regions.

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Cities as career drivers: innovation ecosystems, sustainability, and development in urban centers

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Dr. Janaina Macke

Abstract

It is known that high levels of human capital are a key element for sustainable development. Cities and innovation ecosystems are spaces that foster different capitals and can act as positive drivers for the development of human capital, including work and careers. The general context, however, is often seen as a detrimental factor for career development, especially in countries that are not part of the WEIRD group (“Western”, “Educated”, “Industrialized”, “Rich” and “Democratic”). Labor markets and workers are often forced to operate in conditions of persistent adversity. Such challenges are faced by many Latin American countries, highlighted in general indicators that reflect low education level of the population, low workforce and organizations productivity rates, and constant highs unemployment rates. A non-virtuous cycle is created, contributing negatively to individual trajectories and the circulation of practical knowledge. It impacts development promotion and improves the quality of life at local, regional, and national levels in a broader way. Since ‘work’ is placed at the center of development discussions and can be seen as a vital issue to innovation ecosystems, investigate the interrelationship between these elements can contribute to scientific, technological, economic, and welfare development in the medium and long terms. Thus, this research aims to promote a theoretical articulation between the concepts of careers, cities, innovation ecosystems, and sustainable development. To achieve the

general objective, We analyzed cities as career drivers state-of-the-art and identified key elements, trends, and research gaps relating to innovation ecosystems, sustainability, and development in urban centers. A systematic literature review was carried out using the Web of Science database. By using the keywords (and correlates) “career” and “city” and “sustainability”, “innovation”, “livability”, “smart cities”, “human capital”, “talent”, “employability” and “attractiveness”, the refined search results in a corpus of 45 scientific articles published between 2001 and 2020. Data analysis occurred through content analysis tools and statistical processing of the paper’s abstracts by the Iramuteq software, version 0.7 alpha 2. The results showed four categories that comprise 82.12% of the corpus’s elementary units (e.u.). The first category (27.1% of e.u.) grouped studies on the creative class and cities’ attractiveness. The second brings the perspective of the labor market, particularly the effects of immigration on communities and cities (29.3% of e.u.). The third brings the phenomenon of expatriation, the organizational context, and the barriers to building the career and workers’ identity in unknown territories (15.1% of e.u.). The fourth and final category addresses the relationship between careers, cities, and universities, particularly students’ role as social actors in building local development (28.5% of e.u.). This research provides an integrative approach to understanding the links and dynamics between different socio-ecological systems. By adding the discussion about careers to the debate on ecosystems of innovation and sustainable development in cities’ circumscription, we argue that this research can fill gaps already identified but still treated separately in different fields, contributing to the development of integrated policies and interventions.

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Responsible Tourism: framework proposal based on the experience of the Social Service of Commerce in Brazil.

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Abstract

Tourism sector has been showing 4% of growthing, which made it responsible for approximately 10% of global GDP. Covid-19 pandemic breaks this growth, although, as soon as the pandemic is controlled, tourism is expected to return to the growth. Data on this paper were collected before the pandemic, representing a tourism growthing scenarium and its potential to increase positive and negative impacts on society. The resulting consequences on destinations make it important to study sustainable alternatives to mitigate the negative impacts and intensify the positive ones, focusing on the quality of life of the resident and the value generation for the organizations. This article aims to develop a framework based on the identification and analysis of the Responsible Tourism dimensions through the case study of the Social Service of Commerce (Sesc), a large Brazilian company in the tourism segment that is nationally representative and creates, commercializes, and operates tours and excursions. The study has a quantitative approach: questionnaires were applied to the organization's employees, based on Goffi, Masiero and Pencarelli's research (2018), using seven-point Likert scales. The data were subjected to descriptive statistical analysis, factorial analysis using PCA (Principal Component Analysis), verifying the Kaiser-Meyer-Olkin (KMO) index sample suitability, and confirmation of the internal consistency of the variables through the Cronbach's Alpha. The results, observed through the lens of responsible tourism, showed that the most expressive dimensions were: socio-cultural responsibility (participation and local cooperation, engagement of residents and local businesses); environmental responsibility (use of sustainable accommodation and transport, monitoring of environmental impacts and reduced tourism groups); economic responsibility (encouraging purchase from local producers and use of local labor); image and reputation of the organization (marketing, reputation, and competitive advantage) and incorporation of sustainability into management (sustainable management and perception of quality). The inclusion of residents as active and remunerated participants and the maintenance of the educational attribute as a transversal axis to clients' tourism activities contributed to raising the averages of the dimensions. On the other hand, the difficulties in measuring the impacts of tourism activity and the high costs of sustainable transportation and lodging equipment influenced them

downwards. The framework designed from the empirical results of this study recognizes the complexity of tourism activity and contributes to its responsible management, also establishing a relationship with Sustainable Development Goals (SDG's) 8 and 11, with special attention to the SDG+Target: 8.9 and 11.a. The study provides empirical and theoretical bases to accelerate the progress of these SDG's in times of crisis, as it can help the evolution of the elements on which it is based, that is, the principles of responsible tourism and its value as a support for the development of destinations, tourist organizations and people, from a practical application model.

Keywords | sustainable tourism, stakeholders, social responsibility, tourism management.

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Gender, intersectionality and sustainability – controversies and tensions on women representation in current Brazilian advertising. A socioeducational point of view.

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Abstract

This article explores the gender representation subject in current Brazilian advertising highlighting the maintenance of reductionist, unqualified and excluding symbolic appropriations of the women in social, political and cultural context. Sustainability is understood on its widest meaning, which gender discrimination overcoming turns to be an essential element to the building of a fairer, more equal, harmonical and honest society.

It is highlighted, from this context, that mediatic and marketing productions contribute to the building of imaginary and social representation of the companies sustainability and social responsibility, with its ways of thinking and practices. Therefore the sustainable communication may have qualified and criticizing information, participative dialogue and commitment to promote new practices, trustworthy relationship and active behavior from the companies, according to the new demands and expectations imposed on marketing. Women representation becomes this scenario intersectionality which aims new equal and inclusive approaches.

The advertising agencies have an important role on this speech field as their social range and legitimately enable them proposals on public context, which might question the limits of the ways of production and current consumption unsustainability. They also point out to the lack of sense gaps between the companies speech and practice. Advertising and merchandising are not able to create new values and social meanings. What they do, in fact, is making these elements known by visibility also promoting, disqualifying or condemning and updating them within daily communication and consumption practices. Though, these events do not have a less social importance. On the contrary, they have a remarkable ability to collectively influence either habits, goods and services consumption patterns or the building of imagination, sensibility and contemporary subjectivities. The marketing communication is more and more stimulated to promote the citizens awareness facing the huge current problems, modifying several behaviors and intentions.

The article debates the current advertising role on the context reversion of gender discrimination from two perspectives: i) from outside to inside, in civil society context, and ii) from inside to outside, according to the companies and the people from their marketing communication. The methodology procedures of this research refer to a systematic review of qualitative and quantitative studies and researches about the theme, accomplished by different Brazilian institutions along the last ten years. The findings point out to the needs, demands and opportunities of pragmatical changes in the formal teaching and the practice of Brazilian advertising creation, suggesting new creative approaches for a responsive communication, specifically nonsexist, in this case.

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Colombia and Venezuela border, between diversity, inclusion and equity that Latin America requires. Contributions from public relations and communication management.

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Abstract

In Latin America, economic inequality, social discontent, and apathy about politics increase the risks of inequality and respect for diversity. However, as stated by the Economic Commission for Latin America and the Caribbean, the COVID-19 crisis must be transformed into an opportunity to strengthen care policies in the region, from a systemic and comprehensive approach (CEPAL, 2020). Latin American public relations practitioners must take an active critical role in this post-COVID-19 transformation process.

According to the latest Latinobarometer survey (2018), in the 23 years of the research on citizens' perception of progress in their countries, never before has there been such a low perception (20%). In addition to this, or as a consequence of this, there are increasing manifestations of distrust in governments, disbelief in democratic systems due to corruption - as well as lack of action to curb unemployment - and citizens express apathy or even support for autocratic positions.

This chapter will review this situation of risk to inclusion, equity and diversity by comparing information between Colombia and Venezuela, especially in the conditions of the management of constant migration on the border between the two countries.

The methodology is qualitative with a critical analytical approach; decrees, policies and laws in Colombia that have been issued for the attention of the migrant population have been reviewed. With analysis in Atlas TI, categories of analysis have been identified and have been submitted to triangulation with interviews, documents and two cases of analysis.

We have reviewed the policies of the Colombian government showing the risk situation in the topics: inclusion, equity and diversity comparing information between Colombia and Venezuela, especially in the conditions of constant migration management in the border between both countries. The opinions of 10 professionals: 5 from Colombia and 5 from Venezuela, report on the limitations from the public relations management of the organizations to influence these policies. Two public relations campaigns have been analyzed to identify the strategic messages and values they promote.

This paper considers the special topic of the call for papers: 10.b Sustainable Development in Latin America: “Reduce inequality within and between countries" and goal 10.7 "Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies". (Access:

https://www.un.org/sustainabledevelopment/es/inequality/ and
www.un.org/sustainabledevelopment/es/inequality/)

Full papers

The case study of a biokerosene and renewable platform in Brazil: an alternative to reduce the crisis caused by the inequality virus

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Abstract

Brazil is an emerging country with continental dimensions and an abundant nature, however the ability to implement clean energy in this vast territory is still far from possible. The use of technology, in line with sustainable development, gave rise to the objective of this research - to present a case study of clean energy related to the production of biokerosene in the city of Juiz de Fora, Minas Gerais, Brazil, through partnerships between the public authorities, universities, private companies and civil society organizations. In addition to being renewable energy, biokerosene uses cooking oil as its main source, which is reused from leftovers obtained in university restaurants, snack bars, fast food chains and in homes. Biokerosene will be used in the municipality's public fleet, contributing to environmental, social and economic terms. It can be said that in this case study, eco-efficiency is a key aspect, as it promotes the reduction of material consumption and less environmental pollution (WBCSD / UNEP, 1998). UNESCO's Sustainable Development Goal 7 (2021) must produce affordable and clean energy, produced to ensure reliable, sustainable, modern and affordable access to energy for all. This research addresses the scope of SDG 7, with citizens with a ticket at a fair price, the environment that will absorb less pollution and companies that can make public transportation at a lower cost possible by obtaining their gains and keeping tickets at an attractive price.

Keywords: Brazil, Sustainable Development Goal 7, Clean energy, Case study.

1. Introduction

A better world, with more equality, justice and environmental protection. An objective and sincere statement, however, has been shown complex and difficult to be achieved globally. Different social institutions, governments and public and private organizations address the topic of Sustainable Development (SD) from different perspectives, in view of their directions and realities. In this research, based on the 17 Sustainable Development Goals (SDGs, 2015) proposed by the United Nations (UN, 2015), the topic of clean and sustainable energy will be especially treated, which provides structure to the UN SDG 7.

SDG 7, affordable and clean energy, was created to guarantee access to cheap, reliable, sustainable and renewable energy for all nations, regardless of the social or economic class of individuals. Like the other SDGs, this one has as its final focus the quest for poverty reduction and also seeks to give attention to the protection of the environment. Energy is present in everything in human life, whether it is to feed, move, work and educate. The 17 SDGs (figure 1) created to promote a better world with more equity between people and more balance between environmental, social and economic, were the alternative formula found by the UN and UNESCO (United Nations Educational, Scientific Organization and

Culture, 2021) with the purpose of implementing the named 2030 Agenda, proposed at the Rio +20 Meeting, a conference held in Rio de Janeiro, Brazil, in 2012.

Figure 1. Os 17 ODS da ONU.

Source: UN (2015). Available at https://brasil.un.org/pt-br/sdgs, accessed on March 29, 2021.

Each of the 17 SDGs has its goals and indicators related, respectively, which must be completed by the year 2030, according to the UN forecast (2015). In this context, each UN member country maintains a control schedule to manage the implementation of the goals of each SDG. It is observed that, although each SDG has its specificity well attributed, all objectives are related to each other, that is, the success of one SDG is linked and based on the success of the others.

Regarding SDG 7, UNESCO, being the official representative that promotes education for SD as the UN leader, is concerned with the implementation of the global action program (Global Action Program - GAP, 2015). The GAP, among other functions and objectives, aims to support developing countries, such as Brazil, in the expansion of educational activities related to sustainability, including teacher training and the availability of teaching materials dealing with all the 17 SDGs.

According to the UN (2015), SDG 7 has the following goals: (7.1) by 2030, ensure universal access to affordable, reliable and modern energy services; (7.2) by 2030, increase substantially the share of renewable energy in the global energy mix; (7.3) by 2030, double the global rate of improvement in energy efficiency; (7.a) by 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology; and (7.b) by 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small islands

developing States, and land-locked developing countries, in accordance with their respectives programmes of support. In SDG 7, there is an urgent need to migrate the current energy system to a more sustainable and renewable, efficient and non-polluting model.

Unfortunately, the reality of the world energy matrix is not predominantly renewable and sustainable. At the present moment, among many other sources of energy, fossil fuel is the most widely used to supply vehicles, airplanes and industries. Highly polluting in the way, it is used globally, petroleum and its derivatives, such as gasoline, diesel oil and others, are products that are noxious to humans and lung diseases causing, in addition to being also harmful to the environment (Rokko and Renkes, 2020). According to the International Connection (2018), when it comes only to the supply of fossil fuels, specifically gasoline and aviation kerosene, both being produced by oil, the expected demand by the year 2025 is 14.4 million tonnes, promoting an increase in pollutant gas emissions.

According to Achinas et al (2021), the use of biokerosene has already been proven, however, in terms of final price value, other fossil fuels have a lower production cost. For the authors, the supply of biomass raw material reduces greenhouse gas emissions, and thus, production and commercialization in scale is essential, so that biokerosene can be competitive.

In Brazil, in view of the commitment to reduce emissions by 37% by 2030, according to the agreement signed at the 21st Conference of the Parties on Climate Change (COP 21), there is a movement on the part of the Federal Government to increase production and the consumption of biofuel, which is based on vegetable oils and animal fat, to be used in passenger vehicles, buses, trucks and even in civil aviation.

Owing to the Brazilian scenario and the UN SDG 7, the present investigation had as its central objective to present the case study of the implantation in Brazil of a mini biokerosene plant, as a viable case when creating clean and accessible energy, for through partnerships between government, public authorities, universities, private companies and civil society organizations.

2. Methods

This research is exploratory and qualitative in nature, using the case study as a method. According to Yin (2001), the case study is a scientific investigation tool used to understand processes that occur in society, whether for problematic or successful situations. In the case of this research, the case study of a mini biokerosene plant was chosen to understand how the implementation of a clean energy proposal takes place, and thus, it is possible to disseminate and communicate this sustainable model, which can serve as a basis for other clean energy deployments in Brazil and worldwide.

This biokerosene mini plant project was feasible through a partnership between some institutions, and a cooperation and donation term was formalized. The Federal University of Juiz de Fora (UFJF, 2020)

provided the space and human and material resources to enable the arrival and construction of the mini biokerosene plant. The UFJF provided a team of Exact Science researchers to the project. The British company Green Fuels participates with the technology and the shipping of the mini biokerosene plant, to be assembled at UFJF. The biodiesel processing unit will be installed in the area of the Integrated Center for Education, Research, Extension, Technology and Culture Transfer (CIEPTEC-UFJF Norte) in the Industrial District of the city of Juiz de Fora.

In the case study, data collection occurred in a qualitative way, using a semi-structured script with the interviewees, who are the subjects of relevance to the research (Godoy, 1995). The interviewees' statements were made according to the content analysis (Bardin, 2008), in which the analysis categories were highlighted, which were based on the goals of SDG 7.

The semi-structured script was developed based on the five categories to be analyzed after the interview. Table 1 shows the categories, the pre-question context and, finally, the questions asked.

Table 1 – The analysis categories and questions in the semi-structured script

Categories (Cat)		**Pre-question context**	**Open questions**
Cat. 1	Affordable and clean energy	The first goal of Goal 7 - Affordable and Clean Energy is, by 2030, ensure universal access to affordable, reliable and modern energy services.	Why was the city of Juiz de Fora specifically chosen to receive this bioprocessing plant?
Cat. 2	World energy mix	We know that the world energy mix is unfortunately not predominantly renewable and sustainable and, therefore, target 7.2. of the UN SDGs aim to substantially increase this share.	How does the Zona da Mata Biokerosene and Renewables Platform contribute to this perspective?
Cat. 3	Global clean energy rate improvement	In line with the need to double the global rate of improvement in energy efficiency by 2030 (target 7.3.), Brazil is an emblematic case in view of its abundant natural resources.	What do you think about this statement?
Cat. 4	Clean energy and partnerships and cooperation	Extrapolating this characteristic of the country, the implementation of the Platform was possible by a partnership between UFJF and municipal government and Green Fuels and the British Government, as recommended by goal 7.a. (enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology). Later, there was also the Institute's cooperation proposal with the objective of contributing to the operationalization of the Platform and to the quality of the research to be realized through the adoption of technology.	What is the importance of connecting these actors for a project of this magnitude?
Cat. 5	Structural and technological expansion of clean energy	Goal 7.b. traverse with expanding infrastructure and upgrading technology for supplying modern and sustainable energy services for all in developing countries.	How can the population benefit directly?

Source: survey data (2021)

Based on the questions which represent SDG 7, it was possible to analyze the interviewees' statements, according to the following section.

3. Results and Discussion

Based on the UN as regards the content of SDG 7, clean and accessible energy, 5 interviews were conducted with 5 research subjects, who are involved with the case study, according to table 2.

Table 2 – Research subjects / interviewees

Abbreviations	Research subjects/interviewees	Position
E1	Adilson David da Silva	Head of the partnership project, PhD in Chemistry, professor at UFJF
E2	Ignácio José Godinho Delgado	Secretary of Juiz de Fora for Sustainable and Inclusive Development, Innovation and Competitiveness
E3	Marcus Vinícius David	Dean of Federal University of Juiz de Fora (UFJF)
E4	Manuel Thomson Flores	Chief Executive Officer of Green Fuels in Latin America
E5	Guilherme Oliveira	Creativity Director at Resoluta/Vivart Institute

Source: survey data (2021)

It is important to mention that all interviewees were willing to reveal their names and positions for the research. We chose to analyze each of the five categories in a unique way, according to the respondents' perceptions.

3.1 Category 1 analysis: **Affordable and clean energy**

The beginning of the semi-structured roadmap addressed the relationship between the first goal of SDG 7 - Clean and Accessible Energy, which states that by 2030, universal access to affordable, reliable, modern energy services must be ensured, and the reason why specifically the city of Juiz de Fora was chosen to receive the bioprocessing plant.

It is noteworthy that, from an embryonic perspective, the Biokerosene and Renewables Platform of the Zona da Mata Mineira was presented by the municipal government during the First Icao Stocktaking Seminar Toward the 2050 Vision for Sustainable Aviation Fuels, held at the UN headquarters, in Canada. By consolidating the initiative into a concrete mechanism for reusing used vegetable oil and converting *macaúba* (a native species of the Atlantic Forest, the region's biome) into sustainable innovation through a solid executive project (tangible, measurable and with a long-term perspective), pointed out, for example, projections of planting and recovered areas, production of biokerosene and investments. As a result, it was possible to verify that similar actions that were already being carried

out locally in the direction of the SDGs and especially the institution of municipal public policy of the "Juiz de Fora 2030 Program" also help to justify the fact.

> The National Platform for Biokerosene and Derivatives has existed since 2012 and the State Platform since 2014. Creating a regional platform, in 2018, was a way to accelerate the policy. From there, the Prosperity Fund and Green Fuels realized the consistency of the project and, from a Memorandum of Understanding, we evolved into a Cooperation Term for a research to validate the production of biofuel (E2).

The robust university environment in the city of Juiz de Fora and in the State of Minas Gerais provides a supply of human capital present through a network of Higher Education Institutions (HEIs), composed, for example, by the Federal University of Juiz de Fora. Fora (UFJF), the Federal University of Minas Gerais (UFMG) and the Federal University of Viçosa (UFV), focused on the application of multidisciplinary and complementary knowledge and the development of scientific research offer the necessary support to guarantee the technical quality of the execution of the work plan activities.

> Currently, Juiz de Fora has, in the energy field, one of its main graduate programs and one of its main research groups. UFJF also concentrates an ecology program that works with water resources and also with experimental research centers that even have a farm next to the main water dam in the region, carrying out studies in this direction (E3).

About the physical and logistical conditions and in the context of the implantation of the Scientific and Technological Park of Juiz de Fora and Region (PCTJFR), the Integrated Center for Education, Research, Extension and Transfer of Technology and Culture (CIEPETEC-UFJF Norte) also represents a great opportunity to enhance academic work and the connection with companies, governments and civil society in general. In addition, Juiz de Fora still shows itself as a propitious city to receive this type of movement considering its strategic location (between Belo Horizonte - capital of the State of Minas Gerais, Rio de Janeiro and São Paulo) and the medium size of the city, ideal for prototyping and project validation.

3.2 Category 2 analysis: **Global energy mix**

With regard to the global energy mix not being predominantly renewable and sustainable, and target 7.2. of the UN SDGs aim to substantially increase this share, consequently, the second question sought to explore how the Zona da Mata Biokerosene and Renewables Platform contributes to this perspective.

Even not actually working, the Platform itself reveals that the integrated efforts of Green Fuels (the company that owns and that ceded the machinery) and the Prosperity Fund (the British Government's international cooperation fund that supported the acquisition), in addition to the interaction with the Public Power (Government and HEI) already mentioned, are a promising path in this direction.

> The Platform's concept is from an integrated production and supply chain, from the root of macauba or used cooking oil to the use of advanced biofuels in aircraft turbines. The first step is to build this biodiesel operation, which has a capacity of one million liters per year, to supply the city and its municipalities, such as Empav, Cesama, Demlurb and UFJF. The objective is, in a distributed way and through clean energy, to take Juiz de Fora to reduce the carbon footprint and complement and fulfill the commitments in favor of sustainable development (E4).

Proving these assumptions and the Platform functioning, the city of Juiz de Fora may be known as an important living lab and vector of sustainable development and, thus, there will naturally be the attraction of other partners and technological routes, and the project may be expanded to other verticals, sectors and regions. Therefore, primarily, it is necessary to understand the implementation of the bioprocessing unit as a feasibility test for the possible solution, both from a technical and operational point of view.

> Affected by the COVID-19 pandemic, the price of new oil has increased and people are reusing the product more often, which decreases the volume of collection of used oil. So, more than institutional campaigns to raise awareness and disseminate the project (SDG Zero), we will need to mobilize civil society and involve organizations across the supply chain, showing that all parties are benefiting from the Platform (E5).

The responses indicated that, based on scientific or business theories and, respectively, the scientific method or the business model, the Platform can become a categorical example that it is possible to invest, develop and prove that innovative transformation technologies enable, in a sustainable way, the conversion of environmental liabilities into wealth and benefits to society from the use of new renewable raw materials, such as the recovery of the territory's vegetation and water sources, the improvement of local employability and the increase of the region's GDP.

3.3 Category 3 analysis: **Global clean energy rate improvement**

In line with the need to double the global rate of improvement in energy efficiency by 2030 (target 7.3.) and Brazil being an emblematic case in view of its abundant natural resources, the objective of the third question was to understand what could be done by the country to appropriate its full potential in this direction.

First of all, the importance of Brazil to the sustainability theme is notorious since, invariably, it will always orbit related discussions due to its exuberant natural conditions (reservoirs of freshwater and biodiversity, for example), whose international symbol is the Amazon, the largest tropical forest of the world. The case of Brazilian ethanol, produced from sugar cane, was also cited in the context of the country's global role on the topic.

> We have the potential to explore all possibilities: wind, solar, biomass, etc. There is still space, albeit decreasing, for the expansion of our hydroelectric matrix. The Platform project is innovative because it is based on the idea of distributed production, anchored in the concept of circular economy. It will therefore require a leaner infrastructure and, we hope, with a replicable model (E2).

Through the prerogative of orientation and impact of public policies, it was possible to verify that the Government must send measures that encourage and support the implementation of actions, projects and programs that contemplate the Sustainable Development Goals. In addition to the obvious allocation of resources for the pulp, it is necessary that the characteristics of each region of the country (considerably distinct) are valued in order to better locally use the natural resources of origin and that the existing national and international routes are considered for the formulation of coherent and effective regulatory devices.

> This will ensure a higher probability of obtaining on a large scale and competitive processes to further consider the environmental, social and economic impact on the journey (E1).

As the role of the Government is fundamental, it is mainly in terms of making the scenario attractive for other actors (HEIs, companies and civil society) to take advantage of these stimuli, as well, to participate in the process of creating solutions, not centralizing activities in the majority on itself.

3.4 Category 4 analysis: Clean energy and partnerships and cooperation

Extrapolating this characteristic of the country, the implementation of the Platform was viable by a partnership between UFJF and municipal government and Green Fuels and the British Government, as recommended by goal 7.a. (enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology).

Posteriorly, there was a proposal for cooperation from the Institute with the objective of contributing to the operationalization of the Platform and to the quality of the research to be realized out through the adoption of technology. The fourth question investigated the contributing factors and the advantages of this type of articulation and the interviewees' understanding was unified: complex problems, such as those on which the Platform is based, will only be significantly faced and permanently resolved with the integration of the quadruple helix (Government, HEIs, companies and civil society) and with a long-term perspective.

> Firstly, the municipal government working on a line of thinking about renewable energy alternatives that fit the logic of biofuel production. The municipality's project finds an echo within the University in several research groups that are contributing to the theme and then there is an association of an international company with a sovereign fund in that country, making investments to try to take this technology to developing countries and evaluate the viability of the success of this plant. The

> articulation was possible because all the components of the arrangement were with the same objective and the final secret was, at a certain moment, to appear something that gave a link and that connected all the actors and the interests of Juiz de Fora (E3).

The commitments of each signatory of the Cooperation Agreement were partially presented: transfer resources from the Municipal Environment Fund and monitoring the execution of the Work Plan (municipal government); execute the validation research on the use of biodiesel in replacement of fossil diesel, provide a place with adequate infrastructure to receive the installation, provide vehicles and equipment for testing the use of biodiesel and transfer resources that would already be used for the purchase of fuels (UFJF); assign and import the "Fuelmatic GSX 3" industrial unit (Green Fuels); apply and carry out the administrative and financial management of the transferred resources (Foundation for Support and Development to Teaching, Research and Extension at UFJF - Fadepe).

Likewise, the commitments of the underlying collaborative proposal (which is non profit) were also indicated: provide the used oil to supply the plant, implement a traceability and certification system for verifying the data and issuing reports for the UFJF's research and create a digital platform of incentives to encourage and stimulate good practices (Resoluta / Vivart Institute, Recicla Minas and Rhizom).

> The relationship to be established is not only one of supplying inputs, it is a partnership to collaborate with the feasibility and quality of the research. The proposal immutably guarantees the aggregation of data from the supply chain and the integrated visualization of the entire process, which gives transparency and greater reliability to the reports (E5).

The advantage of the articulation is that it gives the determining conditions for the accomplishment of any type of initiative in this context through the elaboration and execution of public policies, technical and scientific validation, allocation of resources and equipment and adhesion of the population (including the question was mentioned as a catalyst - or even a reagent - for the installation of CIEPETEC-UFJF Norte).

3.5 Category 5 analysis: Structural and technological expansion of clean energy

Category 5, as the last question in the semi-structured roadmap, sought to cover goal 7.b., which deals with expanding infrastructure and upgrading technology for supplying modern and sustainable energy services for all in developing countries, and how and when the population can be directly benefited.

Furthermore to the intention of executing a sustainable project, it really needs to be, and therefore, the validation research on the viability of the production and the quality of the biofuel through the operationalization of the activities, the test on bench engines and the utilization in the public fleet of UFJF and municipal authorities is a turning point. After this process, in which the Platform proves to be feasible and replicable, only then is it doable to proceed to the marketing study, where, based on the concept of reverse logistics and circular economy, and in total consonance with international events on

Sustainable Development, the population possibly will be able to discard the vegetable oil used to supply the machine and receive some kind of incentive from the government or partner companies.

> For Juiz de Fora, the biodiesel generated, initially based on raw material from used cooking oil, can be used in generators in the city, at the University, in the municipalities, being an immediate benefit. The idea is that from these next months this will become a reality within the city and that the path goes forward for green diesel (HVO) (E4).

It can be analyzed that, due to the modernity and magnitude of the project, the effort that is being placed on the Platform is pioneering and has great potential, but it is still not possible to guarantee that the population will benefit specifically and directly with the decrease in the fare of urban buses tickets, for example (although there are tax exemptions in this area that can reach up to 50% of the fuel price). Even the results listed earlier in this article are not confirmed and are, therefore, expected.

> For now, we can only say that we are trying to validate the quality of this fuel obtained by technology. I am the technician, the scientist who will study biodiesel in engines from a physical-chemical perspective. Now, the commercialization part has a whole group, including economists in the process, who will help us in this endeavor (E1).

In this way, solid waste would be, in large quantities and cheaper, converted into biofuel and could be used in any type of vehicle in the city and even in aircraft, provided that even more refined transformation processes are incorporated into the mechanism.

4. Conclusions

In this work it was possible to observe the presentation of the case study of the implantation of a mini biokerosene plant in Brazil, reaching its central objective. Such a case study proved to be feasible for the country to create an environment favorable to the generation of affordable and clean energy through partnerships between public authorities, Higher Education Institutions, companies and civil society. The municipal government and the Federal University of Juiz de Fora (UFJF), located in the State of Minas Gerais, Brazil, together with the British company Green Fuels and with the Civil Society Organization named Resoluta/Vivart Institute, structured the project and will make its execution viable.

Brazil is a country that has a high potential for creating clean energy, and, with the case shown here, it can be an inspiration for other initiatives. The partnership, very well mentioned in the UN's SDG 7, was evident to make the project possible. The narratives synthesized in the data analysis, pointed out that the research subjects, who represent the organizations involved, were at all times concerned with the environmental, social and economic issue, and as such, gave priority and converged in the sum of efforts, which proved to be effective even the prisms and responsibilities of each of the actors being different, as there was an understanding that sustainable development is the only way.

In addition to the solidity and financing of the project, the scientific perspective of technological, economic and environmental validation of the research and the geographic characteristics of the city of Juiz de Fora, it was realized that public policies and municipal regulatory frameworks were essential conditions to foster this small ecosystem of innovation around the Platform. In the case studied, the Government was responsible for igniting this movement, which started more than two years ago and which continued after the municipal elections and the change of management of the executive power.

It was found that, despite being extremely promising by different aspects, it is still necessary to prove, in fact, the viability of the operation, inseparable from the region's vocations and its comparative advantages. Initially, the project will produce biodiesel from urban waste as a way to validate the use of renewable fuel in the public fleet, being considered a first phase for the production of biokerosene, an advanced biofuel. Competitiveness and, consequently, the scale of the product, then, are inherent to the hypothesis of success, as well as the expectation, within the city, of the creation of new environments that promote innovation, the strengthening of the entrepreneurial culture and the attraction of capital.

In continuity, it was noted that the acceleration of digital transformation tends to decentralize technologies, locations and the actors' own performance, which can simplify and cheapen the activities of the supply chain. Therefore, it can also influence critical dimensions for the development of solutions to urgent global problems, such as human capital, financing, infrastructure, demand and incentives.

Thus, maintaining the environmental, social and economic bias, it is necessary to promote basic conditions, based on new conceptions of work organization and the dynamics of interactions between the first, second and third sectors, for the establishment of an innovative ecosystem integrated with new technologies in order to improve people's quality of life.

As proposals for future studies in relation to the case study presented here, it is important to present the results of the partnerships of the institutions and organizations involved, as well as to mention specific aspects through environmental, social and economic indicators.

Finally, some critical points in the process, implementation schedule, institutional initiatives and bureaucracies for signing the partnership agreement, for example, reveal that there is a possibility of improvement in this type of involvement taking into account specific legislation.

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Sustainability and performance model of evaluation proposition for companies in the Brazilian electric sector based on multicriteria decision aiding and machine learning

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Abstract

This research aims to develop an evaluation model for electricity distribution concessionaires companies in Brazil, based on sustainability and performance indicators, aiming a company benchmarking. The proposed model is based on a multicriteria decision aiding with the Rough Sets Theory, which allows the mathematic treatment of inaccuracies originated from quantitative and qualitative measurements of the indicators. The indicators are extracted from Socio-environmental and Economic-Financial Responsibility Report, produced by each concessionaire company. Based on "decision tables" with condition attributes and decision classes from indicators and indexes, the decision rules "*if... then...*" are generated, in addition to the establishment of high, medium or low sustainability and performance classes. Furthermore, through Machine Learning, a subfield of Artificial Intelligence and classification algorithms, it will be possible to predict the sustainability and performance classes based on historical series of indicators. For each company a matching ordered pair will be formed "*class-performance, class-sustainability"*, to be pointed out in a "*Matrix of 9 sectors*". This positioning will always be relative (or normalized), that is, it will have as reference the companies best positioned or classified in the matrix. The benchmarking will take place throughout a historical series of indicators and indexes of sustainability and performance for a single enterprise, as it will in relation to unidentified competitors. As benchmarking results, the use of the proposed model subsidizes an enterprise in establishing its goals, in its development of action plans, in its control of indicators and indexes, and in managing risks. For the public manager, it becomes an opportunity to better understand the best practices of sustainability and performance of enterprises considered benchmark, aiming to elaborate and/or improve public policy of sustainable development for the electricity sector. In the future, data about the companies will be assembled in a World Wide Web platform, as a mean to support the proposed model.

Keywords: Sustainability, Performance, Evaluation Model, Rough Sets Theory, Machine Learning

1. Introduction

According to Pereira and Cândido (2020), the sustainable development and sustainability encompass interdisciplinary themes that are present in discussions of a variety of Science Fields, in both public and private organizations, non-governmental, and in society as a whole. Sustainability is related not only to ecological aspects, but it also relates to economic, political, cultural, social, time and space aspects, deeming it indispensable the creation of measuring instruments, such as sustainability indicators – "tools" composed by one or more variables that can be related to each other in many ways. Consequently, establishing goals and creating instruments are fundamental steps to make possible the measuring of corporate sustainability. There are many indicators' systems of sustainability being used in Brazil at the moment, such as: the Global Reporting Initiative (GRI) model; the Dow Jones Sustainability Index (DJSI); the Brazilian Institute of Social and Economic Analysis (BISEA); the Ethos model; and the Corporate Sustainability Index (ISE).

According to Paz and Kipper (2016), sustainability is based in economic, social and environmental dimensions, and are intentionally recognized as Triple Bottom Line (TBL) of a business' sustainability. The concept of TBL questions and ponders over the need for companies to base its strategic decisions in this tripod, where they will need to keep the economic sustainability of their business while managing for profit companies that generate value, and also a social sustainability stimulating activities linked to education, culture, leisure, well-being, and social justice of the community where the company operates. And all of this while keeping environmental care such as recycling and preservation programs, among other aspects. Furthermore, the TBL is a corporate index that also incorporates inter-relations between the dimensions of sustainable development: eco-environmental, eco-social, and eco-social-environmental, as shown on Figure 1.

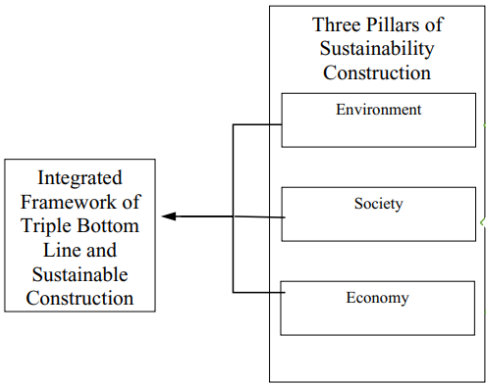

Figure 1 – Sustainability in its environmental, social and economic dimensions (adapted)(Goh et al., 2020).

Paz and Kipper (2016) also point towards many other models made to measure the sustainability in public and private organizations from a variety of fields: Pressure-State-Response (PSR)

(environmental dimension); Driving Forces-State-Response (DSR) (social, environmental, institutional, and economic dimensions); Genuine Progress Indicator (GPI) (social and economic dimensions); World Bank (social, environmental, economic, and cultural dimensions); Human Development Index (HDI) (social, economic, cultural, and political dimensions); the Barometer of Sustainability (social and environmental dimensions); Sustainability Panel (social, environmental, institutional, and economic dimensions); etc.

According to Franceschini et al. (2019), in the performance evaluation of an organizational process, two main activities are required: *a.* Definition of indicators: in this stage the indicators and data that will be relevant are defined; *b.* Decision: depends on the difference between the goal and the measured performance, and has three different actions: individual problem solution, incremental improvements and process re-engineering. This way, the measuring is essential for performance control and potential enhancements. Essential points to consider in the construction of indicators: *i.* the indicators must accurately represent a process; *ii.* they should be understood and accepted by process managers and employees; *iii.* they should be traceable and verifiable. Each indicator refers to a specific goal that can be understood as a reference (absolute or relative) for comparisons. Reference values can be derived from past experiences or even overlapped by benchmarking processes, which allow anticipation of potential problems related to the "gaps" between indicators and their respective goals. Furthermore, the indicators can be "unique", when representing a specific dimension, or "aggregated", when the process' dimensions (or part of them) are represented by a group of indicators that are frequently aggregated in other indicators (derivatives). According to Wu and Wu (2012), in order to reduce the number of indicators or to reflect integrations in a system, indicators are mathematically combined in order to produce "indexes" (two or more aggregated indicators), Figures 2 and 3. The indicators and indexes have been having a growing role in Science and in the practice of sustainability, although they incorporate a certain degree of uncertainty in the data collection and analysis (Wu e Wu, 2012).

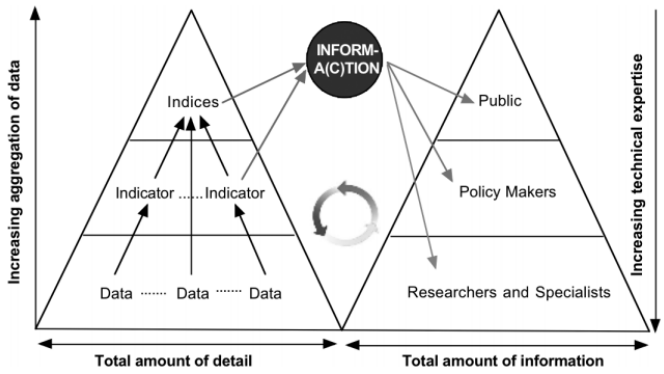

Figure 2 – Relation between data, indicators, indexes, and information for sustainability actions (Wu and Wu, 2012).

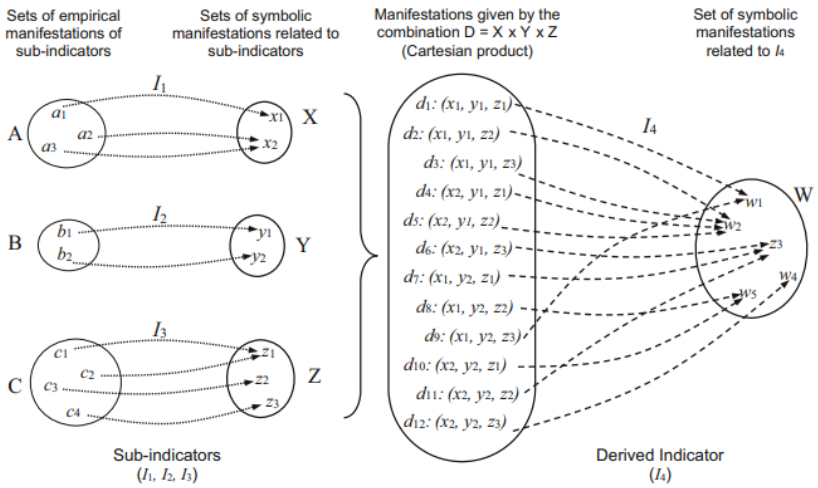

Figure 3 – Schematic representation of derived indicator (Franceschini et al., 2019).

The emphasis in identifying and usage of indicators predictively is relatively new. "Predictive indicators" are appropriate when the main interest is preventing problems from occurring instead of correcting them, for example, the financial flow throughout time (Franceschini et al., 2019). A classification proposition can be seen in Figure 4.

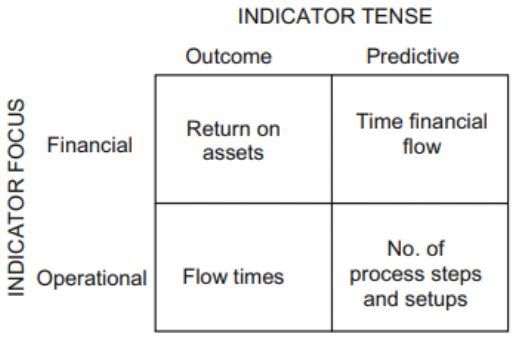

Figure 4 – Classification of indicators according to focus and time (Franceschini et al., 2019).

The matter regarding corporations' and institutions' need to perform benchmarking in sustainability *vis-a-vis* with the review of their business' models, products, services, processes, performance, best practices, inovations etc. is pointed by various authors: Knoepfel (2001), European Commission (2009), Nidumolu et al. (2009), Singh et al. (2009), Ramos and Caeiro (2010), Yigitcanlar and Dur (2010), Moriarty (2011), Hong et al. (2012), Campos et al. (2013), Lameira et al. (2013), Deng (2015), Paz and Kipper (2016), Feil et al. (2019), Ethos Institute for Corporations and Social Responsability (2018), CEMIG (2020), Pereira and Cândido (2020), PETROBRAS (2020).

For the electricity and energy sector, there are researches about the development of Global Sustainability Indexes for India's electricity sector (Deepthi et al., 2014); with the use of Data Envelopment Analysis (DEA), there are researches on the evaluation of efficiency and productivity indexes of electricity distribution concessionaires companies in Brazil (Goulart, 2013), and GRIs for

the Brazilian energy sector with the aim of evaluating its social, economic, and environmental sustainability (Sartori et al., 2017); framework proposal for the multicriteria evaluation of sustainability in energy systems, with the use of attributes from Triple Bottom Line, linguistics preferences and Fuzzy Logic (Hendiani et al., 2020); through multicriteria evaluation, with the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method, there are researches about the analysis of sustainability (economic, social and environmental performances) for the Brazilian energy sector (Caiado et al., 2017), and about renewable energy enterprise in a city situated in Greece, with the aim to obtain a classification/benchmark of these enterprises (Andreopoulou and Koliouska, 2018).

The use of the box matrix was used in the research developed by Shen et al. (2015), aiming to evaluate the sustainable urbanization (speed *versus* quality) with the application of the entropy principle (of thermodynamic), to a case study of a Chinese town. This research refers to the matrix initially developed by the Boston Consulting Group and, afterwards, improved by the enterprise General Electric in the 1970's, as a tool to analyse portfolios of products (competitivity *versus* attractiveness), as shown in Figure 5.

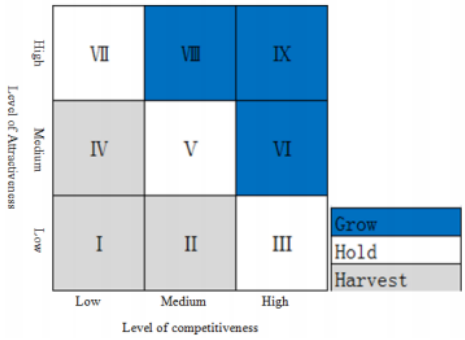

Figure 5 – Matrix for product portfolio analysis (Shen et al., 2015).

According to Lameira et al. (2013), in their research with 205 open Brazilian companies, throughout the period between 2005 and 2009, it was shown that the results were favourable to the establishment of association and discourse that defends that sustainability and better performance can and should be integrated in the process of seeking sustainable growth. Furthermore, ISO 26000 – Social Responsibility Guidance Standard (ABNT, 2010), establishes that "An organization can employ its influence over others to strengthen positive impacts in the sustainable development as it can minimize negative impacts, or even both". Among the methods proposed to exert influence is "promoting good practices". In September of 2015, the United Nations General Assembly, through the "2030 Agenda", established a collection of 17 global (Global Goals for Sustainable Development, SDG) (ONU, 2015). In that Agenda, related to Objective "12" – Ensure production and consumption sustainable standards, we can find the following: "Encourage enterprises, especially the large and transnational ones, to adopt sustainable practices and integrate sustainability information in their report cycle".

As for the national energetic sector, Pereira and Cândido (2020) present the numbers (and its respective descriptions) of corporate sustainability indicators reported by many authors and its respective dimensions (social, environmental, economic, and corporate governance) on Table 1.

Table 1. Quantitative of Sustainability Indicators for the Brazilian Energetic Sector

Authors	Social	Environmental	Economic	Corporate governance	Total
Amaral (2003)	18	10	7	0	35
Camargo et al. (2004)	21	38	7	0	66
Campos (2005)	16	20	11	0	47
Cipolat et al. (2010)	5	27	0	0	32
Grijó (2010)	40	30	9	0	79
D'Albertas et al. (2011)	7	6	4	0	17
Salles (2012)	14	8	9	0	31
Todeschini e Mello (2013)	20	18	9	21	68
Lugoboni et al. (2015)	45	31	9	0	85
TOTAL	**186**	**188**	**65**	**21**	**460**

Source: (Pereira and Cândido, 2020).

Consequently, the National Electric Energy Agency (ANEEL), through the Normative Resolution n. 605, from 11/03/2014, approved the Electricity Sector Accounting Manual (ESAM), where it was established that, among other goals, the contribution to socio-environmental performance optimization through explicit expenses generated by compliance with the Environmental National Policy, necessary for environmental compliance and sustainability of the concessions awarded by the Federal Union, aiming to elaborate the Socio-environmental and Economic-Financial Responsibility Report (RSA) (ANEEL, 2014, 2015). The ESAM correlates the quantitative indicators in comparison to the general dimensions, corporate governance, economic-financial, social and sectoral, and environmental for granted companies (generation, transmission, and distribution of electric energy) required and/or suggested by ANEEL, in addition to environmental performance indicators specific to generation, transmission, and/or distribution companies (ANEEL, 2015). The ESAM also mentions qualitative indicators (ex., corporate governance aspects).

Thus, regarding sustainability, it becomes necessary to have a multidisciplinary vision of the current problems and solutions. Regarding risks, for example, given its hybrid nature, an inevitable dialogue between bioecological and socio-anthropological perspectives is required (Silva Jr., 2013).

The contribution of this research is found in the proposed model to evaluate the sustainability and performance of electricity distribution concessionaires companies in Brazil, notwithstanding the existence of proposals and other models. However, the proposed model allows, through "benchmarking", for companies to make decisions regarding the need to establish or adjust goals, develop action plans, and enhance their work processes. It also allows the economic, social, environmental, and corporate governance management of risks through evaluations, simulations, and inferences. For the public manager, the opportunity to discover companies' best practices when

identifying those considered "benchmark" and using this knowledge as fuel to elaborate and/or enhance public policy of sustainable development for the electricity sector.

This research is currently divided in the following additional sections: 2, Theoretical Reference, divided into subsections, Multicriteria Decision Aiding (2.1), Rough Sets Theory (2.2) and Machine Learning (2.3); 3, Results and Discussions; 4, Conclusions and future research.

2. Theoretical Reference

2.1- Multicriteria Decision Aiding

The Multicriteria Decision Aiding can be defined as an activity for a decision-making analyst who, based on models clearly presented, but not necessarily formalized, aid in the acquirement of response elements to the questions of a decision-making agent throughout a process. These elements aim to clarify each decision and normally recommend it or simply favour it. It is a natural behaviour that increases the coherence between the process' evaluation and the system of values' goals in service of the decision agents who take a stand (Gomes et al., 2004; Gomes and Rangel, 2009a, 2009b). As "multicriteria decision", that which involves problems related to a finite set of objects (alternatives, actions, solutions, etc.) that can be evaluated by a finite set of criteria (attribute, characteristics, variables, etc.) (Slowinski et al., 2012).

2.2- Rough Sets Theory

According to Pawlak (1982; 1991), Pawlak and Slowinski (1994), Pawlak et al. (1995) and Slowinski et al. (2012), the Rough Sets Theory (RST) originated with Zdzislaw Pawlak, at the beginning of the 1980's, as a mathematic tool for data imprecision and uncertainty treatment. The approach that the RST provides is of fundamental importance to the Artificial Intelligence and Cognitive Sciences, especially in Machine Learning areas, knowledge acquisition, decision analysis, discovery of knowledge in databases, specialist systems, decision support systems, inductive reasoning, and pattern recognition. The RST does not compete with the Fuzzy Logic, with which it is often contrasted, but it complements it. In any case, these theories are independent approaches to imperfect knowledge. One of the main advantages of RST is that it does not need preliminary nor additional information about the data, as a probability distribution or a degree of relevance in the fuzzy sets theory. Information System is conceptualized as: K = (U, A), where U is a finite and nonempty set of objects; A is a finite and nonempty set of attributes, such that, a: U $\rightarrow$ V_a for every $a \in$ A, where V_a is the set of values that can be attributed to attribute a.

There is also a concept about "indiscernibility relation": given an information system (U, A) and to any $B \subseteq A$, an "equivalence relation" (or "classification", indistinctly) R_B is defined as (Riza et al., 2014) Equation (1):

$$R_B(x,y) = \{(x,y) \in U^2 | \forall a \in B, a(x) = a(y)\} \quad (1)$$

If $(x,y) \in R_B(x,y)$, then x and y have exactly the same values for the attributes in B. According to Pawlak (1991), it is not always possible to express exactly a set of objects with the available knowledge. Consequently, it is possible to express a set of objects by other two subsets: "lower" approximation ($\underline{R}$) and "upper" approximation ($\overline{R}$), given $X \subseteq U$ and a equivalence relation R, Equation (2):

$$\underline{R}X = \cup \{Y \in U | R: Y \subseteq X\}; \overline{R}X = \cup \{Y \in U | R: Y \cap X \neq \emptyset\} \quad (2),$$

where $\underline{R}X$ is the subset of U elements, that "certainly" can be classified as X elements; $\overline{R}X$ is the subset of U elements, that can "possibly" be classified as X elements. A "rough" set in relation to R, if and only if, $\underline{R}X \neq \overline{R}X$. From the concept of Information System (K = (U, A)), it is possible to obtain the concept of a "decision table": when A is formed by two subsets: C e D, condition and decision attributes, respectively, ($C, D \subset A$); or, T = (U, A, C, D). The classes of equivalence relations R_C and R_D are known as condition and decision classes, respectively. For each $x \in U$, we associate a function d_x: $A \rightarrow V$, such that, $d_x(a) = a(x)$, for every $a \in C \cup D$; function d_x is known as "decision rule" (in T) (Pawlak, 1991). According to Pawlak (1991) and Riza et al. (2014), we define "positive-B" region as the set of objects in U that certainly can be classified using conditional attributes B, Equation (3):

$$POS_B = \bigcup_{x \epsilon U} \underline{R}X \quad (3)$$

Furthermore, it is possible to compute the degree of dependence of the decision attribute in relation to the set of condition attributes B, Equation (4):

$$\gamma_B = |POS_B| / |U| \quad (4)$$

Therefore, a decision table A is considered consistent if $\gamma_A = 1$. According to Riza et al. (2014), a "superreduct" is a group of attributes $B \subset A$ such that $R_B = R_A$, where R_B and R_A are relations of indiscernibility defined by B and A, respectively. If this relation is minimum, it is a "reduct". The intersection of all reducts is a "core", of an information system. Slowinski et al. (2012) presents the Dominance Principle (*Dominance Rough Sets Approach*, DRSA): in case of ordinal classification, "object *a* has been assigned to a worse decision class than object *b*, although *a* is at least as good as *b* on all the considered criteria, i.e. *a* dominates *b*". Consequently, the relations of indiscernibility are replaced by "dominance relations" in the approximation of decision classes.

In Pawlak (2000), we can find an example of a decision table, Table 2. This table is comprised of six stores and four attributes (quantitative or qualitative aspects): E – salespeople autonomy; Q – quality of goods; L – localization with intense traffic; P – result (profit or loss). E, Q, and L represent condition attributes; P represents a decision attribute.

Table 2. Example - Six Stores

Store	E	Q	L	P
1	High	Good	No	Profit
2	Medium	Good	No	Loss
3	Medium	Good	No	Profit
4	None	Medium	No	Loss
5	Medium	Medium	Yes	Loss
6	High	Medium	Yes	Profit

Source: *(Pawlak, 2000).*

We can affirm the following: stores 1 and 6 made profit, stores 4 and 5 had a loss and stores 2 and 3 cannot be classified (as profit or loss), because they are indiscernible in relation to these attributes. Therefore, using attributes E, Q, and L, it is deduced that: stores 1 and 6 certainly made profit, that is, certainly belong to the set {1,3,6}; meanwhile, stores 1, 2, 3 and 6 possibly made profit, that is, possibly belong to the set {1,3,6}. The sets {1,6} and {1,2,3,6} represent, respectively, the "lower" and "upper" approximations of set {1,3,6}. The set {2,3} represents the difference between upper and lower approximation and characterizes the "boundary region" of set {1,3,6}. Potential rules extracted from the Decision Table (Table 2):

(E, medium) and (Q, good) → (P, loss)

(E, none) → (P, loss) (or if E = "none" then "loss")

(E, medium) and (Q, medium) → (P, loss)

Therefore, a decision rule in S is an expression $\Phi \rightarrow \Psi$, reading as if Φ then Ψ, where $\Phi \in For(C)$, $\Psi \in For(D)$, C and D are attributes of condition and decision, respectively.

2.3-Machine Learning

With the emergence of the *homo sapiens* (wise man), our mental abilities showed us how important they are for our daily lives and our sense of self. The Artificial Intelligence (AI) that, contrary to Philosophy and Psychology, that also worry about intelligence, makes an effort to build smart entities and understand them. The interdisciplinary field of Cognitive Science reunites computer models from the AI and experimental techniques from Psychology to try and build precise and testable theories about the way the human mind works (Russell and Norvig, 1995).

Machine Learning refers to the subfield of Artificial Intelligence that aims to create algorithms (finite sequence of operations) that allows computer softwares to learn with past data (Russell and Norvig, 1995). And as an example of instrument there is the "rules induction": condition-action rules, decision trees or similar knowledge structures (Langley and Simon, 1995; Pawlak et al., 1995). Therefore, computer software learn how to automatically recognize complex patterns and make decisions based in

data. For example, a typical problem of Machine Learning is programming a computer, so it automatically recognizes handwritten postal codes after learning from an assortment of examples. The Machine Learning are divided in: supervised (the case of classification; the supervision in the learning comes from the labeled examples in the training data set), unsupervised (the case of "clustering"; the learning process is unsupervised since the input examples are not class labeled) and semi-supervised (a combination of both prior models) (Han et al., 2012).

3. Results and Discussions

This research presents a conceptual model for the joint evaluation of sustainability and performance for electricity distribution concessionaires companies in Brazil, as demonstrated in Figure 6:

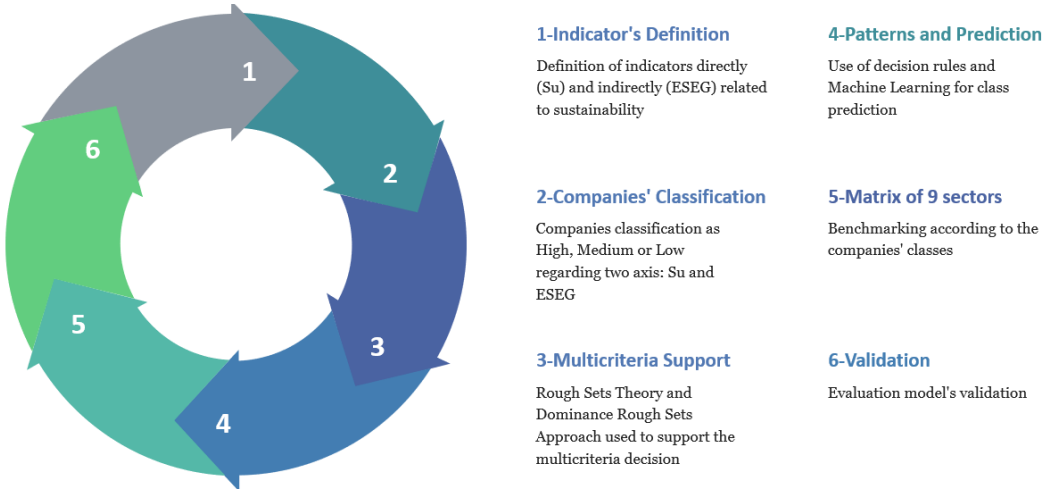

Figure 6 – Conceptual model for the joint evaluation of sustainability (Su) and performance (ESEG) for electricity distribution concessionaires companies. Source: research's authors.

Then, each step is described succinctly and aims to implement the proposed model:

a) Step 1: Indicator's Definition – it consists in the gathering and treating of quantitative and qualitative information through "text mining" using the KH Coder software (Higuchi, 2001; Zhai and Massung, 2016; Zizka et al., 2020), in the Socio-environmental and Economic-Financial Responsibility Report (RSA), according to the Electricity Sector Accounting Manual (ESAM) (ANEEL, 2015). The ESAM distinguishes the indicators "directly" related to sustainability ("Su", initials suggested by the research's authors) (column filled out with reference to the GRI/Sustainability Reporting Guidelines & Electric Utility Sector Supplement (GRI, 2000) standard), and those "indirectly" related to sustainability, but that also indicate a certain "performance" (economic, social, environmental, and corporate governance —

"ESEG", initials suggested by the research's authors) (GRI unfilled column). Examples of indicators direct and indirectly related to sustainability: total water consumption by source (m^3) (initials EN8, GRI standard) and aid and development policy for small and micro enterprises of supply, respectively. On March 2021, from a total of 63 (sixty-three) electricity distribution concessionaires companies, we collected 26 (twenty-six) financial RSA reports (ANEEL, 2021). RSA reports are annual, with demonstrations from the last three financial years. In relation to text mining, comprises the texts extraction and analysis about corporate governance (GRI, 2000; IBGC, 2015; Pereira and Cândido, 2020) constant in RSA, through KH Coder software's features: options ("Word") "Frequency list" (searched words and their respective frequency of occurrence), "Word association" (words strongly related to other words), "KWIC (Key Words in Context) concordance" (how searched words are used in text) and "Co-occurrence network" (a network with syntagmatic relations between words) (Higuchi, 2001; Zhai and Massung, 2016);

b) Step 2: Companies' classification – consists of obtaining the classes through sustainability indexes (InSu) or ESEG (InESEG). For each enterprise, there will be normalized indicators (variation from 0 to 1) in economic, social, environmental, and corporate governance dimensions. Each indicator value (v_i) was then normalized (v_{in}) and aims to obtain a percentage related to the maximum value found (v_{max}) (if indicator "gain"; the bigger, the better) or minimum (v_{min}) (if indicator "cost or loss"; the less, the better): $v_{in} = v_i / v_{max}$ or $v_{in} = 1 / (v_i / v_{min})$, respectively. This way, for each enterprise and for each indicator you find a relative position (%) to the enterprise that can be considered a "paradigm" in that indicator (that obtained the maximum or minimum values, according to the indicator's type – gain or cost, respectively). For each group of indicators of a same dimension (ex., social), there will be a corresponding index, calculated by simple arithmetic mean. At last, there will be a final index to be calculated by the arithmetic mean of economic, social, environmental, and corporate governance indexes in relation to sustainability. The procedure is similar to obtaining the "InESEG" index. Initially the low, medium and high classes are contained in the following intervals of index values (Su or ESAG): [0; 0.3333], (0.3333; 0.6666] and (0.6666; 1], respectively. There are three preference ordered decision classes: low, medium and high. However, it becomes feasible, too, the establishment of these classes through "clustering" and Rough Sets (Yu et al., 2014; Lingras et al., 2014);

c) Step 3: Multicriteria support – use of Rough Sets to verify (possible) "reducts" and "core" knowledge in the Decision Tables; because it is about indicators based on quantitative and qualitative measurements, and, quite likely, imprecisions will occur in these measurements, the application of RST along with the Dominance Rough Set Approach (DRSA), allow the mathematical treatment of these imprecisions for the considered universe of companies and

attributes, through identification of lower and upper approximation sets. It is possible to verify potential "reducts" and/or "core" of knowledge in the decision tables, that is, indicators that would have the same information value that the original group had. It allows for a possible reduction in the sustainability and performance indicators group (Pawlak, 1991; Couto and Gomes, 2010; Slowinski et al., 2012; Couto and Gomes, 2020; Karolak et al., 2020);

d) Step 4: Patterns and prediction – verification of patterns about indicators through decision rules ("if ..., then ...") (Pawlak, 1991; Couto and Gomes, 2010; Slowinski et al., 2012; Couto and Gomes, 2020; Karolak et al., 2020). Furthermore, through Machine Learning (and classification algorithms), it is possible to predict the Su or ESEG classes based on historic series of the indicators' absolute values (Han et al., 2012; Riza et al., 2014, 2019). These algorithms for generation (or inference) of rules are proposed by the "RoughSets" package (v. 1.3-7, 15/12/2019) in "R" (Riza et al., 2014, 2019). This library contains certain functions that make use of both the Rough Sets Theory and the Fuzzy Logic. The result of this prediction can be confronted with the result obtained by RST/DRSA to make a "sensibility analysis" of the results obtained – using the software jMAF (Dominance-Based Rough Set Data Analysis Framework) (Błaszczyński et al., 2013);

e) Step 5: Matrix of 9 sectors – elaboration of "benchmarking" (relative positions), related to the sustainability and ESEG classification of enterprises from the universe considered. For each enterprise, it will be formed a matching ordenated pair (ESEG Class, Su Class), to be pointed in the "Matrix of 9 sectors". This positioning will always be relative, that is, will always have as a reference the best positioned or classified enterprise in the matrix. This benchmarking can be done throughout a long, historical series of sustainability or performance indicators and/or indexes for a single company as well as in relation to competitors (unidentified). Figure 7 illustrates as an example the results to be obtained in the benchmarking, where "X" represents an enterprise under analysis in the face of its competitors ("•"). The sectors have the following meanings: green – indicates the highest classification (H, H) (benchmark); blue – represents enterprises with at least "medium" classes; white – indicates enterprises that have a "low" class; and red – represents the lowest classification (L, L). The distribution of graphic representation of the enterprises is random inside each sector, which means it does not depend on the final index's value (InESEG or InSu), considering that the most important thing is to know the region (sector) in which an enterprise positions itself in the face of its competitors. This benchmarking presents two goals: knowing if there are well-positioned enterprises (i.e., in the green sector) that can serve as benchmark, as well as knowing how much a certain enterprise ("X") is far from this benchmark. It allows an enterprise to establish goals and action plans, as well as distancing itself from minimal baselines (red or white sectors), aiming to mitigate (or eliminate) possible risks associated with its performance.

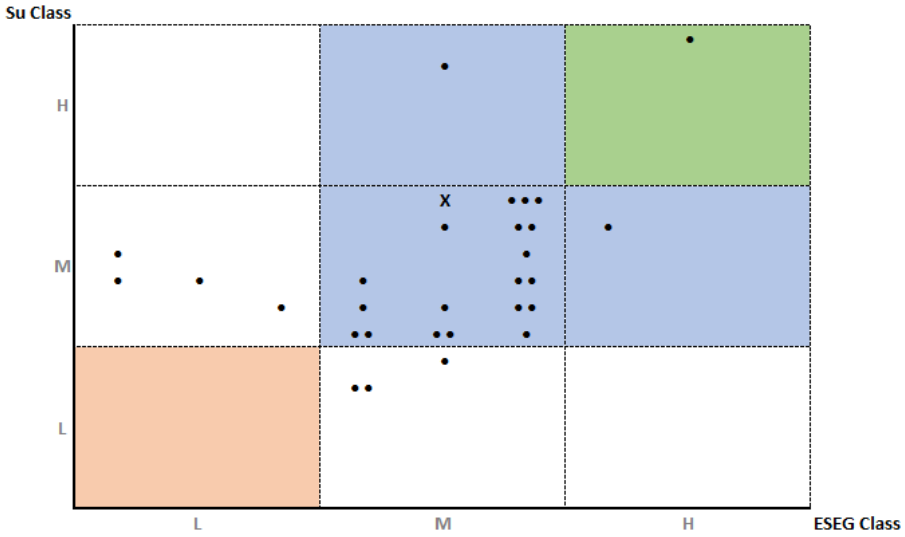

Figure 7. Matrix of 9 sectors: ordenated pairs (ESEG Class, Su Class). Source*: research's authors.*

f) Step 6: Validation – it aims to confront the results obtained in benchmarking with the evaluated enterprises. This way, it makes it possible to discover potential best practices adopted by enterprises from the green sector in the Matrix. For the public manager (ex., ANEEL), the knowledge of these practices can subsidize the elaboration and/or improvement of public policy in sustainable development for the electricity sector. Towards the end, as shown in Figure 6, the cycle of the proposed model reinitiates.

4. Conclusions e future research

However the importance the sustainability subject sparks all over the world, both in the government field as in the private sector, besides the academic, and, lately, almost in a permanent way through society in general, we can notice that the quest for the best way to monitor and control the impacts originated from development in its most expansive form. So, we are still using indicators and indexes that aid us in a way or another to measure the progress (or lack of it) that we achieved aiming to meet some pre-established goal. As an example, we can use the Human Development Index to measure progress in places in regards to life expectancy, schooling, and *per capita* income; the debt/GDP ratio to evaluate if it is worth it (or not) to invest in certain countries; the rate of Covid-19 transmission (*Imperial College* in London) to evaluate whether it makes sense (or not) to adopt restrictive measures of mobility in a certain region; ESG Index (environmental-social-governance) in order to evaluate enterprises and aid the investors with their decision-making; and Gini's Index, or Coefficient, to measure the level of income concentration; etc. Whether we want it or not, and somewhat limited, we

need to make use of indicators and indexes in decision-making in the most diverse circumstances and needs.

In this research's context, we tried to not simply look for the creation of another group of indicators and indexes. We looked for a specific context, electricity distribution concessionaires companies in Brazil, starting from a specific universe of quantitative and qualitative indicators, a proposal of an evaluation model along with performance direct or indirectly related to the enterprise's sustainability. This way, it allows a certain enterprise, keeping the analysis participant enterprises' privacy, to know their "relative position" among their competitors. It constitutes an opportunity to know best practices adopted by enterprises from the green sector of the proposed benchmarking. The knowledge of best practices for the public manager, for example, allows subsidizing the elaboration and/or improvement of public policy of sustainable development for the electric energy sector.

From another perspective, in possible support to the management of risks and, for undoubtable reasons of social and ethical responsibility of those enterprises, this model tries to give the private manager and the public manager, the ability to evaluate, simulate and infer, with the use of Multicriteria Decision Analysis, Rough Sets Theory, the survey of decision rules and Machine Learning, the companies' sustainability and ESEG classes. It aligns, as well, to the perspective of using "Integrated Reporting" for the companies, as a process for integrated management and accountability to society. The report encompasses, among other components, topics of corporate governance, risks and performance opportunities. Currently, in Brazil, there are many public and private enterprises that already use this integrated management process.

As future research, there's the opportunity to validate the proposed model, amplify the indicators and indexes' universe, and identify possible improvements/needs along with ANEEL, electricity distribution concessionaires companies and specialists in the field.

Complementary, there is the possibility to make possible the creation of a web platform so that these enterprises can offer their data about sustainability and performance, and benefit from the benchmarking with analysis, simulations, inferences, indicators' monitoring, goals establishment, and elaboration of action plans, aiming to improve their own work processes and in risk management.

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Food anti-consumption:

A systematic review to explore the rejection of food

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Abstract

Food is one of the three most critical consumer sectors regarding impact and harm to the environment, besides its relevance to public health, poverty and malnutrition. In consumer behavior, rejection is an aspect still under-explored when compared to choice and acquisition processes. In Latin American countries, the discussion of anti-consumption is relevant because of the size and economic relevance of the consumer market, agriculture, and livestock, besides the health and nutritional problems faced by the region. The present study aimed to review the literature on food anti-consumption, exploring what food people reject and how and why food anti-consumption occurs. We carried out a systematic literature review of 30 articles, applying the ProKnow-C protocol. The systemic analysis was based on conceptual categories. As result, we i) explored the relevant and current literature on food anti-consumption; ii) identified which type of foods are subject to anti-consumption studies; ii) identified aspects of the selected literature; iii) described main characteristics of food anti-consumption manifestations; and iv) identified relevant research topics to future investigations, focusing in Latin America context. Findings indicated a predominance of studies with a qualitative approach and conducted in developed countries. Meat, junk/fast-food, dairy, eggs, soft drink, and frozen food were found as subjects of the studies, encompassing particular study contexts such as food waste, dumpster diving, brand hate, and organic and sustainable food. The results suggest that the food intake restriction or reduction is accompanied by green, sustainable, ethical, moral, and alternative consumption behavior or voluntary simplicity lifestyle. Insubordination practices emerge when anti-consumption is related to resistance to consumption, and symbolic anti-consumption is connected to the desire to remove an unwanted self-image. Avoidance of a brand, product, or food category appears linked to the brand hate phenomenon. Finally, boycotts and activist consumption mainly targeted food brands and were associated with ideological and country-related reasons.

Keywords: anti-consumption; food anti-consumption; food consumption; consumer behavior; Latin America.

1. Introduction

The current agricultural system is considered harmful to the environment since it demands significant land and natural resources (The Lancet, 2018). Food is one of the three most critical consumer sectors regarding impact and harm to the environment (Lehner et al., 2016), besides its relevance to public health, poverty, and malnutrition. Changes in diet patterns are necessary to limit damages to the environment and are a goal of healthy and sustainable diets (IPCC, 2019). Current dietarian shift recommendations include reducing global consumption of food considered unhealthy, especially meat and sugar (Willett et al., 2019), and the substitution for alternatives products, as plant-based protein products (Vermeir et al., 2020). These changes are expected to significantly impact different aspects of human health, such as the obesity epidemic, chronic disease mortality, and malnutrition (Wright and

Bragge, 2018). Also, have the potential to reduce gas emissions, freshwater use, biodiversity loss, land-system change, and preserve nitrogen and phosphorus cycles (Willett et al., 2019).

Latin America (LA) is the world's largest producer and exporter of agricultural products (Mahlknecht et al., 2020). Global changes in food consumption patterns impact the regional environment, economy, and society. Reducing or increasing demand for grains or meat, for example, affects the land, energy, water use, and the whole agri-food system (Mahlknecht et al., 2020). The relevance of dietary changes in LA also affects public health and issues related to nutrition-related diseases. The double burden of malnutrition - the coexistence of both under and sub-nutrition - is a growing problem faced by Latin countries (Perez-Escamilla et al., 2018).

Moreover, the topic of anti-consumption has been gaining visibility since its appearance two decades ago (Dalmoro et al., 2020), even though anti-consumption is under-explored when compared to consumption (Hogg et al., 2009). The anti-consumption "might be characterized as a resistance to, distaste of, or even resentment or rejection of, consumption more generally" (Zavestoski, 2002, p. 121) and occurs when consumers, intentionally and meaningfully, cut goods from their consumption routine (Lee et al., 2011).

The purpose of anti-consumers ranges from collective to individualistic motivations (Yver and Muncy, 2009), and rejection, restriction, and reclaim are its main manifestations of consumer behavior (Lee et al., 2011). Anti-consumption has its roots in concerns about sustainability issues (Seegebarth et al., 2016), since "people" and "planet" appear as the primary motivations for anti-consumer manifestations (Sudbury-Riley and Kohlbacher, 2018). Products, brands, companies, categories, or nations may be targets of anti-consumption manifestations (Chatzidakis and Lee, 2013; García-De-Frutos et al., 2018; Iyer and Muncy, 2009; Lee et al., 2009).

Some concepts are often related to anti-consumption, giving clues about its use in studies. These concepts were organized within six conceptual clusters presented by Makri et al. (2020): resistance to consumption; green consumption or sustainable consumption, ethical or moral consumption, alternative consumption; voluntary simplicity, boycotts or activist consumption; avoidance of brand or product; and symbolic consumption. Despite the author's proposition of clusters, the phenomena are nonexclusive, and they must be observed from their interactions (Makri et al., 2020).

Anti-consumption has its place in the food science domain (Makri et al., 2020), and studies on food anti-consumption regarding its diverse categories are encouraged (Malek et al., 2019; Soule and Sekhon, 2019). To the best of our knowledge, there is no systematic literature review about studies on food anti-consumption. Exploring this topic is an interesting task due to the discussions around more healthy and sustainable diets, which encourage the rejection or reduction of certain foods. To fulfill this

gap, the study aims to review the literature on food anti-consumption, exploring what food people reject and how and why food anti-consumption occurs.

To do this, we applied the ProKnow-C protocol to review 30 articles. The systemic analysis was based on the conceptual categories proposed by Makri et al. (2020). As result, we i) explored the relevant and current literature on food anti-consumption; ii) identified which type of foods are subject to anti-consumption studies; ii) identified aspects of the selected literature; iii) described main characteristics of food anti-consumption manifestations; and iv) identified relevant research topics to future investigations, focusing in Latin America context.

This paper is framed within a relevant, original, and contemporary global theme. It is connected with a society's demands in a moment of transition and can explore challenges and socio-environmental changes related to the current agri-food chains. Our study is related to SDG Goal 12, mainly targets 12.3, 12.8, and 12A. In a time of crisis, as the COVID-19 pandemic, consumers change their consumption patterns. The study of food consumer behavior is essential to input information to reverse current consumption and production trends towards a more fair and sustainable economy.

Our study contributes to the advancement of the anti-consumption corpus of literature by exploring the main characteristics of food anti-consumption studies to indicate future research paths for the Latin American context. The results can also have managerial contributions since changes in food consumption patterns affect the economy and agricultural chain and may support the formulation of public policies on nutrition and food.

2. Methods

We carried out exploratory research by a systematic descriptive literature review (Paré et al., 2015). The ProKnow-C protocol from the Constructivist Decision Support Methodology Laboratory of the Federal University of Santa Catarina, Brazil, was used to structure the review. The protocol consists of four main stages (Afonso et al., 2012): (i) selection of the bibliographic portfolio; (ii) bibliometric analysis; (iii) systemic analysis; and (iv) purpose of future research questions.

For the bibliographic portfolio selection, keywords of two axes were established for the literature review: i) "rejection, restriction or reclaim to consumption", related to the anti-consumption approach, and ii) "food consumption", directed to the object of the present study. The choice of words was deliberately wide since the study aimed to access all available content on food anti-consumption for further analysis. To confirm the adherence of the keywords, an exploratory step was conducted. It was possible to verify two different spellings of the word anti-consumption, which were considered in the bibliographic portfolio's official selection. The final terms were: "anticonsumption", "anti-consumption", and "food".

The research was carried out in April 2020 in the databases Web of Science, Scopus, and EBSCOHost, resulting in 115 articles (Figure 1). These databases were selected due to their coverage, credibility, multidisciplinarity, and responsive search interface (Gusenbauer and Haddaway, 2020). All results were exported to an MS Excel spreadsheet.

Table 1.*Bibliographic portfolio selection protocol.*

Databases	**Web of Science**	**Scopus**	**EBSCOHost**
Keywords	*((anticonsum* OR anti-consum*) AND food)*		
Language	English		
Period	No restrictions		
Search date	April 2020		
Results	48 papers	37 papers	30 papers

Two researchers were involved in the filter process, analyzing the papers separately to reduce bias. Any conflicts between the reviewers were subject to additional screening for the final decision. Exclusion criteria were applied to filter the results: we have only considered empirical studies, removed duplicate results, and verified the alignment of titles and abstracts with the research objectives. Three questions guided the filter process: *i) Does the study have the word "anti-consumption" or its variables in the title, abstract, or keywords?; ii) Is the study related to the food sector?; iii) Is the study in the area of consumer behavior or consumption?.*

Another filter applied, following the ProKnow-C protocol, was that of relevance and timeliness. We maintained those papers representing 85% of the citations concerning the whole set of selected articles (*n*=11), the most current ones, and those published between 2018 and 2020 (*n*= 21). The researchers added a new criterion to the original method, checking the source's quality of the excluded papers due to relevance or timeliness. As a result, seven articles were included in the set for full reading, rated higher than Q2 in Scimago ranking.

Figure 2 shows a summary of the filtering criterion. Finally, we selected a sample of 30 papers to carry out a bibliometric and systematic analysis.

Bibliometric analysis contributed to indicate which foods are the target of anti-consumption and general aspects of publications. The systemic analysis sought to understand anti-consumption behaviors and their relation to the conceptual clusters proposed by Makri et al. (2020): sustainable consumption; consumer resistance; voluntary simplicity; consumer activism; symbolic consumption; brand or product avoidance.

To do this, an MS Excel spreadsheet was created to categorize publications data (authors, journals, year of publication, country researched), methods used, conceptual clusters related to anti-consumption, food category, and food context. Reading sheets, abstracts and notes were also used as supporting material.

Table 2.*Filtering process.*

Filtering Criterion (ProKnow-C protocol)	Excluded	N. of papers
Initial	-	115
Duplicates	48	67
Alignment of titles and abstract with research objectives	23	44
Relevance and timeliness	6	38 - 11 relevant (85% more cited), 21 timeliness (published between 2018 and 2020), and 7 included by the authors
Availability	1	37
Final selection after a complete reading	7	30

3. Results and Discussion

3.1. Bibliometric analysis

The bibliometric analysis allowed us to understand the papers' central aspects, giving clues to the most significant interest in food anti-consumption. It thus responds to what kind of food is the target of anti-consumption.

Papers were published from 2008 to 2020 (Figure 1), and there was an increase in publications in the last five years. It should be considered that the search was conducted in April 2020, which could explain the downward trend in 2020, and that it should be disregarded.

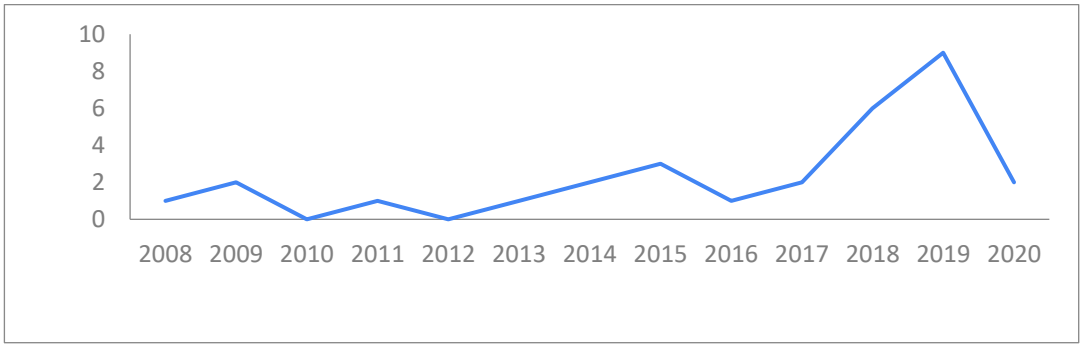

Figure 1. *Years of publication.*

Regarding the research methods, most papers adopted qualitative methodologies (Figure 2).

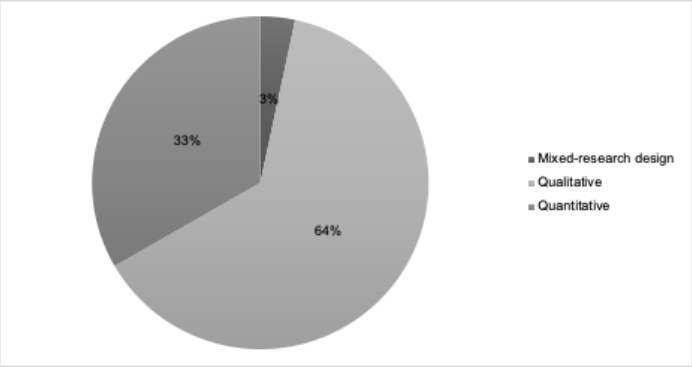

Figure 2. *Research methods.*

In general, the analyzed works have focused on more than one food product—forming the "general" category—, meat and junk/fast food. Other food types studied were soft drinks, eggs, and hazelnut cream. The "soft drink" category is associated with the Coca-Cola brand, and the "Hazelnut cream" deals specifically with the Nutella brand, with the paper being a case study on the palm oil conflict, another food product that is part of the cream's composition (Figure 3).

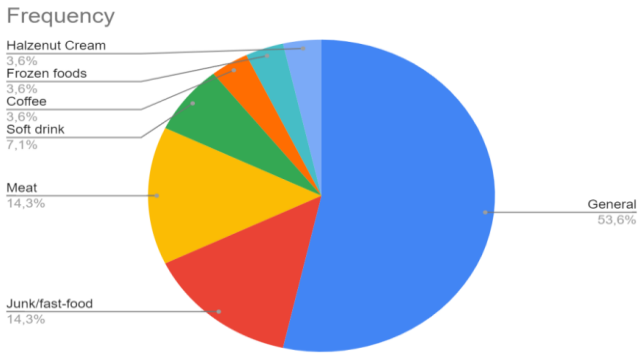

Figure 3. *Food categories studied.*

The geographical scope of analysis is presented by country (Figure 4). There is a predominance of studies in Turkey (n = 5), Australia (n = 4), Canada (n = 3) and the United States (n = 3). Four of the five studies in Turkey were published in a special edition of the British Food Journal, with a Turkish guest editor. Just one study was carried out in South America (Brazil) (De Barcellos et al., 2014).

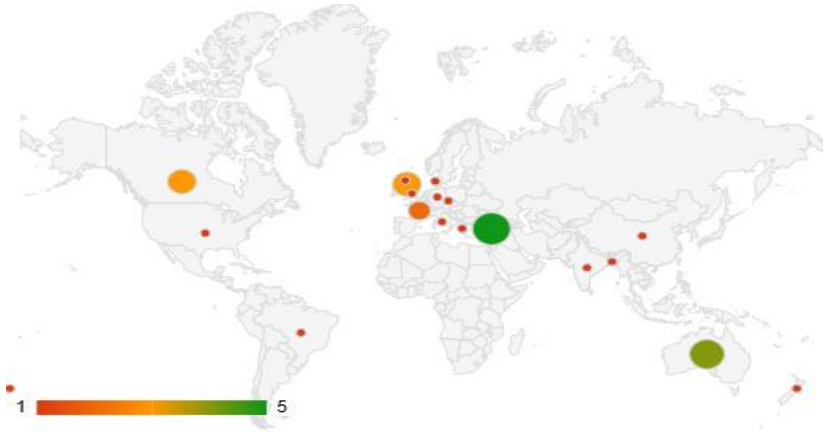

Figure 4. *Food anti-consumption by country*

Finally, we sought to understand which journals publish the most on the subject of food anti-consumption (Table 3). Attention is drawn again to the special edition of the British Food Journal.

Table 3. *Food anti-consumption by journals*

Source	Papers
British Food Journal	11
International Journal of Consumer Studies	3
European Journal of Marketing	2
Journal of Public Policy & Marketing	2
Consumption Markets & Culture	1
Food Quality and Preference	1
Human Affairs-Post disciplinary Humanities & Social Sciences Quarterly	1
International Food and Agribusiness Management Review	1
International Journal of Business and Society	1
Journal of Consumer Affairs	1
Journal of Consumer Behavior	1
Journal of Consumer Culture	1
Journal of Consumer Research	1
Journal of Marketing Management	1
Local Environment	1
Sustainability	1
Total	**30**

The bibliometric analysis results provide insights into the selected body of literature and information to support the considerations of the systemic analysis, as presented below.

3.2. Systemic analysis

In this stage, we analyzed the characteristics of food anti-consumption manifestations and supported the theory's development by testing the adherence of categories that emerged from the conceptual clusters proposed by Makri et al. (2020).

3.2.1. Sustainable consumption

The original classification by Makri et al. (2020) was "green/sustainable consumption, ethical/moral consumption, alternative consumption", which here was called "sustainable consumption" by understanding that sustainable consumption encompasses all the aspects. In this category are the reviewed studies on anti-meat and animal product consumption and new sustainable business models. Concerns related to sustainability, such as health, animal welfare, and environmental protection, appear among the primary motivations for abandoning or reduce meat (Apostolidis and McLeay, 2019; Malek et al., 2019; Soule and Sekhon, 2019; Tosun and Gürce, 2018). Anti-consumption of meat can be justified for several reasons: taste, religion, economic motivation, and sustainability issues (Tosun and Gürce, 2018). However, economic factors such as the relationship between price and income also influence consumer decisions (Malek et al., 2019). Studies on meat avoidance report an ongoing change in consumption patterns that can lead to more sustainable diets (Malek et al., 2019).

The change in meat consumption habits also occurs from a "curtailment" of consumption (Apostolidis and McLeay, 2019; Soule and Sekhon, 2019), which implies a reduction in the portions served or frequency ingestion. Substitution behavior also appears as a topic of interest. We identified as possible replacements: chose meat of animals raised with methods of production that preserve animal welfare (Apostolidis and McLeay, 2019; Soule and Sekhon, 2019); types of meats with lower prices (Malek et al., 2019); and analogous solutions based on plants (Soule and Sekhon, 2019).

Studies on new sustainable business models explore the case of an alternative network. The sellers and consumers communicate via a mobile application for the sale of food that would be thrown away by local businesses (e.g., groceries and bakeries), reducing food waste through the reuse of food (De Bernardi and Tirabeni, 2018). Smaje (2014) explored the niche of boxes by subscription with agroecological food products, highlighting a business model that shortens the supply chain and brings consumers and producers closer. The two studies address anti-consumption while rejecting a conventional business model to prioritize a more ethical one.

3.2.2. Consumer resistance

Food waste prevention through food networks and the dumpster diving movement are observed and manifestations of resistance in specific cultures of anti-consumption. According to Makri et al. (2020), anti-consumption behaviors related to the resistance to consumption lead to cut goods from the consumption routine.

As with sustainable consumption, manifestations of resistance to consumption can also generate alternative food networks and markets. Cherrier (2017), for example, describes an organization of homeless people that collect and share food that would be wasted as an alternative food market, but that differs by not involving money exchanges. This specific movement to redistribute food allows the

connection of people isolated by the circumstances of poverty and marginality, getting them out of a position of isolation (Cherrier, 2017).

Dealing with the dumpster diving movement, it is also noted the existence of a public with financial conditions to buy food but who choose not to buy. This choice is linked to a heroic identity since food rescue and sharing create a positive image for dumpsters (Fernandez et al., 2011). It is possible to say that this manifestation of resistance to consumption is also related to symbolic consumption for contributing to identity construction.

The resistance to consumption on conventional markets by the lens of Consumer Culture Theory is also analyzed, as the case of a collaborative and non-profit community that proposes the division of land to produce food, avoiding external purchases (McArthur, 2015). Another observed group is the "freegan" subculture, with practitioners who adopt veganism and want to "live free", which means participating minimally in the capitalist economy to mitigate social and environmental impacts through food choices (Lodjová, 2020). Freegans believe that their actions help reduce food waste and hunger globally and are practitioners of dumpster diving (Lodjová, 2020). In the studies, it is understood that the control of food production and the reuse of food products that would be wasted by own consumption or sharing are possible manifestations of resistance in food anti-consumption behavior.

3.2.3. Voluntary simplicity

According to Makri et al. (2020, p. 182), voluntary simplicity "extends beyond reducing consumption by exercising self-reliance and developing intellect and other nonmaterial facets of human existence". It translates into consumer behavior by "reduction (or simplification) of consumption pattern by choice out of the free will to limit expenditures and/or enhance well-being" (p.182). The selected papers show simplicity through lifestyles related to food movements, such as dumpster diving and the Slow Food Movement, the act of fasting, and the preference to purchase goods of rural producers.

The rescue of food that was thrown away is associated with more than one concept of anti-consumption. The resistance to consumption (Fernandez et al., 2011; Lodjová, 2020) supports the construction of the desired identity (symbolic field of consumption) (Fernandez et al., 2011) and also represent a simple life choice, which deals with the management of excesses and reduction of consumption (Rombach and Bitsch, 2015). Slow Food, for instance, is a philosophy that criticizes the act of eating "fast", linked to contemporary lifestyles (Rombach and Bitsch, 2015).

Religion and spirituality are keywords related to voluntary simplicity. The investigation of Kiryakova-Dineva et al. (2019), with monks from orthodox monasteries, sought to understand the possibility of transposing the secular practice of fasting to contemporary lifestyles. "Artificial" food replacement

(e.g., light and diet alternatives of food products) was criticized since the practice of fasting aims for spiritual elevation through the sacrifice of reducing food consumption for a certain period.

Moreover, Shaw and Moraes (2009) investigates how voluntary simplifiers in rural areas negotiate the existing tensions between market interactions and non-consumption decisions. Consumers fail to escape the predominant market logic for reasons such as convenience, price, and assortment. However, behaviors to reduce and modify consumption, linked to social and environmental concerns, are identified through a preference to buy from local producers and businesses and choose to eat seasonal products.

3.2.4. Boycotts/consumer activism

Boycott is associated with activist consumption and occurs from the "refrain from purchasing certain products due to ideological discontent/incongruency with an organization or country" (Makri et al., 2020, p. 182). It is normally initiated by someone and ended by others (Makri et al., 2020) and can be addressed to a specific brand, like Nutella, Starbucks, Coca-Cola, or country.

Nutella became the object of anti-consumption due to social and environmental conflicts from the extraction of palm oil (Cova and D'Antone, 2016). The hostility from French consumers to the American coffee chain Starbucks was identified by Bryson and Atwal (2019) in support of national and local coffee shops and entrepreneurs. Varman and Belk (2009) explore the rejection of foreign products (Coca-Cola brand) in India due to a socio-historical process of the precariousness of local people and products during the colonization process, extending through anti-consumption acts to the present days.

Regarding the dumpster diving movement, our analysis indicates that it permeates several concepts of anti-consumption, including boycott and activist consumption. There is a division between dumpsters that rescue food from the trash by necessity and those that choose to do so: "insecure" and "secure" people, respectively (Vinegar et al., 2016). The "secures" make their choice as a form of resistance to consumption (Fernandez et al., 2011), but also through activist consumption (Vinegar et al., 2016), overlapping anti-consumption manifestations.

3.2.5. Symbolic consumption

Consumer behavior related to symbolic consumption occurs through the "rejection of goods or consumption habits for symbolic reasons that are personally or socially important to the consumer" (Makri et al., 2020, p. 182). Symbolic consumption is associated with the construction of self-identity and its dynamics with other group identities. We find out in the analyzed papers identity ethical and moral meanings and social expectations, such as aesthetics.

Bettany and Kerrane (2011) suggest a relationship between consumers and objects since subjective human relationships socially construct objects, and these relationships also develop to them. The authors observed the meaning of raising domestic chickens for egg production in urban areas, concluding that such practice reinforces self-identity through a more ethical and moral image for detaching from traditional production methods.

Farah and Shahzad (2020) explore fast-food addiction as a phenomenon built by socio-cultural factors and encouraged by advertising practices. The attractiveness of fast-food is due to its convenience, price, and accessibility, characteristics that induce buyback. However, fast-food addiction can create negative feelings about health problems or an unwanted body image, resulting in anti-consumption (Farah and Shahzad, 2020).

3.2.6. Brand/product avoidance

The deliberate avoidance of specific brands or products occurs "because of the associations or negative meanings they carry" (Makri et al., 2020, p. 182). In the selected studies, brand avoidance was recognized in rejecting food categories and the brand hate phenomenon. The food categories avoided were poor in nutrients —e.g., soft drinks— or the long-term consumption has a negative effect on health.

Soft drinks are associated with chronic diseases, and obesity and social groups such as family and friends play an important role in this anti-consumption (Shahzad et al., 2019). The same is observed in a study on the anti-consumption of fast-food by children since parental decisions are important for avoiding the category (Yarimoglu et al., 2019). Decisions start from a perceived risk related to fast-foods and an early regret associated with health issues (Yarimoglu et al., 2019). This "early regret" was also seen in symbolic (anti) consumption and related to an unwanted body image (Farah and Shahzad, 2020).

Brand hate is feared by organizations (Ahmed and Hashim, 2018) and gains new dimensions with the multiplication of online environments. Online contexts provide a fertile ground for the spread of negative comments, affecting the image and reputation of brands and products (Arslan et al., 2018). This is due, in part, to the fact that humans express their negative feelings more than positive ones (Ahmed and Hashim, 2018).

In the online context, Arslan, Yıldırım, and Dinçer (2018) identify the prevalence of complaints about the beverage, junk foods, food preparations, and desserts. The anti-consumption was motivated by product defects, poor hygiene, quality of service, misleading advertising, unsatisfactory performance, and poor food quality. Khan et al. (2019) investigated the avoidance of fast-food chains in a developing country context depicting social media comments. The main reasons observed were previous

experiences (unmet expectations and dangers and risks), identity issues (symbolic incongruity), moral issues (ideological incompatibility), and avoidance through interactivity related to cultural traditions, which are expected to be preserved. The results obtained relate not only to the concept of brand avoidance but also to symbolic (anti)consumption and boycotts/activist consumption (Khan et al., 2019).

The brand's hatred can be reversible from reconciliation with the consumer (Ahmed and Hashim, 2018) or even with the emission of positive messages for a change in negative perceptions (Dursun and Kabadayi, 2013). However, for some groups, changing the brand hate is impossible (Dursun and Kabadayi, 2013), as in symbolic incongruity and ideological incompatibility, which have more substantial degrees of and are related to other anti-consumption manifestations of rejection (Ahmed and Hashim, 2018).

3.3 Emerging themes on food anti-consumption

We systematize the founds considering the categories of analysis (Table 4). The data were organized describing the consumer anti-consumption behaviors related, anti-consumption spillover behaviors, possible consequences in the value chain, and manifestations and movements on food anti-consumption related. As already mentioned, these points are not limited in themselves, and their intersections will be deepened in the discussion.

Table 4. *Anti-consumption on food context.*

Category	Consumer anti-consumption behaviors	Anti-consumption spillovers behaviors	Possible consequences in the value chain	Manifestations and movements related
Sustainable Consumption	Reduction and rejection	Substitution	Reduction and rejection occur to mitigate the consequences of a predatory lifestyle and can target specific food categories, such as meat. Substitutions are solutions that accompany an increasing market movement, offering more sustainable, ethical, and moral products.	Alternative food chains with monetary exchanges (De Bernardi and Tirabeni, 2018) and new business models (Smaje, 2014); Green and conscious capitalism; criticism of the co-optation of the market by corporatism (Smaje, 2014).
Consumer Resistance	Reduction	Reuse and sharing	The reduction is observed since resistance to consumption avoids excesses. Reusing food that would be wasted and sharing surpluses are also behaviors linked to food anti-consumption due to resistance to consumption.	Alternative food network without monetary exchange (Cherrier, 2017), dumpster diving (Fernandez et al., 2011), and land-sharing for agriculture (McArthur, 2015). Cases of movements that occur outside the conventional market circuit (Cherrier and Hill, 2018).

Category	Consumer anti-consumption behaviors	Anti-consumption spillovers behaviors	Possible consequences in the value chain	Manifestations and movements related
Voluntary Simplicity	Reduction	Modification	Reduction is the main behavior, and substitutions are often rejected. There are greater involvement and changes in consumer behavior, which develops food practices and explains the "modification" behavior on consumption observed. This modification is also linked with a greater literacy of production.	Fasting (Kiryakova-Dineva et al., 2019) and participation in food movements such as Slow Food and dumpster diving (Rombach and Bitsch, 2015); Preference for local rural producers (Shaw and Moraes, 2009).
Boycott/ consumer activism	Rejection	Substitution, except when linked to resistance to consumption	Rejection of certain products, categories, or brands. Substitutions are observed in the valorization of national products in opposition to the rejection of ideologically incompatible foreign products.	Brands association with environmental and social damage (Cova and D'Antone, 2016); Rejection to foreign organizations that impact the local economy (Bryson and Atwal, 2019; Varman and Belk, 2009); Dumpster diving linked to a boycott of the economic system when associated with resistance to consumption (Vinegar et al., 2016).
Symbolic Consumption	Rejection	Substitution, except when linked to resistance to consumption	Rejection of specific categories, with the substitution acting as a reinforcement of the desired identity. It can be associated with resistance to consumption when the intention is to reinforce a resistance identity.	Expression of an ethical and moral self (Bettany and Kerrane, 2011); Fast-food chains are associated with an unwanted body image, but food addiction is a barrier to abandonment (Farah and Shahzad, 2020).
Avoidance of brand or product	Rejection	Substitution and recovery. Recovery except when linked with resistance to consumption, boycott/ activist consumption, and symbolic consumption.	Rejection of brands or products can generate substitutions for reasons such as performance, for example. When linked to deeper motivations, such as symbolic and ideological ones, the recovery of hatred is not confirmed.	Brand hate phenomenon (Ahmed and Hashim, 2018; Arslan et al., 2018); Early regret of consumption as a factor for avoidance (Yarimoglu et al., 2019).

4. Discussion

Bibliometric results showed similar findings compared with the review of Makri et al. (2020), such as qualitative studies' prevalence. However, the list of top journals differs in the area of food anti-consumption. The podium is occupied by a journal specialized in the food domain, the British Food

Journal. More than that, the data allowed us to observe a greater concentration of research in Europe, with only one study from Latin America. However, developing countries from other areas appear to be applying research on food anti-consumption, such as Turkey, Bangladesh, and China. Regarding food categories of anti-consumption studies, most studies do not focus on a specific category, exploring various food types (that we called "general category").

It was noticed that reflections on aspects of the production side and the economic system mediated exchanges between goods. Anti-consumption is associated with how individuals relate to objects around them to create meanings that generate opposition (Witkowski, 2020). Consequently, isolating the anti-consumer from the context is difficult and contraindicated, as contextual factors support the understanding of anti-consumer decision-making.

The results suggest that the manifestations of food anti-consumption present antagonisms, a conflict considered a barrier to developing the theory (Makri et al., 2020). During the empirical analysis of food anti-consumption, an antagonistic situation over two case studies was observed. Exchanges occur differently, and even opposite, since one considers monetary exchanges and the other the sharing of products. The first case was an alternative food network/market to prevent food waste and reduce excesses based on an entrepreneurial and neo-capitalist logic (De Bernardi and Tirabeni, 2018). The second, an alternative food network/market, described an effort of social reorganization to distribute food that would be wasted on homeless people (Cherrier, 2017).

We found several overlaps of anti-consumption-related concepts. Manifestations related to sustainable consumption, resistance to consumption, voluntary simplicity, boycott / activist consumption, and the avoidance of products and brands can generate attributes for the image of consumers, individuals, or groups. Thus, it is possible to notice the symbolic (anti)consumption in parallel.

On the intersection of food anti-consumption, Betanny and Kerrane (2008) study explores the ethical and moral self-identity linked to a reinvention of food production and the adoption of a lifestyle of voluntary simplicity. In the study by Arslan, Yıldırım, and Dinçer (2018), some food products are avoided due to characteristics related to unmet performance, associating with the concerns of the anti-loyal consumer (Yver and Muncy, 2009). However, it is known that hatred of the brand can be reversible in these cases (Ahmed and Hashim, 2018; Dursun and Kabadayi, 2013), but this reversibility is unlikely to occur when deeper motivations, such as ideologies, are associated (Ahmed and Hashim, 2018). There is often an association with symbolic consumption, resistance to consumption, activist consumption, and boycott movements.

Contradictions can also be seen in the spillover of anti-consumption behaviors. Substitution and reversal of hatred have rebound effects that lead us to some reflections. Substitution appears both as a topic of interest linked to anti-consumption (e.g., meat versus plant-based alternatives) and a spillover effect.

However, the substitution needs to be better understood, bringing contributions on a managerial level. While it can help the abandonment or reduction of unhealthy food, the substitution quality can be worse than the food substituted (e.g., substitution of animal products by ultra-processed plant-based foods).

In the same line, the reversion of hatred towards brands is supported by studies to recover the reputation of categories that have suffered avoidance. The effort to recover the brand image can also be used for less ethical corporations. The substitution and reversal of hatred are behaviors that can be further investigated at the micro-level, along with scientific literature that deals with rebound effects on sustainability, since many innovations have an ambivalent character (Paech, 2007).

A prominent food anti-consumption movement is the dumpster diver that covers several concepts related to anti-consumption. The literature presents different reasons for why it occurs. For example, poverty (Cherrier, 2017; Vinegar et al., 2016) and resistance to institutional powers such as that of the market (Fernandez et al., 2011; Vinegar et al., 2016) or the State (Cherrier and Hill, 2018). The studies highlight benefits of this behavior in reducing food waste, linking the movement to sustainability. Dumpster diver deals with food waste by avoiding food losses and the associated resources for its production and distribution, such as energy and water (Makri et al., 2020) and lower expenditure on associated material flows (Lee et al., 2009).

However, a closer look must be given considering regionals' aspects as nutritional insecurity and colonization. One question that arises is how much people collect garbage to eat as resistance to consumption and how much they do it out of necessity. Besides, when Khan et al. (2019) highlight the symbolic incongruity as a factor for avoiding fast-foods, it is identified that a cultural and identity gap can generate repulsion in consumers (Hogg et al., 2009), demonstrating a disengagement from a foreign food culture. Deeper socio-historical roots related to colonization can cause animosity regarding foreign food products and brands' entry (Varman and Belk, 2009). These same processes occurred throughout Latin America.

Meat and soft drinks are prominent categories of food reduction (Willett et al., 2019). High levels of meat consumption also contribute to the environmental imbalance. In the studies, meat substitute options attributes were explored, such as consuming plant-based proteins and organic products (Vermeir et al., 2020), supporting business development. However, the price is also a determining factor for purchasing meat (Malek et al., 2019). It must be carefully considered in Latin American countries, with a concentration of low-and middle-income countries (Perez-Escamilla et al., 2018; Schott et al., 2019), especially at a time of severe economic crisis due to COVID-19.

Entering the case of Latin America, some notes need to be made, considering that the region has different characteristics from most of the countries studied. Developing countries have context-specific socio-economic issues, like poverty, hunger, inequality, and the role of food production and exportation

in the economy. For example, Brazil is currently the world's largest (i) producer of beef and buffalo meat, (ii) meat exporter country (Brazilian Beef Exporters' Association, 2019). Besides the external market, most Brazilian meat production is destined for the domestic market. The importance of meat to the Brazilian economy highlights the impact of changes in the demand for meat resulting from anti-consumption behaviors.

Table 5 summarizes the research questions (RQ) on anti-consumption identified in the Latin American context concerning SDG Goal 12, mainly target 12.3, 12.8, and 12.A, completing the stages of the ProKnow-C method.

The anti-consumption theory has been developing for 20 years, while sustainable consumption challenges have been posed since 2015. This would be enough to direct the questions to the SDG. However, in a time of crisis, as the COVID-19 pandemic, consumers change their consumption patterns. The study of food consumer behavior is essential to input information to reverse current consumption and production trends towards a sustainable economy that seeks social justice.

Table 5. *Future directions for food anti-consumption research in Latin America.*

Approach	**Future directions for food anti-consumption research in Latin America**	**SDG Goal Addressed**
Consumer anti-consumption behaviors	RQ1: Do the meat paradoxes faced by people in developing countries are different from the meat paradoxes faced by people in developed countries? RQ2: What are the effects of the Covid-19 pandemic on anti-consumption behavior in LA?	12.A
Anti-consumption spillovers behaviors	RQ2: Alternative food substitution options may have rebound effects on sustainability in LA? RQ3: The recovery of brand hatred can nullify anti-consumption effects aimed at socially or environmentally harmful products or brands?	12.8
Possible consequences in the value chain	RQ5: Is there a greater appreciation of food products produced locally due to anti-consumption directed to colonization processes?	12.A
Manifestations and movements related	RQ6: What is the acceptance of food consumption that would be wasted by local businesses (e.g., bakeries, markets) by Latin American consumers?	12.3

5. Conclusions

The review aimed to explore current and relevant scientific production on food anti-consumption related to new conceptual categorizations in research Administration and related areas: sustainable consumption, resistance to consumption, voluntary simplicity, activist consumption or boycott, symbolic consumption, and brand or product avoidance.

Rejection, reduction, and reclaiming behaviors are usual on anti-consumption theory and were identified. However, studies already showed steps after anti-consumption manifestations and spillover behaviors such as substitution, sharing and modification of food consumption patterns. Factors influencing the choice of food substitutes and consequences of recovery from brand hatred needs to be understood and discussed, whether substitution and recovery are micro-level behaviors that, depending on their consequences, can cause rebound effects. Food movements and manifestations of anti-consumption are also analyzed and provide an empirical view of how food anti-consumption can occur.

Latin America is an important world producer and exporter of food and faces public health problems from the Covid-19 pandemic and the double burden of malnutrition. Future research questions have been proposed for this particular context. It is understood that changes in production to food consumption directly impact Latin American people and economies. The questions seek to understand the rebound effects of substitution and recovery in Latin America, the paradoxes of meat consumption compared to developed countries, the acceptance of reused food, effects of Covid-19 pandemic in anti-consumption behaviors, and the attitudes of hatred towards products from colonizing countries. The questions are linked to the sub-items of SDG 12, responsible consumption, and production. This direction seeks to act on a global agenda for a more sustainable future without ignoring that we face a severe economic crisis due to COVID-19.

Among the study's main limitations, we found that broad, functional, and reliable bases were considered, but only in the English language. Future research should use Latin American databases and papers in Portuguese and Spanish to seek regional productions on food anti-consumption, adding to the present study's findings.

Regarding the contribution of this work to Management studies, we emphasize that it seeks a breakthrough in the development of anti-consumption theory by studying the adherence of recently published conceptual clusters, already with empirical examples from the food sector. It also contributes academics, practitioners, and public policymakers to understand manifestations of food anti-consumption, which can affect changes from production to consumption of food. Furthermore, it builds an agenda of future research questions concerning SGD 12 to help reveal anti-consumption aspects in the Latin American context to build a more sustainable future.

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Posters

The 27th International Sustainable Development Research Society Conference
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Accelerating the progress towards the 2030 Sustainable Development Goals in times of crisis
Mid Sweden University
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Responsible Tourism: framework proposal based on the experience of the Social Service of Commerce in Brazil.

Introduction

The tourism sector has been growing over 4% a year since 2009, and before the Covid-19 pandemic, 1.3 billion tourists used to travel around the world annually. The sector's commodity chain, in the periods prior to the crisis, accounted for more than 10% of the world's GDP (WorldTourism Organization and Organization of American States, 2018). Nevertheless, research has shown that tourism can generate several negative impacts on destinations, in the economic, environmental and sociocultural dimensions. Data indicates that there are practical problems when it comes to sustainability and tourism, due to the wide variety of actors involved in the development of touristic activities, with a different set of goals and different grasps on the ambiguous concept of sustainability, often concentrated in the environmental dimension (Farmaki, Panayiotis, Yiasemi, & Karis 2014; Goodwin, 2016; Mihalic, 2016; Moscardo, & Murphy, 2014; Santos, Méxas, & Meiriño, 2017; World Travel and Tourism Council, 2017). It is within this context that the concept of Responsible Tourism presents itself as an extension of the discussion, as it can benefit companies, improve the image and competitiveness of destinations and improve the quality of life in their communities (Camilleri, 2016; Farmaki et al., 2014 ; Mathew, 2017). Spenceley et al. (2002) list five key elements of Responsible Tourism: developing a competitive advantage; assessment, monitoring and divulging of the impacts of tourism development; ensuring the involvement of communities and the establishment of significant economic ties; encouraging natural, economic, social and cultural diversity; and promoting the sustainable use of local resources. For Moscardo and Murphy (2014), tourism businesses are co-responsible for the impacts on the quality of life of the receiving communities. This scenario leads to the question: how to minimize the negative impacts and maximize the positive ones based on the dimensions of Responsible Tourism? This necessity establishes as the objective of this study the development of a framework proposal for responsible tourism management, based on a case study of a Brazilian travel and tourism agency.

Method

The procedures followed in this study have a quantitative approach, and it is a descriptive and applied research. For collecting perceptions, a form survey was adopted, based on the research instrument developed by Goffi, Masiero and Pencarelli (2018), using a 7-point Likert-type grade scale. The surveys were electronically mailed to 120 employees of the travel and tourism agencies of the Social Service for Commerce (Sesc). Sesc is a non-profit, nationwide-reach, Brazilian enterprise, created in 1946 by business and service entrepreneurs and union organizations, who finance and run it (SESC DN, 2014). It organizes, markets and operates tourist excursions, while sustaining relationships with a large part of the commodity chain of the tourism sector. Its agencies are present in 23 Brazilian states, having carried out, in 2017, 7.300 tours and 4.100 excursions (SESC DN, 2018). The research instrument was made available for two periods of thirty days in 2018 and 2019, and the final results conveyed 72 valid surveys for analysis. Data were processed using the SPSS 25 software and subjected to PCA factor analysis, with varimax rotation; observation of the Kaiser-Meyer-Olkin (KMO) adequacy index, which indicates the factorability of the data; Bartlett's sphericity test, which provides the statistical probability that the correlation matrix is significant and the internal consistency of the variables through Cronbach's Alpha (Hair, 2005).

Results

Perceptions about responsible tourism in the survailed company's daily operations are mainly explained by the dimension of sociocultural responsibility (local participation and cooperation, engagement of residents and local companies), which accounts for 30,075% of the total variance; followed by environmental responsibility (use of sustainable facilities and transportation, monitoring of environmental impacts and reduced tourists groups), with 14,137%; economic responsibility (encouragement to purchase from local producers and hiring of local labor force), which accounts for 10,584%; image and recognition (marketing, reputation and competitive advantage), with 7,673%; and, finally, incorporation of sustainability into management (sustainable management and quality awareness), which takes up 5,728% of the total variance. The chart below presents a summary of the possible hypotheses for the levels of agreement found:

Dimensions	Agreement level (average)	Hypotheses
Economic Responsibility	6.31	Include local residents as active and paid participants in the itineraries offered.
		Include local gastronomy and handicrafts as elements of intangible heritage, stimulating consumption by local producers.
Image and Reputation	5.75	Have generalist environmental sustainability programs, not specific to the organization's travel and tours sector, but that give importance to the theme.
		Realize that the theme "sustainability" is a trend.
Incorporating sustainability into management	5.58	Have a Sustainability Policy, transversal to its main activities, which includes trips and tours.
		Support tourism projects in documents that reinforce the need for sustainable action, such as the Declaration of Montreal (ISTO, 1996).
Sociocultural Responsibility	4,89	Have clear objectives related to the sustainable development of destinations set out in the organization's guidelines, mission or vision.
		Include destinations outside the traditional tourist axis in the products offered to customers.
		Maintain the educational character as a transversal axis to the tourism activities offered to clients.
		Having difficulties measuring sociocultural impacts
Environmental responsibility	3.85	Realize high cost and low supply of sustainable transport and accommodation equipment
		Not producing sustainability reports on a regular basis.
		Keep tour groups with a reduced number of people.

In light of the analysiss conducted, it is proposed a framework for responsible tourism management, which inserts the elements - insociocultural, environmental and economic dimensions - in a productive environment, where sustainability and education cross paths with all of them. It highlights the need to measure the impacts of touristic activity and disclose them regularly to business partners and to society in general. Finally, it presents a responsible tourism management planner that sums up the needs for its implementation.

Framework

Conclusion

The study enabled the structuring of a framework that can contribute to the management of tourism based on a perspective of responsibility towards the development of destinations, touristic organizations, tourists and residents, given that it supports the reduction of negative and the enhancement of positive impacts of touristic activity. The execution of the proposed framework is recommended, especially in longitudinal case studies, to ascertain its applicability and adjustment needs, as well as the design of qualitative researches, in order to ensure completion and quality of the results.

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10. Special Themes

10c. Quality management and sustainability

Abstracts

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Service quality, gamification and sustainable mobility: an empirical study in Italy on shared mobility

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Abstract

The present study aims to understand user perceptions of service quality and gamification mechanics in shared mobility services.

In the last years, there has been a growing interest in sharing mobility for the potentiality to generate a reduction in consumption and a greater awareness of environmental issues. In addition, the COVID-19 pandemic had a crucial impact on the actors involved in the transport sector, accelerating interest in issues related to sustainability and Agenda 2030.

The sustainable mobility is recognized as a priority by the Agenda 2030 that directly connects this phenomenon to service quality management practices: develop quality, reliable, sustainable and resilient infrastructures (SDG-9.1); improve safety and quality of the service provided (SDG-11.2); and promote an accessible and flexible solution that reduces emissions (SDG-13).

At the same time, sustainable practices, as sharing mobility, disruptive technologies and quality management work together to pursuing sustainable development. In this regard, gamification mechanics, implemented in mobile applications, emerge as an innovative tool to encourage sustainable practices.

In light of this, the present research investigates the service quality role on user satisfaction on shared mobility services and analyzes whether the intention to reuse these services changed after the pandemic. In addition, the effect of game mechanics on users loyalty and service quality is analyzed.

A theoretical framework is proposed, and an empirical study is developed in Italy by adopting the mixed-method approach. Data are collected by integrating qualitative techniques (in-depth interviews) and quantitative tools (questionnaire). The proposed theoretical model is tested through structural equation modelling (SEM) statistical techniques.

The study highlighted the crucial role of service quality and gamification to promote and incentivize shared mobility. To encourage users to adopt eco-friendly lifestyles, the service quality must be improved considering the needs and expectations of users: convenience, reliability, safety and availability of vehicles and the ease of use and security of the platforms. Gamification mechanics guide and educate users to report broken or badly parked vehicles, generating useful information for mobility operators.

Findings confirmed that service quality, synthesized in quality of means and platform, is an antecedent to user satisfaction, influencing services loyalty. The gamification improves service quality and directly affects users loyalty.

The originality of the paper is grounded on the analysis of the linkage between service quality and gamification. The results provide insights for mobility operators to improve the service quality and for policymakers to promote sustainable mobility and support the recovery from COVID-19. The integration of gamification and the continuous quality improvements paves the way for pursuing sustainable development. Gamification is a useful tool for changing transport habits, generating knowledge of environmental issues by educating and raising awareness among citizens. The use of these mechanics helps to explore citizens needs by highlighting their travel habits. Through mobile applications, the information collected can be used by governments and mobility companies to improve urban strategies and infrastructures to implement a digital transition that favours the achievement of the Agenda 2030 goals.

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New ways to better understand the real causes of sustainability problems: Root causes analysis, Traceability and Directed acyclic graphs.

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Abstract

Introduction

There is wide acceptance of the need for a more holistic approach to sustainability. However, practical solutions remain elusive and tend to exhibit underlying conflicts between different paradigms. This paper argues the need to wield analytical tools that themselves embody the principles of systemic – focused on organizational and second order cybernetics – that highlights our understanding of the concept of sustainability. Some techniques widely used in quality management as root cause analysis, process traceability and directed acyclic graphs could help in the process to look for and find the principal causes of the environmental problems. It is very relevant in complex, multifactorial and difficult to detect problems to isolate all confounding and moderator variables as it distorts the relationship between the real cause and the effect. In complex problems, such as environmental challenges, the use of statistical models without any consideration about causal basis of sustainability phenomenon must be avoided. The objective of the research is to determine whether sustainability research analyzes properly the causal variables of the problem.

Methodology

To develop the research, a methodology of literature review and case analysis has been followed. First, a literature review for understanding the use of three techniques Root Cause Analysis, Directed Acyclic Graphs and Traceability in the sustainability field. In all searches, only scientific articles were selected.

Secondly, a focus group based on the analysis of sustainability scientific articles will determine whether the Root Cause analysis, Directed Acyclic Graphs and Traceabiity methodologies could improve the capability of researches for analyzing the real causes of sustainability problems.

Findings or results

28,331 scientific articles that include in their title the word sustainability were found from January, 1st 2000 to January, 26th 2021. In the same period, 15,769, 8,829 and 3,022 included in their topic the word Root Cause Analysis, Traceability and Directed Acyclic Graphs, respectively. Only 25, 49 and 2 articles out of 28,331 published under the title sustainability included in their topic Root Cause Analysis, Traceability and Directed Acyclic Graphs, respectively, which means that most articles have used statistical analyses without any consideration about the causal basis.

Discussion

This paper encourages researchers to search more for the real cause of sustainability problems than to use statistical models without a good understanding of the causal basis of the problem. Finding the efficient cause allows focusing resources and accelerating the process to solve the sustainability challenge. To find the efficient cause, it is necessary to classify properly the research variables into causal, confounding, moderating, etc. Root Cause Analysis, Traceability and Directed Acyclic Graphs could improve the capability of researchers to better understand the causes and correctly classify the different variables affecting the phenomenon.

Conclusions

The methodologies of root cause analysis, directed acyclic graphs and traceability may facilitate the search for real causes in scientific research, especially in complex, multifactorial and difficult problems such as those related to sustainability.

a. SDG+Target:3.1+6.3+11.5+13.2+14.1+14.2+14.3+15.1+15.2+15.3+15.4+15.5+15.7+15.8

b. Root Cause Analysis, Traceability and Directed Acyclic Graphs could improve the capability of researchers to better understand the real causes of sustainability problems.

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Interaction between the use of environmental management accounting and the environmental budget with environmental performance

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Abstract

In the current scenario of ecological issues'importance for organizations, having the commitment to the natural environment is relevant to management (Kamel & Elbanna 2016). In this context, the literature addresses the importance of developing strategic mechanisms that integrate environmental issues, which connects environmental aspects to organizational strategy (Henri & Journeault, 2018).

To deepen these issues, this study aims to understand how the interaction between the use of environmental management accounting and the organizational environmental budget with the environmental performance in a timber industry located in southern Brazil.

According to Fierro, Redondo & Wilson (2008) the environmental budget generates information, which promotes the necessary support for the strategic decision making process. Considering that, currently the difficulty is no longer related to include or not environmental strategies, but in how organizations should behave to implement such actions, especially those focused on revenues and investments of the organization (Epstein, Buhovac & Yuthas, 2015). The contribution of the research is to understand the paths that the studied organization is taking for the construction of the management focused on the ecological environment and the results obtained through these actions.

This study applies to a specific company in the lumber industry, which was selected by those belonging to environmentally sensitive sectors (Environmentally Sensitive Industries). The design of this study is with qualitative approach, the objectives are descriptive and the procedures as case study.

In this way, it is expected to understand how the interaction between the use of environmental management accounting and the environmental organizational budget with environmental performance occurs through the application of a study in a timber industry. Thus expressing whether the environmental management controls, when linked to the application of an organizational environmental budget, promote benefits and support decision making in its management process, which can lead to greater environmental performance. In case of a positive relationship between the variables of this study, according to Journeault (2016), it may result in an important support mechanism for environmental implementation within organizations.

Regarding the report on Global Sustainable Development (GSD), this study addressed items 8 (Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all) and 9 (Build resilient infrastructure, inclusive promote and sustainable industrialization and foster innovation), by studying ways that industries can promote environmental care and management, resulting in sustained economic growth through a resilient strategic infrastructure.

This study is in line with the theme proposed for this congress, as it deals with the analysis of accounting management systems focused on environmental care, trying as a return for managers, the identification of the implementation of measures to support decision-making, favoring for a quality management based on sustainability.

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Finland-Sweden 1-0?

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Abstract

Finland-Sweden 1-0?

For several decades, Finland and Sweden have had similar systems regarding an external and partly state-controlled school inspectorate in order to ensure the quality of the basic school system. Sweden's political intentions have called for a stronger and more centralized school inspectorate, while Finland has gone in the opposite direction where the regional school inspectors have been gradually abolished, which came into force in 1988. Despite the fact that Sweden has expanded its school inspectorate in recent decades and increased funding from 40% in 2009 to 57% in 2013, Sweden shows poorer school results than Finland does in international surveys.

Sustainability can be understood from a number of different aspects and this work is based on Hargreave's and Fink's declaration on sustainability with a focus on the school. *"Sustainable leadership and sustainable improvement in education preserves and develops in-depth learning for all who spread and last, and in ways that do not harm but give positive results for others, now and in the future"*.

A report from the Swedish Schools Inspectorate presents a picture of what is significant for successful principals: The principal is committed, bases decisions on analyzing the connection between teaching patterns and the development of knowledge results, is democratic and involves employees, creates a culture that fosters commitment and encourages skills development.

Offensive quality development consists of six cornerstones:

1) Put the customer in the center

2) Base decisions on facts

3) Work with the processes

4) Work with continuous improvements

5) Create opportunities for everyone to participate

6) Develop a committed leadership

Despite the fact that Finland has a similar funding system with a municipal school as Sweden, there are still large qualitative differences between knowledge levels in the two countries. Finland has provided external quality control and moved towards increased internal quality assurance, while in Sweden the external school inspectorate has been strengthened.

The research questions in this context are based on the principals' attitude to external and internal quality assurance and its connection to the school's primary utility - to educate and educate the students.

Question 1. What has the inspection development been like in Finland and Sweden during the post-war period?

Question 2. How do the principals in each country experience the connection between quality assurance via school inspection processes and the students' actual levels of knowledge?

Question 3. How does leadership in the control and management chain affect students' actual knowledge results based on the principles of quality development?

The research project will be based on the principals' attitude to external and internal quality assurance, and qualitative interviews with principals in three municipalities in each country will be conducted at compulsory schools. The selection will be Swedish-speaking schools in Finland. The expected result of the empirical survey is that internal quality assurance based on the local school's own conditions provides a higher degree of sustainability in the system and that sustainable leadership is based on the principal's close contact with the school.

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Innovative Sustainable Global Partnerships between Schools and Organizations Provide Quality Education and Value for all Stakeholders, a Literature Review.

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Abstract

The purpose of this paper is to present results from a literature review on Quality Management systems and the role of partnership to support sustainable innovative practice. Research shows that partnerships create value for the organizations and are an important component to developing responsive and sustainable systems. In education, partnerships between schools and business and international organizations is showing promise to enhance the quality of education and prepare youth for a sustainable global community as part of the UN sustainable development goals.

The primary goal for schools seeking to enter into a partnership with an international organization is to foster the students' growth as global citizens with an international mindset, and to increase and sustain their customer base. The primary goal for international organizations to enter partnerships with schools is to grow as an organization through their outreach into school communities and to foster students' growth as global citizens. This research is important in that it will provide insight into the Quality Management practices taken by innovative sustainable partnerships which follow the United Nations Sustainable Development Goal Target 4.7, providing a quality education that promotes "a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development." There is a growing need among private schools to create value for their customers by incorporating innovative environmental and sustainability educational opportunities for the students, as global awareness is increasingly growing throughout the customer base.

Next steps, following this conference, will include a study which focuses on a private school in the United States that regularly develops and sustains innovative global partnerships. These partnerships are recognized as complex adaptive systems that contain a dynamic network of complex, interconnected pathways of human interaction that evolve and change based on episodes of disequilibrium.

The sustainable relationship between the organization and the school depend and develop upon a basic formative structure. As there is a demand for private schools to develop innovative global relationships with organizations, there is also a demand by these schools for a vetted structure that can be implemented in order to develop and sustain partnerships. This topic will be the focus of the research following this literature review.

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The problem of mathematics placement: a question of quality education and sustainability for society? - a systematic literature review.

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Abstract

The United Nations (UN) has developed the 2030 Agenda for Sustainable Development, recognizing that education is one of the main foundations for sustainable development. During the World Education Forum 2015 participants shared their vision: "to transform lives through education, recognizing the important role of education as a main driver of development and in achieving the other proposed SDGs [Sustainable Development Goals]". To contribute to a sustainable society, students need to learn skills that will prepare them to solve 21st century challenges.

Mathematics is known as a major gatekeeper to education. Students from all genders and learning styles need to have equitable opportunities in education. In mathematics education, students are often rewarded for speed and memorization of facts. Many times, placement in accelerated classes is based on procedural knowledge alone. There is evidence to suggest that students who are accelerated without developing depth of understanding tend to drop out of mathematics and forgo the opportunities to pursue STEM (Science, Technology, Engineering, and Mathematics) related careers. This is a fundamental question about quality in education. Addressing this is important to ensure sustainability in the students' learning progress and add value to their education. Taking into consideration the non-linear structure of mathematics education and seeing mathematics education as a complex adaptive system, may lead to different kinds of decisions on students' acceleration in mathematics, adding an important perspective about how to enhance quality in mathematics education.

The seven principles of quality management (International Organization for Standardization [ISO], 2015) may guide decision makers through the process of continual improvement. When following the quality management principles, decisions need to be evidence-based and need to meet students' current and future needs. To enhance its capability to design and deliver a valuable placement system, school leaders need to empower and engage mathematics educators in the decision process.

The purpose of this paper is to present a literature review that will draw from the quality management literature to provide a rationale for creating a placement system that is sustainable for students in their learning, as well as for the sustainability of the mathematics program in education. In particular, the literature review will examine systems and complexity theory, value co-creation, decision making, and sustainability.

This abstract contributes to the track focus of researching the connectedness of quality management and sustainable development. This focus relates to the topic: Synergies between Quality, Quality Management and Sustainability.

Full papers

The Human Networked Organization:

Toward Contemporary Quality Management and Sustainability

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Abstract

In this paper, we examine the role of networking as a management strategy for organizational development to help leaders create sustainable practices that invite adaptability and responsiveness to emerging internal and external needs. Networking has been identified as one of the ingredients in contemporary organizational development as part of the emergence paradigm in quality management. Yet little research exists on how networks can be used within organisations to strengthen the infrastructure toward agility and sustainable development. We are interested in exploring how leaders can use and develop networks as a management strategy within an organization to foster agile, resilient, responsive sustainable infrastructures as part of the UN Sustainability Goal #9.

In our research we coined the term, "*Human Networked Organization"* to suggest a new organizational prototype to promote sustainable organizational development that occurs when leaders systematically structure the functions of work in a network system, which includes values and culture. This prototype is the result of an ethnographic study of a private school in Tampa, Florida, USA. Data were collected systematically from 2016-2018 through observations, focus groups, informal conversations, document analysis, and a process-map to examine how the leadership team and teaching staff worked. Data were analysed based on social network analysis to examine, understand and illustrate the complex fabric of life in the school. Findings from this study contribute to the conference track focus on understanding the connections between quality management and sustainable development at the organizational level, and the UN Sustainability Goal #9.

Keywords: Leadership, Networks, Sustainable, Quality

1. Introduction

The UN Sustainability goals (SDG) offer a powerful framework for addressing primary global challenges, such as generating economic growth, achieving social justice, exercising environmental stewardship, and strengthening governance https://sdgs.un.org/goals. In particular UN Sustainability Goal #9: "to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" stimulates continued research and development to explore how organisations can integrate sustainability and organisational quality, both as an internal practice and an external goal. To resolve any of the UN targets for anticipated transformation, new capacities will be required for industry, social and governmental agencies, as well as small businesses. Hence, priority is given in this paper to the leadership and quality management of sustainable enterprises for a new age of work.

Building sustainable organizations in the complex and rapidly changing environment of today is demanding bold new management strategies from leaders. In fact, leading and organizing work systems in the 21st century is undergoing a dramatic paradigm shift (Rill, 2016). At the forefront of the dialogue is a recognition that new systems and approaches are needed for organizations to become more adaptive and responsive to complexities in industry, service delivery and customer needs (Ulh-Bien & Arena, 2018). Amidst the dialog, echo concerns, challenges and opportunities about what role businesses and organisational development can serve to achieve the sustainable development goals (Mårtensson, et al., 2019; Vandenbrande, 2021). Quality management as a field has an important role and stake in this endeavour.

Quality management is entering both a new era and paradigm that recognizes the need to integrate sustainability (Deleryd & Fundin, 2020) and expand approaches to organisational development (Fundin, et al, 2021), which also embrace the human dimension (Park-Dahlgaard & Dahlgaard, 2003). While, it is perhaps easy to support sustainable development practices through statistical target goals (i.e. UN Global Compact and eco-metrics), many argue that this is all but one piece of the puzzle (Ramanathan, 2021). Developing sustainable practice requires a mind-shift and new practices within organisations (Rill, 2016) and a recognition that society is also a customer (Deleryd & Fundin, 2021).

Researchers in quality management suggest there is a paradigm conflict between current business forms based on models from the 20th century and what is needed for meeting the complexity of society today (Fundin, et al, 2021). Explorations in the Emergence Paradigm (Fundin, et al., 2021) consider network and complexity theory to develop organizational prototypes for leading organizations today. Leading adaptive organizations requires a shift from short-term solutions to proactive visioning that is value-based to create responsive, adaptable, and sustainable practice (Bäckström, et al., 2018). It assumes a "Systems Approach" to designing adaptive organizational structures, enabling networked interactions, nurturing innovation and providing leadership development that fosters collaboration along with individual performance" (Holms, et al., 2013, p 89).

If our knowledge and understanding about quality management is shifting to reflect a paradigm of emergence, self-organisation, out-of-the box thinking, participatory practice, and sustainability among other things, what implications does this have for leading organisations? This question, we suggest, is missing from the dialogue on quality and sustainability in the new millennium. Mårtensson, et al. (2019) found that despite knowledge about important interlinkages between sustainability theory and quality management philosophy, few leaders demonstrated knowledge and awareness about how to link the two in practice. In a Delphi-dialogue study, Fundin, et al., (2021) identified a need for further research to study and learn from best practice how to help leaders combine and balance self-organisation with traditional leadership. If businesses and organisations are to succeed in meeting and satisfying societal needs today and in the future, new approaches to leading and organizing are paramount.

Over the last five decades we have been researching leadership for developing school and school district organizations. This work is based on a Systems Perspective (Snyder & Anderson, 1986), along with a lens from Chaos Theory and Quality Management (Snyder, et al., 2000; 2008) which promotes perspectives and practices for how leaders can develop an organization's resilience, its energy system and innovative practices that adapt work quickly to emerging and challenging conditions. With the more recent concept of sustainability added to the organizational development equation, new questions emerge about how to respond to complex changing times, and to the challenges of living in this global age. Our working definition of sustainability in organisations has derived from the new sciences for emerging laws of change and survival in natural systems: *Sustainability is the responsiveness of a living system to changes in the environment* (Snyder et al. 2008). Creating sustainable conditions for work requires a departure from isolation in any form, which assumes a fundamental shift toward systems thinking.

After decades of promoting systems thinking and the interdependency of work systems, we now perceive that the next level of organizational development theory is network thinking. Networking has been identified as one of the ingredients in contemporary organizational development and quality management, yet much of the research on networking focuses on network formation and maintenance between organisations. Mohrman et al (2003) and Mcgrath & Krackhardt (2003) have studied the importance of networks for organisational change illustrating how loosely connected ties between people and functions lead to greater change and development as compared with traditional hierarchical structures. These studies provide insights into the importance that network theory offers leadership and organisational development. Less emphasis is given, however, to explore the network model as a potential organisational form and how a network might function to strengthen the infrastructure toward agility and sustainable development. We are interested in exploring how leaders can use and develop human networks as a management strategy within an organization to foster agile, resilient, responsive sustainable infrastructures as part of the UN Sustainability Goal #9.

The purpose of this paper is to present the theoretical rationale for the *Human Networked Organisation* as a prototype, and to illustrate it based on findings from an ethnographic study of a private school in Florida. Impetus for the study emerged while seeking to understand how this private school achieves its high levels of involvement and performance with a strong value-based leadership and a sense of culture and identity among all staff and students. During the initial stages of the research it became clear that current ideas of school organization were no longer adequate for understanding the complexity and leadership that drives the school; human networking appeared to be a norm, as were strong values to connect people, process, and performance. Yet in the literature, the dominant connection between organizations and networking science promotes the architecture of an organization's digital networks, with its electronic structure, or the application of network theory to support change. Nowhere is there speculation on intentionally designing a human networked organization that can provide leaders with an understanding of how to build sustainable systems that are adaptive, responsive and continuously improving. This is a story about human energy and how it can be systemically supported and unleashed in organizations to continually adapt to emerging challenges and opportunities.

2. Background

Uhl-Bien and Arena (2018) suggest one of the biggest challenges for leaders today is how to "position and enable organizations and people for adaptability in the face of increasingly dynamic and demanding environments" (p1). Kim and Mauborgne (2015) argue that the organization itself is no longer the unit of analysis, but rather, it is the strategic moves, with managerial actions and decisions involved in making moves, that determines how well an organization adapts continuously to rapid and complex change. Evidence is now emerging about the power of the human network for building adaptive, responsive systems that are fluid, interactive, and transparent to meet the complexity that surrounds organizations. One question that emerges is what does it take for such fluid, adaptable systems of interaction to become stable and sustainable, and yet ensure quality? We suggest answers can be found by harnessing knowledge from the sciences, and in particular network theory.

2.1 Organizations as Living Systems

Alexander Humboldt was the first to publish observations from journeys all over the globe to illustrate how nature is a web of life that emerges from interconnected forces to form an intricate fabric of life (Wulf, 2015; Humboldt, 1864). Humboldt unified the earth *as a whole* for scientists, by studying the natural forces of nature that interact and stimulate continuous change. He documented how nature is an organization of interconnected forces that are net-like, which he called *a web of life*. As physicists continued to study the universe, new laws emerged to clarify *how it all works*. Six fundamental ideas have been identified, which are an essential foundation for leading growth and change in organizations (Snyder, et. al, 2008). The six ideas are presented in figure 1:

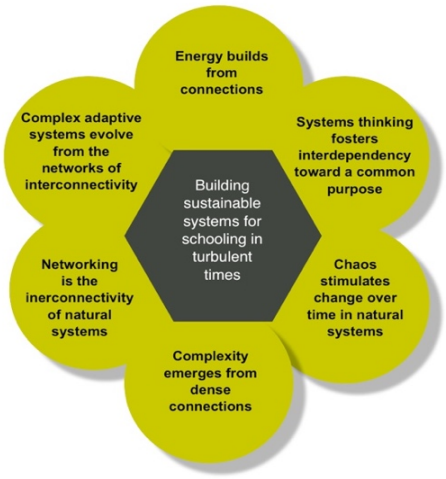

Figure 1: Six lessons from the sciences (Snyder & Snyder 2021)

2.1.1 Big Idea #1: Energy Builds from Connections

Change in natural systems evolves from continuous connections with the external environment, as well as from within the system itself. The quality of connections matters, however, for negative and positive connections promote altogether different levels of energy and outcomes (Snyder et al., 2008). For example, negative connections build negatively, whereas positive connections build positively. And, where there are no connections, there is little energy generated and virtually no growth. When the connections become dense, the system develops its own energy system and direction for growth.

2.1.2 Big Idea #2: Systems Thinking Fosters Interdependency and Common Purpose

Physicists observe that the emergence of systems thinking is a profound revolution in modern history, for it causes us to shift our approach to life from "fixing the problems in machines" to "promoting growth in living systems" (Capra & Luisi, 2016). A systems view of life creates the mindset that everyone is working together toward a common purpose. A systems approach is a shift toward a multidisciplinary strategy for development, is relationship-oriented, embraces mapping possibilities rather than evaluation systems, and measures success in quality, values, and process. Systems thinking can alter how we think about change and building sustainable school programs and services.

2.1.3 Big Idea #3: Chaos Stimulates Change over time in Natural Systems

If an organisation is a living system with interdependent functions that work toward common purposes, what then is the nature of growth and change over time? Scientists began to study change in different

kinds of natural systems, beginning with mathematics (Gleick, 1987). They soon became aware that change is not predictable, nor is it linear, and yet it follows patterns of consistency within its own system (i.e., forests grow and die as forests) (Snyder et al., 2008). We have observed that educators find relief from the positive impact of disequilibrium on development Eventually, we developed the *Chaos Theory of Change* (Snyder et al, 2000*),* which is based on the essential patterns that scientists found in natural systems, and identifies essential features of change processes found in natural systems. This perspective on growth over time is natural, for we experience it in our daily lives; we are not machines but rather living systems that need continuous feeding to grow in healthy ways.

2.1.4 Big Idea #4: Complexity Emerges from Dense Connections

A fundamental feature of living systems is that complexity grows naturally, and it emerges over time, following its design. Systems-thinking naturally leads to greater complexity, which strengthens a system's cohesiveness and resilience (Buchanan, 2002). As complex systems grow more complex; they never reverse and become simple. Since complex natural systems grow in a non-linear fashion, move quickly and unpredictability, surprises emerge. Surprise becomes routine from the multidimensional life that exists within a system with a non-linear set of rules. New professional capacities emerge to address the growing complexity and surprises of school life.

2.1.5 Big Idea #5: Networking is the Interconnectivity of Natural Systems

Networking within an organization is the natural result of systems-thinking, which involves a growing connection of elements within and outside the organization, and the understanding of disequilibrium and self-organization in the organic process of growth. Human networks have existed since the beginning of civilization, although they have been studied as a science only since the 1960s with the Six Degrees of Separation phenomenon (Barabasi, 2003). After decades of promoting systems-thinking and the interdependency of work systems, we now suggest that the next level of organizational development is network-thinking. Technology platforms have fuelled networking to function well along with more traditional hierarchical structures, creating a new norm (Ferguson, 2017).

2.1.6 Big Idea #6: Complex Adaptive Systems Evolve from Networks of Interconnectivity

The concept of complex adaptive systems (CAS) emerged from the science of chaos theory and has become a metaphor for living systemically and sustainably (Holland, 1995). Highly developed complex systems, and networks of systems, easily adapt to changing conditions. A dynamic network of many agents works in parallel, constantly acting and reacting to what other agents are doing and learning (Barabasi, 2016). Control is decentralized as agents continuously learn from each other and the environment about change and possibilities. Rules change continuously in the adaptation process as agents learn, respond to, and pursue their system's sustainability.

For sustainability to continue, there needs to be a balance between disorganized and organized complexity, where variations no longer cancel one another out, but rather become reinforcing (Miller & Page, 2007). In complex adaptive systems the following characteristics are found naturally: a variety of networks, continuous interactions, self-organizing, interconnections, emergence, dynamic, co-evolution. Some leaders identify sustainability strategies, and begin to map sustainability issues while working with cross divisional teams, outside consultants, and external stakeholders. They are finding that sustainability strategies improve performance, innovation, customer loyalty, media coverage, and stakeholder engagement (Tensil, et al, 2021). Leaders shift their roles during a transition from a directive role to one of support and mentoring (Rigby, 2020). Building an agile enterprise means finding the right balance between standardizing operations and pursuing innovation.

2.2 Networking as a Promising Management Strategy

If one accepts the premise that the organization is a living growing system, which needs to be fed continuously to enable its people to work across the organization, the question emerges: What are useful strategies for building more agile and yet accountable cultures of work without a free-for-all resulting, where the organization progresses from chaos (a healthy state) to turbulence (where systems fall apart)? We contend that networking is a promising strategy for unleashing talent, maximizing resources, encouraging innovation, and increasing resilience and responsiveness to changing conditions.

Networking has been the basic building block of communities since Sumerian times, thousands of years ago (Kramer, 1963). Everyone naturally accumulates personal networks of family, friends, and professional connection systems. Leaders and managers naturally build external partnerships and coalitions for advancing their organization's products or services. And, as the demands on organizations become increasingly complex, leaders often create their own professional networks to add resources and opportunity to the challenges they face.

A network, simply defined, "is nothing more than a collection of objects connected to each other in some fashion" (Watts, 2003; p. 27). There are a variety of network types including technological and human (Buchanan, 2002). Early theories about networks assumed that they are static structures. As Watts (2003) reports, later findings disproved this notion: networks are dynamic objects not just because things happen in networked systems, but because the networks themselves evolve and change in time, driven by the activities or decisions of those very components. In this connected age, what happens and how it happens depends is a network health (ibid p. 28).

Scholars now have identified common features of emergent living systems and their effects, and as a consequence, networking theory is becoming a vital part of the Physics of Complexity. For example, scientists have learned that a network grows from within itself, rather than from external forces as it responds continuously to changing conditions and opportunities (Barabasi, 2003; 2016). The network can only be understood as a whole, and with it the function of emerging parts to the whole (Buchanan,

2002). The Science of Complexity now searches for patterns in networks that make them vital and sustainable. Scientists are examining networks as the new structures for the global age, where networking is fast becoming a primary leadership skill. According to Barabasi (2003), the 21st Century is likely to concentrate on Complexity and the Network, which he predicts will have the following characteristics:

- A network is a rapidly evolving dynamic system of interconnectedness.
- The Scale-free Network idea is built around Hubs of interest
- Networks are self-organizing and based on the strength of Hubs.
- Hubs have many nodes and links internally.
- Hubs connect to other Hubs through weak links, thus forming the network.
- Large Hubs define the direction and shape of the network.
- Two laws govern networks: growth and preferential attachment

If the network pattern for work will become a dominant feature in the 21st century, what are the implications for management, for network development, and for institutions of all kind? Barabasi (2003) argues that the 21st Century Business Model will move from hierarchy to networks in the following ways.

- All organizations need to shed hierarchical thinking and develop networking thinking patterns.
- For the network to grow, hubs must get bigger and stronger, and also connect with each other.
- The shape of a network is governed by the biggest hubs, which keeps the network together.
- Strategic partnerships and alliances are the means of survival in development, training, service, and research.
- Each Hub must add value to the network to survive in it.
- Products and ideas spread through hubs.
- Real networks are self-organizing.
- Three types of networks exist: centralized, decentralized, and distributed.
- Multi-tasking is an inherent property of networking.
- Clusters of workers develop parts of the system and its functions.

2.3 A Human Networked Organization: A prototype for consideration

Ideas about networking within organizations are only beginning to take shape. After decades of promoting systems thinking and the interdependency of work systems, we now suggest that *the next level of organizational development is network thinking, with the interconnectedness of everything.* Consider what might happen if organizations intentionally become networked systems of interconnectedness? What if attention were given to major units of work and minor units that were all connected by common values and purposes? What if new leadership roles were intentionally created to link hubs and clusters together to influence the quality of work and its impact on the customer?

Scientists observe that networks create their own energy system, and expand as interests and needs emerge (Buchanan, 2002). Recent studies reveal that purpose-driven organizations tap into the basic interests of their workers to create energy for innovation and continuous improvement (Quinn & Thakor, 2018). A scale-free network is a complex cluster of interconnectivities, which includes hubs that dominate network activity, along with smaller clusters of work that support and are connected to hubs and many other clusters (Barabasi, 2016). The distinction between various existing systems of work in schools (learning communities, teams, departments, houses, specials), for example, and networks is the connecting links between and among them. Links that connect clusters and hubs are vital to the stimulation of a network's growth. Without links there are no connected hubs or clusters, making *links the distinguishing element for integrating many work systems to form a growing network*.

The presence of Multiple leaders is also a major characteristic of networks, where power comes from the unifying purpose and a specific function that advances the organization. A surprising find is this: the more complex the network, the fewer fluctuations there are in its performance and growth; the most stable type of network is complex (Buchanan, 2002). More simple networks are found to be more vulnerable and less sustainable in performance and growth. Complexity is a good thing, it seems, for it grows naturally in a healthy network, strengthens its structure as a living system, and leads to durability and sustainability over time.

We can now hypothesize that *sustainability over time emerges from healthy, growing networks of human activity around a unifying purpose*. Human networks emerge from a unifying purpose, along with independent and voluntary links, and with multiple leaders. The unifying purpose, systems of work, processes, values, and procedures are all central to consistency across the network. These vital features prompt new pathways to open and enhance life within the network and have the potential to advance organizations and leaders into a new paradigm for leading complex systems.

3.0 Methods

An ethnographic study was conducted from 2016-2018 based on a single-site case study of a private school in Tampa, Florida USA. The school is recognized locally and internationally for its innovation, professional development and continuous improvement efforts, partnering with many national and international organizations, and has been the site of other research studies initiated by among others Yale and Harvard Universities regarding pedagogical practice and well-being.

This study was initiated based on a long-term professional relationship between us as researchers and the school leadership team, which originated in the 1980s as Professors in Education at the local university, and continued subsequently through a partnership project to develop schools as global learning centers (Snyder, K.J. (2019). One of the necessary prerequisites for conducting an ethnography is gaining access to the case site. Based on our long-term professional relationship, we had established

access and trust among the staff and leadership team, providing us with possibilities to explore more in depth the school as an organizational system.

3.1 Case Description

Using Vandenbrande's (2021) Sustainability-Quality Matrix, we suggest the school can be identified in the fourth quadrant, "holistic sustainability", having integrated SDGs in the vision and mission of the school, as well as the pedagogical and organisational practices through their work since 2004 with the International School Connection and International Baccalaureate programs.

3.2 Data Collection and Analysis

Over the course of two years, data were collected systematically by the lead author, from 2016-2018. Data are based on observations, focus groups, informal conversations, document analysis, and a process-map to both examine how the leadership team and teaching staff worked. The second author participated in analyzing the findings.

Data were analyzed based on social network analysis (Garton et al, 1999) to examine, understand and illustrate the complex fabric of life in the school. Social network analysis is a process of understanding the connections between sets of people (hubs and clusters) that are connected by a set of social relationships (links-ties). Social network analysts seek to "describe networks of relations as fully as possible, tease out the prominent patterns in such networks, trace the flow of information through them, and discover what effects these relations and networks have on people and organizations.

The decision to use social network theory as an analytic framework emerged during the course of the ethnographic study during which it became evident that understanding and describing the case sites organization and leadership did not fit into the mold of traditional research on school or organizational development and leadership. In the results section, findings are presented based on the network analysis that illustrate the Human Networked Organization as a prototype and a management strategy for leading sustainable organizational development.

3.3 Ethical considerations

Permission to conduct this study was given by the leadership of the school, including the Board of Trustees. Access to key informants was established through the leadership team, and consent to participate was secured prior to interview. Observations took place over time, and were carried about by the lead author whose presence in the school was already established based on her work with the International School Connection. As such, she was integrated into the context of the school and her presence did not appear to disturb the context of study.

4.0 Results

The results are presented in narrative form to illustrate networking as an organizational model. In this first section, a description of the school is offered based on the school's planning documents, observations and interviews with staff and the leadership team.

4.1 The Case Setting: Corbett Preparatory School at IDS (CP)

CP is a private school in Tampa, Florida USA with about 520 students, pre-K through middle school, which recently celebrated its 50th anniversary. Members of the student body and teaching faculty are international, bringing global perspectives naturally to school learning. The professional staff and students are organized into learning communities, with many additional special programs that are offered during the school day, evenings, weekends, and summers to accelerate learning. The curriculum is guided by the International Baccalaureate Program, and by the *More Options for Results in Education Program (M.O.R.E. Approach) (Cohen, 2003),* which encourages brain-friendly learning and social/emotional development. Students are engaged in musical, art, Stem research and symposia, and sports performances throughout the year, to strengthen student self-concept, character, and capacities while working continuously within a positive environment. Moreover, Systems Thinking, Quality Management, and Chaos Theory, are used as conceptual guideposts to support organizational sustainability, continuous improvement and customer satisfaction, as articulated in the M.O.R.E model (ibid).

Characteristic of the school is the continuous development of new approaches to learning and organization that drive professional development and a culture of continuous learning and improvement. Teachers assume, and are paid extra for responsibility beyond their primary jobs, for initiatives across the school, forming a vast network of interconnectivity that raises the level of performance significantly for adults and students. The school now functions on an unprecedented scale of human activity to advance learning for everyone.

The school has regular classroom hours, and in addition, buzzes every day from early morning until late at night, every weekend, and throughout the school year with engaged students, teachers, parents. Everyone seems happy and in charge of something important, while thriving within a culture of "Olympic Thinking", where challenges are addressed to become new systems of work. Some teachers move on to other schools for various reasons, and new ones come aboard to help continue the school's development journey. The school never seems to miss a beat in its forward momentum as a sustainable learning community for everyone.

In this purpose-driven organization, workers take on new chores and challenges in response to emerging demands of the growing system. The phenomenon is clearly a network of growing clusters of initiatives, with new kinds of leadership roles emerging, and where human energy is a force for innovation.

Important here is that the Corbett Prep network didn't happen overnight because of administrative directives, but rather emerged naturally as the professional staff, with school leaders, pursued ideas for enriching the learning environment for its students.

The school leader's role shifted over time from supervising individuals, teams and programs to managing the systems of work throughout the network, along with the health of the school's culture and its impact on every learner. Teachers are responsible for everything that occurs within their learning communities, while mentoring and coaching each other to "Olympic" performance. Many teachers take on additional major responsibilities for the entire school, which strengthens the school's connection system, its purpose and values, and its sustainability potential.

Vital to the educators at Corbett Prep is the weekly professional development event that is led by the Headmaster, many teacher experts in one innovation after another, and visiting experts with the focus on "What is best for kids". Professional dialogue is a dominant feature during these events, which spills over into the daily life of their work with students. In addition, many teachers are sent every year for specialized training to become the school's expert in various initiatives, and then assume responsibility for the success of that program throughout the school. New teachers are trained in every core program of value to the school prior to their teaching debut. The administrative teams appear to have one purpose, and that is to support the work of teachers in achieving high success levels for each student. What now exists is a complex web of life, with its energy for learning, where every student is cherished and nurtured, which is apparent to every student and parent, as well as to over 400 national and international visitors to the school each year.

4.2 Corbett Preparatory School as a Human Networked Organization

In this next section we illustrate how CP can be viewed as a Human Networked Organization based on the social network analysis. In the analysis we explore the presence of 1) academic hubs, 2) core values, 3) clusters of programs and services, and 4) network links that bind relations between people and functions.

4.2.1 Academic Hubs

Based on social network theory, the first unit of analysis to consider is the Hubs, which are the main components of a network. In figure 2, the five purple academic hubs are the primary work units for every teacher and other academic professionals. The primary purpose of these units is "developing the whole child", a purpose that every professional can easily verify. Students are organized into both multi-age and age-specific groups, which generate a fluid system for connecting between and among hubs for academic purposes, school-wide.

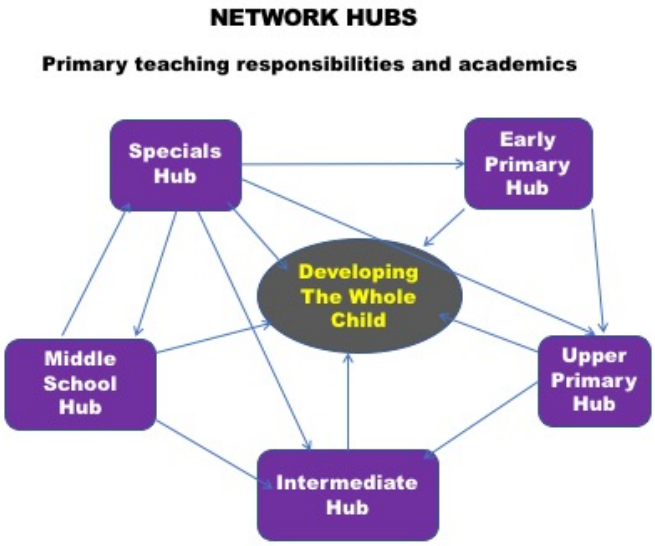

Figure 2: Academic Hubs at Corbett Preparatory School

4.2.2 Core Values

CP is guided by a strong set of values that is grounded in pedagogical philosophy, human development, social relations, leadership and global citizenry. The values have developed over time and form the school's central guiding document: *More Options for Results in Education (A M.O.R.E. Approach)* (Cohen, (2003). These core learning systems, illustrated in figure 3 create cohesiveness in the school's culture and network development. The nineteen programs are commonly shared among and between professionals in all five academic hubs (see 4.2.1) to promote a common culture for the school as a unit. These learning systems are the core values in the school's culture of work, which include nurturing approaches to learning and teaching, and to collaboration at all levels. Programs also nurture social and emotional development, and guide global learning using various international models and standards of excellence.

For example, all hubs in purple (Early Childhood to Middle School) integrate core values from mindfulness, team teaching, global learning, social emotional learning, cooperative learning, etc. in their pedagogical praxis and curricula. While the academic content differs for each grade level, the core values are present at all levels. As well, the staff serves as role models for students in the behaviours, attitude and language to reflect the values, while students in turn coach one another based on the shared values.

During a study visit to the school, international guests are often guided by students around the school who share the school's activities, practices, and core values. During one visit, we witnessed how a 10 years old student-guide passed by a 6-year old student who was upset by an event. Immediately, the student-guide stopped to ask the 6-year old how to help them. With a clear priority to help the young student, the guide asked the group of visitors to be patient while she helped the younger student find

the necessary support. Within minutes, the tour resumed as the younger student was carefully guided into the hands of a teacher. This exchange illustrates how the culture of shared values permeates all levels of the school, and how the school also coaches students to develop responsibility and a shared community to bind the school together as a growing network.

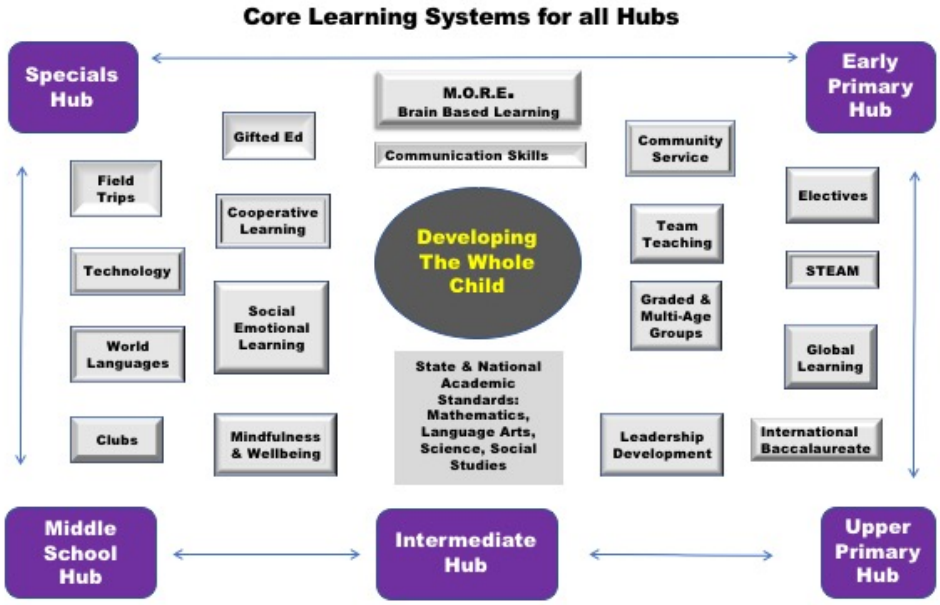

Figure 3: Core Values Embedded in the M.O.R.E. Approach (Cohen, 2003)

4.2.3 Clusters of Programs and Services

Surrounding the academic hubs are learning clusters, illustrated in figure 4, which are utilized by each of the hubs to support academic development with programs that enhance student growth. Four of the clusters provide added dimensions for learning and social development (arts, music, STEM, physical education, Spanish and Chinese language, and international experiences), while three other clusters (technology, administration, and board of trustees) provide a support system to help the school to thrive. Each cluster not only has its own series of programs, but also works in relation to other clusters and with all academic hubs. The blue lines illustrate the actual working relationships that exist between and among hubs and clusters at Corbett Prep. For example, the Arts cluster is also connected to the Music cluster and the Technology cluster reflecting the interdependent approach to the arts and technology for learning. The administration cluster is connected to all clusters as a central support system. The extensive network of programs promotes learning within each hub, signaling the energy systems within the network that supports learning for all. Gone is isolation in any form, as well as "silo thinking" among hubs and clusters.

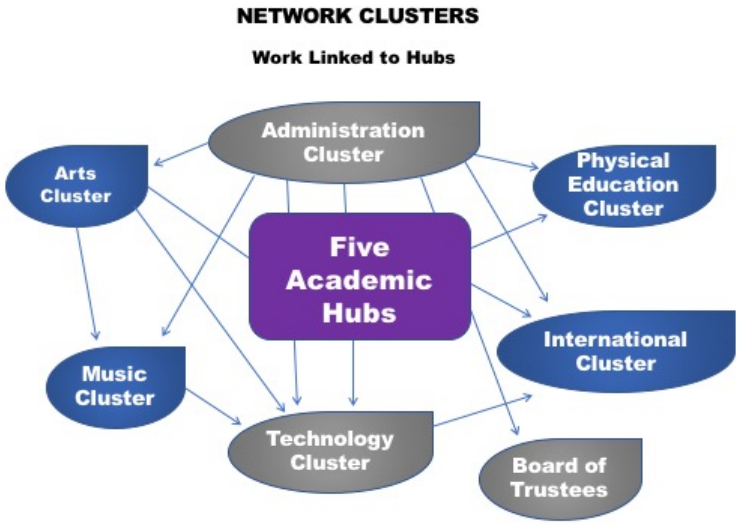

Figure 4: Clusters and Program Services

4.2.4 Network Links

Figure 5 depicts a more detailed view of the kinds of programs and connections that exist within the work of the school's different clusters (in blue) connecting them with hubs (in purple). The network model is illustrated by a number of events that take place regularly in the school. For example, during grandparents day, which is offered once a year, everyone participates in a school-wide performance, which is developed and orchestrated between teachers from the Music, Art, and Technology clusters, involving students from all grades and different programs, among them dance, choir, band, art, TV, live streaming, world languages, thematic curricula.

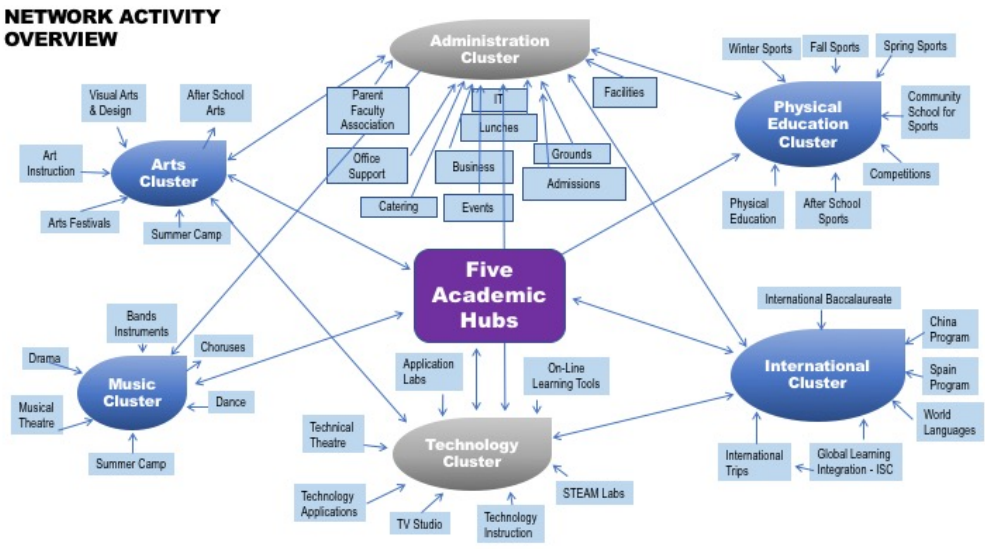

Figure 5: The Living Network at Corbett Preparatory School

The network feature that is embedded in figure 5 is the Links that distinguish a networked school from other schools, where hubs may or may not be connected to each other, and the clusters of non-academic work may or may not be connected to each other and/or to the academic hubs. LINKS in the network create the connection system that distributes knowledge, resources and feedback, and which enables the network to stay open and expand over time. How does this kind of network evolve?

In the Corbett Prep story, links are the secondary responsibilities of selected teachers. The blue lines reflect actual human links for school-wide responsibilities. Selected teachers are sent for special training in their area of school leadership to provide overall training, guidance, supervision, and accountability for the success of their program school wide. At Corbett Prep when a new initiative is identified for school-wide promotion, leaders are either selected or volunteer, which is typically in the form of teams that pursue the link function.

The actual 16 network links, in figure 6, identify existing school-wide programs at Corbett Prep that function under the leadership of one or several teachers. The program links are responsible for gaining knowledge about the new initiative, teaching everyone else the basics, and then ensuring the success of the program school wide. The work that emerges from the links adds complex requirements to each academic hub, where the response is to engage in continuous integration, adaptation of the new, maintaining that which is working, and tossing out that which has become outdated. This dance of complex adaptation is now the norm for the school's entire professional and administrative hubs and clusters, which function within a culture of continuous improvement and clarity about purpose and values.

NETWORK LINKS

Secondary Teacher Responsibilities:
school-wide coordinators, directors and leaders

• Curriculum Studies	• Division/School Leaders
• International Baccalaureate	• Yale's 4 Pillars of well-being
Kagen Cooperative Learning	• ISC School Partnerships
• ISC Global Learning Integration	• Math School Wide
• Division Musicals	• Fine Arts Festivals
• Whole School Musicals	• Community School of the Arts
• STEAM Program & Exhibitions	• Language Arts School Wide
• Community School of Sports	• Modeling Teaching for Visitors

Figure 6: The 16 Network Links at Corbett Preparatory School

Findings from this study illustrate how organisational leaders can intentionally develop internal work systems and cultures based on a complex network of units with programs, and services. As well, how workers can partner across the hubs building interdependent functions, which together deliver high performance for learning and work. Based on Network Theory (Barabasi, 2003), we can see how CP can be viewed as *a Human Networked Organization:*

> HUBS: Hubs are the most highly connected features of the network. In a Networked School, academic learning communities are the hubs, which are the primary and strongest energy source in the school. Work within and across the academic hubs is the primary activity of the network, which dominates the school's work. At Corbett Prep a vast system of values is found in 16 core programs that support learning and the curriculum, and which binds the hubs together with common valued practices.
>
> CLUSTERS: Work in the smaller units is purpose oriented while related and connected to the Hubs and to the primary purpose of the organization. In a Networked School, clusters are those special programs, activities, and events that enhance learning opportunities for all students, which are connected to each hub, and in many cases the clusters are also connected to each other in their support of the school's mission.
>
> LINKS: *It is only because of links that a network can form and grow.* Links make the difference between silos of connected work and a network of interconnected work. The links connect clusters to each other and also to the hubs. Links in a Human Networked School are the many teacher leaders who assume additional responsibilities for the whole school, who have become experts in something important, and who are connected to all clusters and academic hubs.

The interconnectivity of hubs and clusters, through links, is vital for developing a complex, cohesive, and strong network for sustainable growth. To keep the network's pathways open, positive energy must be pursued, while negative energy is stopped. A network grows when the communication channels are open between and among programs and services, and where there is clarity of purpose that drives the learning and work for everyone. Sustainability over time emerges from healthy, growing networks of human activity around a common purpose. The unifying purpose, systems of work, processes, values, and procedures, are all vital for consistency in performance across the network.

5. Discussion

The global imperative to address sustainable development is pressing organizational leaders to re-examine internal practices and align systems of work with values that promote sustainable development, both within the organization as well as in society (Deleryd & Fundin, 2020). In the field of quality management, advances are now made to integrate sustainable development with internal practices and

external products and services (ibid) to help organisations meet this global imperative. Advances are also underway that recognize the importance of a systems view, the human dimension (Park-Dahlgaard & Dahlgaard, 2003) and the need for such things as smart self-organising to become an organisational norm (Fundin, et al., 2021). Among the areas currently being explored is the role of networks to support self-organisation and foster a systems' view.

In this paper we explored how network theory, based on quantum physics, can advance our understanding of new organizational forms that interconnect structure, function, culture and identity to foster sustainable practice for leading organizations as complex adaptive systems. The Human Networked Organisation prototype is rooted in both systems thinking and complexity theory, which provide an important foundation for illustrating how leaders can develop stable organisational structures that thrive on change (Fundin, et al. 2021; Rigby, 2020), and value the human dimension (Park-Dahlgaard & Dahlgaard, 2003; Snyder, et al. 2018).

In keeping with the research on organizations as complex adaptive systems (Ulh-Bien & Arena, 2018) we demonstrated how network structures, grounded in a set of values that promote loosely coupled partnerships (Rigby, 2020), has the potential to generate sustainable programs and innovation within a growing complex environment (Tensil, 2021). In the Human Networked Organisation prototype, human networks become the organisational infrastructure that interlinks human activity, values, customer needs with organisational goals and processes. Designing organisations based on a network system of interdependent roles, functions, and activities creates a natural, organic structure that is both dynamic and fluid, as well as stable (Quinn & Thakor, 2018).

This study extends previous research in social network theory (Mohrman et al 2003; Mcgrath & Krackhardt, 2003) by examining the internal systems of a school as an intentionally organized human network. It also contributes to research in the Emergence paradigm in Quality Management (Fundin, et al. 2021) illustrating how organizations can integrate traditional leadership with new structures. Findings from this study also contribute insights about how leaders can potentially link sustainability and quality management (Mårtensson, et al, 2019) through network models that support shared leadership, customer focus, values, systematic work processes.

6. Conclusions

The Human Networked Organisation prototype is our contribution to the research agenda within the Emergence paradigm in quality management and Quality 5.0. We suggest that leaders can benefit from understanding how to design human networks to balance the equation between self-organising principles with leadership. Designing organisations based on a network system of interconnected roles, functions, and activities creates a natural, organic structure that is both dynamic and fluid, as well as stable. We suggest that leaders have the opportunity to harness the network model as a management

strategy to design and foster resilient, responsive and sustainable quality development, such that the human network is seen as a stable infrastructure in the organisation's design. As networks are connected by a common purpose, the human networked organisation, is driven by a systems perspective, grounded in values, goals, and customer needs, and at the same time adaptive and resilient enough to meet complex external challenges, such as global sustainable development.

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Leading sustainable quality in organisations: Insights from the pandemic

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Abstract

In this paper, a qualitative case study is presented of how a private school in Florida, USA developed innovative responses to the Covid-19 pandemic, while maintaining and sustaining quality, within the school and in relation to global sustainable development goals. The analysis examines the school's leadership, and how strategic decision making, shared leadership, teaming and collaboration, and the school's core values and organizational culture were used to adapt and respond to the crisis. Findings from this case study provide insights to better understand how leaders can develop adaptive systems, built on quality management principles, and to foster sustainable practices that are value-based and customer oriented within the Quality 5.0 era. The paper connects to the track's focus to illustrate and discuss how quality management practices can be used to support sustainable development on the organizational level through adaptability and innovation.

Keywords: Leadership, Networks, Agile, Sustainable, Quality

1. Introduction

How leaders respond to a pandemic without sacrificing quality is an indication of how sustainable and adaptable is the organization. This past year has opened doors for researchers to examine from the front-line the practices and strategies that leaders use to re-design and innovate services to meet the emerging needs of their customers. This opportunity comes at historical cross-roads in which businesses and organizations are challenged to find ways to meet among other things the UN Agenda on Sustainable Development (Cole, 2003; Hawkins & James, 2018; Mårtensson, et al. 2019). Fundin et al. (2020) identified a need for more research in this area to understand what and how leaders can bridge the gap between traditional views of quality management and organisational development and the need for adaptive, participatory work cultures.

Researchers in quality management and organizational design suggest there is a paradigm conflict between current business forms that are used, based on models from the 20th century and what is needed for meeting the complex demands of society today (Fundin, et al, 2019; Van Kemenade and Hardjono, 2019). Among the questions to consider include, what does sustainability mean for quality management? Should the focus be on sustainable systems? or on the ways in which organizations and business can contribute to securing a sustainable future society? Many now suggest that the answer is, both (Deleryd & Fundin, 2020; Halinen, 2017; Mårtensson, 2019; Snyder, 2021). Among the changes required to meet this complexity will be a different kind of organisational infrastructure that promotes adaptability and responsiveness (Rill, 2016; Rigby, et. al, 2020; Saurez & Montes, 2020; Tensil, 2021) and a new mindset (Rill, 2016; Sanders, 2010). One of the biggest challenges for leaders today is how to "position and enable organizations and people for adaptability in the face of increasingly dynamic and demanding environments", (Uhl-Bien and Arena, 2018, p. 1). Kim and Mauborgne (2015) argue that the organization itself is no longer the unit of analysis, but rather, it is the strategic moves, with managerial actions and decisions involved in making moves, that determines how well an organization adapts continuously to rapid and complex change.

When the Covid -19 pandemic hit Florida in March 2020, Corbett Preparatory School of IDS (CPS), like all other schools around the world was faced with the basic question: *How can schooling continue?* This question was critical, not only in the immediate, but also for the future sustainability of society, in which education is vital. Schooling in the 21st century is necessarily linked to the problems and opportunities we face today, and to each community and nation's future and its role in the global community (Halinen, 2017; UN Agenda 2030). Sustainability for the future, then, is the challenge for every family, agency, business, and community, requiring all systems to become more integrated and interdependent than ever (Snyder, 2019).

Based on a long-term professional relationship to the school, we began to follow the school as a case-study. Of interest was to understand how leaders create strong internal systems of work that are based

on interdependent functions connected around a common purpose and set of values. During the first phase of the pandemic ins 2020, CPS remained open as a virtual school, following the same weekly schedule as on-campus schooling. While successful as a short-term solution, in hindsight leaders and teachers realized this organisational learning model was not sustainable in the long run. If the school campus was to open in the fall, learning needed to be reimagined to retain the school's core values of a safe and nurturing environment for everyone, and to insure the continuing of education for society.

The purpose of this paper is to explore and understand how leaders can develop organisational work cultures based on quality management practice that foster the growth and sustainability of organisational practice toward achieving the U.N. Sustainable Development goals, especially # 4, 9, and 16. In the first section of the paper we examine research and theory from systems thinking, chaos and complexity theories, and their application to organisational development. In the second section, we present a qualitative case study to examine how a private school in Florida, USA developed innovative responses to the pandemic, while maintaining and sustaining quality at the organizational and classroom levels. Specifically, we examined the leadership of the school, and how the role that strategic decision making, shared leadership, teaming and collaboration, and the schools core values and organizational work systems and culture were used to adapt and respond to crisis. Through this case study we aim to share insights into the connection between quality management and sustainability that can be used to strengthen leadership for sustainability in complex and turbulent times. This case serves to address the need for further research on leadership in the emergence paradigm and Quality 5.0 to integrate sustainable development and quality management.

2. Background

2.2 Leading organisations in complex times: the need for a mind-shift

The global imperative to address sustainable development is pressing organizational leaders, both public and private, to re-examine internal practices to align systems of work with values that promote sustainable development (Cole, 2003; Hawkins & James, 2018; Mårtensson, et al. 2019). New organizational systems need to meet customer needs, while being grounded and stable for building the kinds of healthy work environments that invite innovation and creativity to support sustainable development (Bäckström, et al., 2018; Stegall, 2006; Uhl-Bien and Arena 2018). With the growing recognition that society is now considered a customer (Deleryd & Fundin, 2020), the internal work systems, routines and practices will necessariliy need to integrate and link with sustainable societal development goals (Mårtensson, et al. 2019).

Current research in quality management suggests that we are now in a new era, called Quality 5.0, in which sustainability is a key component of quality, expanding the notion of customer to include society (Deleryd & Fundin, 2020). This perspective expands how we think about the inter-relationship between sustainable organisational development and sustainable societal development (Deleryd & Fundin, 2020;

Ramanathan, 2021). We are now entering a fourth paradigm in Quality management, the Emergence Paradigm, which builds on systems thinking and self-organising principles, and relates to complex adaptive systems. Van Kemenade and Hardjono (2019) state that, "The emergence paradigm defines quality in a dialogue of all stakeholders…knowing quality can be different tomorrow" (p. 160). Among the characteristics, quality is seen as dynamic, not static, based on shared values, flexible, adaptable, dialog and communication oriented, participatory, shared leadership, strategic and systems oriented (ibid).

In recent issues of the *Harvard Business Review* both scholars and CEOs share perspectives on current management practice, which connects with the features of contemporary Quality Management. For example, in a consumer goods company the CEO creates agility within the organization through leadership teams, which in time generated the *Agile Leadership Manifesto* to include the following features: 1) individuals and interactions are the focus, rather than processes and tools, 2) customer engagement is the focus, rather than contracts, 3) working solutions are the focus rather than excessive documentation, and 4) flexibility is the emphasis, rather than concrete plans. Agility is ramped up everywhere by adding more and more teams (Rigby, et. al, 2020). Gulate (2018) promoted the use of frameworks in his research with Netflix, Alaska Airlines, Warby Parker start-up, and Nokia, noting a constant infusion of energy. In contemporary times, agility of organizational teams has become a new focus while people are engaged in continuous adaptation and invention, assuming responsibility for the overarching purpose of the company.

Creating the conditions for organizational transformation within complex systems, which are governed by deep cultural traditions and values, may require leaders to think beyond *the box*. Rill (2016) refers to this as strategic innovation, citing Markides (1997), who calls this "a strategy of breaking the rules" (p. 1136 in Rills, 2016). Achieving this mind shift will require leaders to move from Linear/static thinking with separate functions, to random/dynamic thinking, in which functions are seen as interrelated and systemic (Sanders, 2010). This has implications for both organizational structure as well as the organisation's culture (Chatman & Eunyoung. 2003; Schein, 2004; Snyder, et al. 2018). Traditional structures of the 20th century will not suffice (van Kemenade & Hardjono, 2018). Suarez and Montes (2020) hypothesis that building organizational resilience requires organizational routines and simple rules, which combined with improvisation are the key ingredients for resilience, suggesting the balance between structure and culture is paramount.

Snyder, et al. (2018) found that many organizational leaders struggle to understand how to balance structure with culture to create the conditions necessary to sustain quality development in an age of complexity. All too often, focus is given to structure and policy, ignoring the power and importance of people, values, and behaviours as key ingredients for sustainable organizational development. They also found that leaders who understand the importance of connecting structure and culture have stronger internal systems that are adaptive and responsive to change; a finding that is also supported by Ingelsson

(2013) and Park-Dahlgaard and Dahlgaard (2003) in their work about generating high performance quality organizations. If organisational leaders are going to be successful moving outside the box, they can benefit from understanding the inter-relationship between culture and structure (Ingelsson, 2013 Snyder, et al., 2018).

Of interest to consider then is: What knowledge do leaders need to break the rules and still meet customer needs while remaining accountable? Important insights are contained within chaos and complexity theory, as well as systems theory (Snyder, et al. (2008) and others (Rigby, 2021; Sanders, 2010; Tensil, 2021). A systems approach is a shift toward a multidisciplinary strategy for development, is relationship-oriented, embraces mapping possibilities rather than evaluation systems, and measures success in quality, values, and process. Systems thinking can alter how we think about change and building sustainable school programs and services (Shaked & Schechter, 2017). Developing an understanding of these theories and their application in organisations provides leaders with tools for a necessary mind shift for addressing sustainable global development through organisational practice.

2.2 Leading organisations in complex times: lessons from the sciences

In our work with educational leaders over the last five decades (Snyder & Anderson, 1986; Snyder et al, 2000; 2008), we focused on the school as a living dynamic system with the integration of work functions around the core purpose of student success for sustainable futures. Quality practices become strategies for addressing the changing and complex needs of students, communities, and society as a whole. Drawing knowledge and insights from the sciences, we developed a model for leading sustainable school development (Snyder et al., 2008), which has been modified somewhat over the years, and integrates components of quality management, quantum physics, and sustainable development practice. This model is in line with the principles found in Quality 5.0 (Deleryd & Fundin, 2020) and the emergence paradigm (Fundin, et al, 2021; van Kemenade & Hardjono, 2019), which articulates the need for organisations to integrate sustainable development goals as a part of quality management.

The Chaos Theory of Change (Snyder, et al. 2008) addresses the dynamic of change over time, which is based on theoretical principles from *system thinking* (Bertalanfy, 1968; Capra & Luigi, 2016), *chaos and complexity theories* (Buchanan, 2002; Gleick, 1987; Kaufman, 1995; Prigogine, 1990) and *networking science* (Barabasi, 2003 Watts, 2003). A Systems view of life creates the mindset that everyone is working together toward a common purpose (Capra & Luigi, 2016). It reflects a shift toward a multidisciplinary strategy for development, that is relationship oriented, embraces mapping possibilities rather than evaluation systems, and measures success in quality, values, and process.

Systems-thinking naturally leads to greater complexity, which strengthens a system's cohesiveness and resilience (Buchanan, 2002). As complex systems grow more complex; they never reverse and become simple again, but rather grow in a non-linear fashion, and move quickly (Kaufman, 1995). Surprise

becomes routine from the multidimensional life that exists within a system with a non-linear set of rules, with energy systems of cohesive connections (Holland, 1995). Highly developed complex systems, and networks of systems, easily adapt to changing conditions (ibid). A dynamic network of many agents works in parallel, constantly acting and reacting to what other agents are doing and learning (Barabasi, 2003). Control is decentralized as agents continuously learn from each other and the environment about change and possibilities. Rules change continuously in the adaptation process as agents learn, respond to, and pursue their system's sustainability.

The Chaos Theory of Change (figure 1) includes six main stages: 1) Growing systems respond to environmental changes; 2) Disequilibrium promotes change; 3) Energy builds through connections, 4) Natural systems self-organize, 5) New systems evolve from complete prototypes, and 6) Change is a dance of life and death.

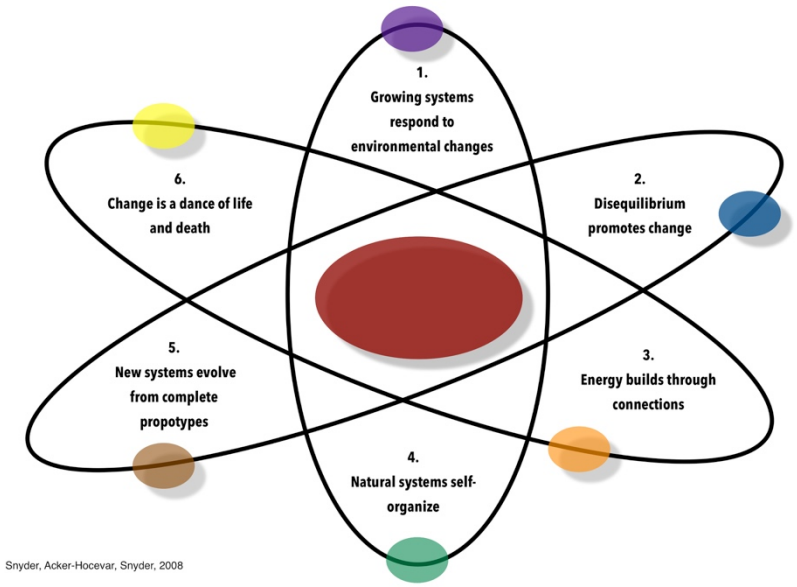

Figure 1: The Chaos Theory of Change model. Snyder, et al. 2008

The first lesson suggests that external forces impact human organisations, which are numerous and complex, and only increase over time in their complexity. The leadership function is to acknowledge both internal and external paradoxes and to become an influence on the external environment as well as the organisation's responses to changing conditions. *The second lesson* suggests that disequilibrium, rather than stability, stimulates the system to respond in the most dynamic, fundamental and sustainable ways. The leadership task is to use information to stimulate disequilibrium, which provides the energy and focus for change. From the *third lesson* we understand that the stronger the web of interactions, the stronger the forces and human energy for change. The leadership function is to develop professional capacities, partnerships and networks to respond to emerging challenges in the system. The *fourth*

lesson teaches us that natural systems have a strong capacity to respond to both external and internal forces, to self-organize, and to become self-determining. The leadership function is to respond to and develop the organisations internal readiness to adapt to changing conditions. In the *fifth lesson*, we understand that building prototypes eventually leads to total systems that are composed of multiples of those prototypes. The leadership task is to sponsor development of completely new forms; the system of services and practices is transformed. In the *sixth, and final lesson*, we learn that the process of creation and destruction is the cosmic dance in natural systems, whereby energy patterns are dissolved and rearranged to fit emerging conditions. From this perspective, the leadership task is to promote both the end and the beginning of work systems, structures, and services.

For sustainability to continue, there needs to be a balance between disorganized and organized complexity, where variations no longer cancel one another out, but rather become reinforcing (Miller & Page, 2007). In complex adaptive systems the following characteristics are found naturally: a variety of networks, continuous interactions, self-organizing, interconnections, emergence, dynamic, co-evolution. Some leaders identify sustainability strategies, and begin to map sustainability issues while working with cross divisional teams, outside consultants, and external stakeholders. They are finding that sustainability strategies improve performance, innovation, customer loyalty, media coverage, and stakeholder engagement (Tensil, et al, 2021). Leaders shift their roles during a transition from a directive role to one of support and mentoring (Rigby, 2018). Building an agile enterprise means finding the right balance between standardizing operations and pursuing innovation. As Suarez and Montes (2020) point out adaptability also requires routine and structure; it is in the balance between the two that complexity can thrive and serve as a catalyst for innovation and change (Snyder, et al. 2008).

In the next section we present findings from a qualitative case study to examine how application of these lessons from the sciences positions an organisation to be responsive and adaptive in a pandemic, while at the same time maintaining its core values and meeting customer needs, including students, parents, community and society.

3. Methods

A qualitative single-site case study was conducted of a private school in Florida, USA to describe and examine the leadership of the school during a pandemic, and how the role of strategic decision making, shared leadership, teaming and collaboration, and the school's core values and organizational culture were used to adapt and respond to the crisis. This school was selected based on a convenience sample given the long-term professional relationship between the researchers and the school. Qualitative research is often based on building relationships with key informants, and gaining access to the case site. Given this, we chose to benefit from our relationship to the school which gave us immediate access. In so doing, we recognize that the findings are not necessarily generalizable. However, research on

quality management in the emergent paradigm needs good examples from which to begin developing knowledge.

3.1 Data Collection

Data were gathered through interviews, observations, focus groups, document analysis, and net-based social communication through the school's Facebook page. Two interviews were conducted with the Head of the school and Deputy Head to describe and examine the challenges, decisions, and strategic planning used in adapting to the pandemic. Interview questions were provided prior to the interviews via email, and the interviews were conducted by the first author through Zoom.

Two focus groups were conducted via zoom with four teachers in the school. Two of the teachers, were also program coordinators in the middle school, and two teachers represented the primary grades. Focus groups were conducted by both authors to examine the impact of the pandemic on the school's programming at the classroom and middle leadership levels.

Document analysis was conducted of the school's newly formed strategic plan in response to the pandemic, and other documents reflecting core values and organisational design. Additionally, we were able to observe the direct result of strategic planning through videos and Facebook postings that were managed by the school administration.

3.2 Ethical considerations

Permission to conduct this study was given by the leadership of the school, including the Board of Trustees. Access to key informants was established through the leadership team, and consent to participate in the study was secured prior to interviews.

3.3 The Case

CPS is a private school in Tampa, Florida USA with about 520 students, pre-K through middle school, which recently celebrated its 50th anniversary. Members of the student body and teaching faculty are international, bringing global perspectives to school learning. The professional staff and students are organized into learning communities, with many additional special programs that are offered during the school day, evenings, weekends, and summers to accelerate learning. The curriculum is guided by the International Baccalaureate Program, and the *More Options for Results in Education Program (M.O.R.E. Approach),* which encourages brain-friendly learning and social/emotional development. In addition, the International School Connection's *Global Learning Benchmarks*, integrates the UN Sustainability Goals with core curricula and pedagogical practice to provide a continuous global orientation to learning.

The professional staff participates weekly in workshops at the school, while small groups and individuals also engage in a variety of other programs to advance their own knowledge and strategically strengthen the school's performance. State, National and international student, staff, and team awards

are common, as is the recognition of the school as a unit. The previous Headmaster, led the school's continuous development for 25 years, promoting continuous development as a strategic component of the school. Over the years she developed the *M.O.R.E. Approach* (Cohen, 2003) that reflects a variety of theoretical, practical and value-based practices to support both curriculum and pedagogical development in the school as well as a culture for social and emotional well-being. Her leadership is based on Systems Thinking, Quality Management, and Chaos Theory, as conceptual guideposts to support organizational sustainability, continuous improvement, and customer satisfaction.

In this purpose-driven organization (Quinn & Thakor, 2018), workers take on new chores and challenges in response to emerging demands of the growing system. The phenomenon is clearly a network of growing clusters of initiatives, through which new kinds of leadership roles emerge to meet current needs (Snyder, 2019), and where human energy is a force for innovation. Important here is that the CPS's internal network didn't happen overnight because of administrative directives, but rather emerged naturally as the professional staff, with school leaders, pursued ideas for enriching the learning environment for its students. The school leader's role shifted over time from supervising individuals, teams and programs to managing the systems of work throughout the network, along with the health of the school's culture and its impact on every learner. Teachers are responsible for everything that occurs within their learning communities, while mentoring and coaching each other to "Olympic" performance. Many teachers take on additional major responsibilities for the entire school, which strengthens the school's network system, its purpose and values, and its sustainability potential.

Vital to educators at CPS is the weekly professional development event that is led by the Headmaster, many teacher experts in one innovation after another, and visiting experts with the focus on "What is best for kids". Professional dialogue is a dominant feature during these events, which spills over into the daily life of work with students. In addition, many teachers are sent every year for specialized training to become the school's expert in various initiatives, and then assume responsibility for the success of that program throughout the school. New teachers are trained in every core program of value to the school prior to their teaching debut. The administrative teams appear to have one purpose, and that is to support the work of teachers in achieving high success levels for each student. What now exists is a complex web of life, with its energy for learning, where every student is cherished and nurtured, and which is apparent to every student and parent, as well as to over 400 national and international visitors to the school each year.

In July 2020, a new headmaster was instated at CPS. This change, although planned before the pandemic, caused a kind of disequilibrium in the school that would later be used to stimulate a fresh mindset. Over the summer months, the school's leadership team built a strong energy system that connected the school and community in dynamic new ways. In August 2020, CPS opened its doors with a hybrid model for teaching and learning that was designed around the school's core values of team teaching and cooperative learning, communication, and community. The results from this innovation

were so striking that communities across the region celebrated CPS for its remarkable achievement.in the results section, we examine leadership choices that made this possible.

4 Results and Analysis

It is July 7 and a new day dawns on the campus of CPS. The headmaster of 25 years has assumed another leadership role in the school, and the new headmaster has entered the campus. Unique to this common transition, however, is that there are no teachers in the school and classrooms are empty. It is Covid-19 and the world is still deeply paralyzed by the current Pandemic. The question looming is how can CPS continue to serve its students, parents and community with a quality education that is safe for all? A schooling that is well known for its strong values in student-centered learning, team teaching, cooperative learning and respect for individuals and their unique talents, resilience, and community?

As a new Head of School, Nick found himself throwing the old paradigm of traditional solutions to which he was accustom, out the window; if he was going to open the school in mid-August he needed a new set of lenses and a new approach. At his side were three other school leaders, Joyce, Mike and Jenn. *"It's like we are building a puzzle without the outside pieces." shared Nick,*

> *It's like we are trying to build a plane while we're flying: just keep building because the puzzle keeps moving depending on what angle you are going at. We have lots of balls in the air at the same time trying to build a back-to-school-plan, build trust online since most of our meetings are distance-based, securing communication, and creating space for involvement and ownership among staff. There was no time for personal conflicts or to build relationships with me as a new head. we needed to do something quickly, in the right way, and communicate it: the question became: who's on board?"*

The associate headmaster, Mike, had eagerly awaited the arrival of Nick, and had spent the month prior concerned that unlike most schools, CPS had yet to develop a Back-to-School plan. He shared in an interview,

> *"We have some battle scars from our experience in the spring, and definitely from summer camp, in terms of what it looks like to open something in person on campus and what are the things you need to do. Summer camp was a disaster. no blame, but we learned so much from it, and that's what really informed us. During the month of June, I'm thinking all these other schools already have their back-to-school plan. We don't, and Nick doesn't' start until July 7. There was an anxiety, but what actually happened proved to be in hindsight a huge advantage to us".*

As the core leadership team, including the Headmaster, President, Associate Headmasters and Middle School Division leader, began to work together, it was evident that trust and communication were essential, as was the network systems of interdependent teaching teams, if they were to pull off a miracle. As Nick and Mike shared in their interviews, they needed buy-in from the staff and parents to ignite energy for getting innovative, while keeping their eye on the values and principles of the school.

During our interview, Mike described how the leadership team spent the first day together walking through the school facilities. They visited every classroom taking notes about what equipment they had, what changes needed to be made to make the school safe. Partnering with them was the team from facilities management and the IT staff. To their advantage they also had the knowledge and experience of 20 other private schools in the area who had already completed their back-to-school plans. Getting a late start proved to be beneficial, for it challenged the leadership team at CPS to network with other schools and learn from them. As Mike shared,

> "*There were a lot of schools that had to back track on information about what they were going to do because the conditions of Covid and the CDC*[1] *protocols kept changing. Starting late allowed us a lot of organizational ambidexterity and we were writing a back-to-school plan at a rate faster than anyone else because we networked with others who had done lots of homework. When we shared it with staff first, and then parents a week later, they were blown away because nothing like it had ever before been developed at CPS".*

According to both Nick and Mike, the core leadership team (Nick, Joyce, Mike, Jenn) met every day for 12 hours a day over the next three weeks to build the 60 page back-to-school plan. Characteristic to their work was collaboration, networking, and communication, along with the values and principles of the school that became the glue and back-bone to their plan.

> *"We created a task force with four of the School's Board members, who had the responsibility to network with 10 medical professionals within our community. We met with them as we were building the plan, which proved to be a very useful process. As we were writing we asked questions of the Board; they would pose the questions to the experts, and we would either get an answer right away or would do further research and get back to us. This enabled us to focus on the pedagogy as our area of expertise and feel confident that we had up to date knowledge about building healthy systems from the medical community perspective," shared Mike.*

[1] Center for Disease Control

In the middle of July, the first draft was ready, and it was time to share the plan with the faculty and get their input. According to Nick and Mike, the new model for schooling was designed on a hybrid model of teaching and learning with classroom and home-based (remote) learners being taught synchronously. One of the challenges that Mike articulated was how they were going to transfer to a hybrid model without much lead time or extra resources. As he shared their process, it was evident that internal collaboration would be essential:

> *"Rather than spending a lot of money on new technology, we got together with the IT staff and asked the question: what resources do we have that we can begin to utilize in a different way? The school was lucky to have invested in new I-pads for all teachers. Additional technology was added with an Omi-directional microphone, a Bluetooth headset, and a tripod for the I-pad to sit on in the middle of the classroom. This could give teachers the flexibility to move around the classroom, and for the students, both remote and in class, to participate in shaping their learning."*

The next step on the path to adaptation, as described by Nick and Mike, was to involve all staff. As Mike described, the purpose was first,

> *"to bring everyone together and to have a conversation with Nick as the new head of school. The second was to create the realization that we are trying to pull off something that we have never done before, and we need everyone's help. Thirdly, we needed to demonstrate with technology our plan for how teachers would teach. On July 15, a week after Nick started, we had a faculty meeting in which we invited all those who were comfortable to come to campus, and the rest connected on zoom. This was the first time for them to be on campus since March.".*

Characteristic of CPS was a strong network system of shared leadership among all staff and Divisions within the school, as indicated in the documents and weekly meeting schedule. Unlike most traditional school models in which there are specific roles structured within a hierarchy, CPS was known for its division teams and leaders who were also grounded in the classroom. *"Originally when I came here, shared Nick, I thought we needed a couple of the traditional roles because we are so flat. But soon I began to realize the power of the model and saw that the Division leaders in the current format know what is going on in the classroom. When we need to make decisions at the classroom level there is an immediate respect because the Division leaders know first-hand what the needs are of the classroom. This has been critical in our ability to build a new puzzle without knowing the parameters, more than safety and kids first."*

The interconnectedness of the Division teams as a pedagogical and organizational system, fostered the conditions necessary for adaptability. Cultures of trust, established work systems and routines, and a clarity of common purpose were in place. As one of the teachers shared, when their division began to meet, "*everyone volunteered ideas for what was needed to be accomplished for classrooms in Early Childhood, and each teacher and aide spontaneously volunteered to take on tasks for the whole Division. Something that was new....it was spontaneous*."

The school's leadership continued to build on the strength and energy of collaboration. Not only was the entire school office staff and buildings and grounds staff involved at high levels to prepare the school, many additional groups, typically outside the planning process were involved: "*parents, a Board task force of lawyers/parents, area/parent medical doctors, the CDC guidelines, guidelines from Harvard University via a teacher, plus the office and buildings/grounds crew.*" It was becoming apparent that the ability of the school and the readiness of the school to adapt to a pandemic within a one-month time frame, was due in large part to following the natural laws of science to build energy systems and establish connections, and to value the strength of the network. Also prevalent within the structures was the role of communication: quick, open, transparent, inviting creativity centered around a common purpose, and grounded in the school's values.

According to Nick "*the values at CPS are strong and shared amongst all staff. I have known this school for many years, having once worked here as a teacher and associate head. At that time one of the characteristics of the school was its strong value system for kids and learning. Returning ten years later, those values are still as strong as ever: the work ethic among teachers, care and concern from kids, wanting to go above and beyond and knowing they [the teachers] have autonomy to make this a "wow" experience for all students."* This engagement and orientation to improvement was identified as an integral part of the energy system that made it possible for the school to regroup and to adapt their structures and culture of teaching in fundamentally new ways.

During the month of July, the core leadership team began to build a new "back-to-school plan" that was designed to ensure safety from the virus, be flexible in meeting the variety of student needs, and allow the school to stay open to adaptation over time. The initial prototype was designed, on blended learning models to deliver education simultaneously on campus and remote via Zoom, with a goal to maintain two core principles of the school pedagogical practice: team teaching and cooperative learning, according to Mike. The plan for reopening was to offer a team-taught combination of kids at home and in class. This required changes in the on-site school facilities, training for teachers, and the purchase of technological equipment. It also required a mind-shift among the staff and students, which advanced them into the digital culture. With little time for training, the teachers worked in teams to redesign their teaching and get ready for a whole new world.

In August 2020, the school opened its doors with a new blended learning model in which students were given the opportunity to learn from home connected to the classroom through live-feed video, or to be on campus. At school opening, 68% of the students were on campus, with the rest on ZOOM. This model was to be tested for the first 6 weeks of school and then re-evaluated for further refinement or a complete change, which at the time was unknown.

In Table 1, we highlight a few samples of changes that took place, categorized in the four elements based on the Digital Culture model (Snyder, 2007): technology, communication, pedagogy, organizational structure and administration. This list is only a start. As Nick shared, "*Everything changes so fast and we make decisions daily. I could write a protocol today, that I would need to change tomorrow. We just need to stay open and communicate with one another"*. What it does reflect, from a theoretical perspective is an understanding that leading sustainable organisational development is strengthened when structure, culture and identity are inter-dependent (Snyder, et al. 2018). The changes that were implemented according to Table 1 illustrate how the pedagogical values and identity subsumed within was foundational to structural innovation As well, the culture of the school made it possible to transform and innovate quickly.

Pedagogy	Technology	Communication	Organization
Team teaching and cooperative learning were the foundations around which technological solutions were designed.	I-pads and tripods were used to set up ZOOM stations on movable I-pad tripods to maintain flexibility and student-centered learning.	Teachers wore microphones over their face masks; at-home student photos were displayed on the classroom whiteboard.	The buildings and grounds were all cleaned; furniture and learning arrangements were modified. New sinks and walkway gates were added to self-contained student groups.
Kids were put into cooperative learning groups in 7th grade English combining classroom-based and remote learners in learning communities	Teacher planning and scheduling have moved from paper to a shared online document and they communicate with parents daily to get feedback	Canvas LMS was used to communicate and share information; ZOOM was used to communicate synchronously during the day.	The flow of students was changed: students remained in the classroom and teachers moved from room to room: for example, the arts came to the classroom, the science teachers had a lab cart that they took with them.
7th graders functioned in ZOOM breakout rooms, integrating in-class and at home kids into the groups to discuss short stories.	New fire walls were added to the campus, with increased broad band width and access points.	At home, students photo copy their work and send it to CANVASS, or upload it to email.	Desks were spaced either six feet apart, or plexiglass partitions were inserted between students at tables and desk combinations.

Table 1: Examples of innovation based on the CPS Back-to-School Plan

Two-months into the transition period, the leaders and teachers at CPS were going full steam ahead. The continuous improvement approach to change invited reflection about the experiences from all persons including: students, staff, parents, community. *"I have worn out the seat in my office spending time in communication with parents and community members about how we are doing*." shared Nick." *I am typically the guy who is never in my office, instead throwing a football with the kids, talking with and observing teachers. During this pandemic, my job is focused on a different kind of communication with all systems, including parents daily, to make sure that we are delivering the best possible education for their kids that is safe in a pandemic*".

According to the teachers they have also seen changes in the kids over time. One of the teachers reported that *the tempo of life is slowing down and kids are starting to engage in their own learning differently.* Kids are also given more freedom to engage in their learning and to own their learning space. In the sixth-grade, students are invited to give identity and meaning to their personal workspace (for classroom-based kids this means their desks or end of the table; for distance learners, it means their home space). "*Kids pride themselves in their designs and they get really creative with the materials they use. One kid made a "COVID fortress" outlining his desk with Christmas lights and signs*." Another teacher reported a perceived shift in attitude among teachers compared to the spring when she conducted a study of digital readiness. She shared that the focus is shifting from "*do we have what it takes to do this?" to "how can we do it sustainably*?"

New systems are emerging daily in the school from what they are learning about how to support this hybrid model of schooling. Currently teachers are exploring questions related to resource management for the kids: working on how to schedule 1:1 coaching for remote learners after school and in the classroom; how to reintroduce spontaneity in learning for teachers who don't have access to their own labs; how to create a sustainable daily schedule with the expansion of flex time and the spreading out of lunch periods. As well, how to help parents at all grade levels be satisfied with the online model of learning. "*One of the big lessons of leading in a pandemic," Nick shared, "is how much stress affects people. Sustaining this requires that we have an open communication, clarity of purpose. clarity of role, and network of teams who are all working in the same direction."*

5. Discussion and Conclusions

The ability of an organization to adapt quickly to customer needs at all levels is a contemporary indicator of Quality (Deleryd & Fundin, 2020; Tensil, et al., 2021). Creating organizational infrastructures that are fluid and flexible, while at the same time grounded in the organisation's values and customer needs is paramount if business and organisations in society will succeed as actors in the U.N. 2030 Agenda on Sustainable Development (Mårtensson, et al. 2019; Stegall, 2006; United

Nations, 2021). To truly connect sustainability and quality management requires that organisations adopt values that reflect a care for society and the planet, which are supported by the organisation's practices, routines and structures (Suarez & Montes, 2020). The values are drivers that keep adaptation in line with future goals, while the structures provide a framework for improvisation and innovation. To merely change structure, without being grounded in a set of values, places organisations at risk of failure (Mårtensson, et al. 2019; Snyder, et al., 2018). It is the inter-play between structure and culture that creates the conditions for leading sustainable quality development in today's society.

In this paper, we illustrated how a school was able to adapt quickly to the complex conditions of the Covid-19 Pandemic. This case is an example of the self-organising principle in the Emergence Paradigm (Fundin, 2021). Evident was how the leadership team built upon the school's foundational values of collaboration, teaming, and networking, and the need to maintain education for societal growth. Tensil, et al., (2021) suggests that this is important as a sustainability strategy that interconnects performance with innovation, customer needs and stakeholder engagement. The heavy emphasis on collaboration and inclusion in the school, also reflects the mind-shift to which Sanders (2010) refers, with the focus on dynamic thinking, collaboration, and drawing on the strengths of the internal school work systems. The leaders also demonstrated key characteristics for sustainable development by shifting from director to facilitator and co-creator (Rigby, 2018) as part of the need to find balance between standardizing operations and pursuing innovation.

In this case example, we also see how lessons from the sciences provided a framework for unleashing the mind-shift to see the school as a living and growing system. As well, key functions and routines were in place that created conditions for both adaptability and resilience (Suarez & Mortes, 2020). Seven quality management-based system functions were drawn upon by the leadership throughout the planning phases. Among the functions were: strategic leadership, cooperative work system, professional learning system, 21st century curriculum, student learning system, and global learning system (Snyder, 2019), each of which was connected by the core purpose of the school, which is to prepare students as competent and caring global citizens. It is our hope that this paper contributes insights into how leaders can develop organisational systems that are both stable and dynamic to free adaptability and innovation as part of the ongoing responsibility to contribute to sustainable societal development.

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Sustainable development as a driver for customer satisfaction

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Abstract

The concept of Sustainable Development (SD) has become widely accepted among nations, organisations, and individuals. SD is today high on the agenda in most organisations as well as on the goals of global development. According to the Brundtland Commission, SD is defined as a development that meets the needs of the present generation without compromising the ability for future generations to meet their needs. Recent research has also indicated strong relations between SD, brand image and customer satisfaction. Moreover, recent conceptual models have discussed stakeholder perspectives and SD. Thus, it is crucial to understand how companies and organisations may use SD to strengthen customer relations and affect costumers demands, needs, expectations and behaviours, especially in a time of uncertainty and rapid change. Studying the perception of sustainability, as a driver and guidance tool for organisations to deeper understand customers' needs, can contribute to an extended overall stakeholder value. Thus, this study aims to contribute to a clarification of how the concept of SD could be more understandable, measurable, and manageable through a deeper understanding of customer perceptions. By using customer perception data from the Extended Performance Satisfaction Index (EPSI) Rating database, this study evaluates relationships between customer satisfaction and customers' perception of SD. Data is gathered by computer assisted web interviews (CAWI) in a cross-sectional structure spanning over several major Swedish industries. Further, a PLS Path Modelling (PLS-PM) analysis is applied on an extended version of the EPSI model to study how important latent variables, such as the perception of SD, may drive customer satisfaction and other customer related aspects. The study finds several question items to be used as a standalone construct of perceived sustainability and further provides statistical evidence of its relation, as a driving aspect, of brand identity and possible overall satisfaction, in accordance with the EPSI model.

Keywords:, Sustainable development, Customer satisfaction, Triple bottom line, PLS-PM

1. Introduction

The concept of Sustainable Development (usually defined as a development that meets the needs of the present generation without compromising the ability of future generations to meet their needs) has been on the global agenda for fifty years and is now widely accepted among nations, organisations, and individuals alike (Hallencreutz et al, 2020; Martinez et al., 2013; Ranängen et al., 2018). The notion that Sustainable Development (SD) is crucial to achieve long term prosperity has in recent years been catalysed by troublesome political, social and environmental developments now accelerated by the global Covid 19 pandemic (Hallencreutz et al, 2020). The collective capacity of the international community to address fundamental societal problems has rather become weaker during the pandemic despite good intentions and efforts (ibid). In this new volatile business environment, it will be more important than ever to evaluate economic, social and environmental benefits of the competition, based on both financial and non-financial indicators (Iveroth and Hallencreutz, 2020). Previous research has also emphasised that organisations need performance measurements with the ability to capture past, present, as well as future performance (Birch Jensen et al, 2018; Bititci et al., 2012; Taticchi et al., 2010). The perceived level of SD should be seen as one such critical non-financial performance indicator (Hallencreutz et al, 2020; Westin and Parmler, 2020; Fundin et al., 2020).

Theoretical perspectives of corporate social responsibility (CSR) and SD have been broadly discussed and applied throughout the years (Martinez et al., 2013). But as with many items on the global agenda there seems to be a gap between theory and practice, and there is a need for further research on the integration of corporate sustainability with core business processes and measurements (Asif et al, 2011; Hallencreutz et al., 2020; Isaksson, 2019). To expand management focus from a single bottom line of financial performance, Elkington (1999), Topfer (2000), and Walker (2000) presented the concept of a triple bottom line (TBL) of economic, environmental, and social sustainability. This approach has become widely used as a framework for sustainability measurement and management in organisations (Steffen et al., 2015). This and other methods to measure different aspects of SD have been thoroughly studied and a general conclusion is that the deployment largely vary dependant on context and stakeholders (Dahlsrud, 2008; Martinez et al., 2013; Moisescu, 2015; Van Marrewijk, 2003). For instance, when studying sustainability reports, the economic dimension in the TBL seems to generally be interpreted as standard financial performance (Isaksson, 2019). The positive relation between SD efforts and financial performance has also been questioned (Vishwanathan et al., 2020). Thus, after decades of academic research and theoretical modelling, there still seems to be urgent to make SD more understandable and workable for everyday business life (Hallencreutz et al, 2020; Isaksson, 2019; Moisescu, 2015). There is a need to develop methods with the purpose of clarifying how sustainability measures may be quantified and operationalised. As often problematised in studies of social and behavioural science, a quantified result may be more of a theoretical concept or a hypothetical variable in contrast to the strict laws of nature (Sanchez, 2013). Even so, recent research (Hallencreutz et al.,

2020; Mendonca and Zhou, 2019; Westin and Parmler, 2020) suggests that organizations perceived as sustainable, by the market and its stakeholders, are rewarded with benefits such as improved customer and employee satisfaction as well as economic prosperity.

With this background as a vantage point, this study aims to test a model based Sustainable Development Index (SDI) based on the conceptual definition of SD comprising the three TBL dimensions economic, social and environmental sustainability. Using PLS-SEM modelling and customer perception data from the Extended Performance Satisfaction Index – EPSI Rating (Eklöf and Westlund, 2002; Hallencreutz and Parmler, 2019), the study also evaluates relationships between customer satisfaction and customers' perceptions of SD and other latent variables in the existing EPSI model (see appendix A and B). The analysis is built on data collected by computer assisted web interviews (CAWI) capturing the perceptions of Swedish consumers in a cross-sectional structure spanning over four industries: banking, insurance, telecom and energy. These industries engage a large proportion of private consumers and are all present in the public sustainability debate from different perspectives, which enables multi-dimensional analysis.

2. Methods

The study is designed to build and test a model that may predict relationships between different constructs (Jaakkola, 2020). A PLS Path Modelling (PLS-PM) model approach is used to estimate relationships between SDI and customer experience. PLS-PM is a method and technique to estimate Structural Equation Models (Bollen, 1989; Kaplan, 2000). Hence, a structural system of interdependent equations which are used to measure unobserved latent constructs/variables by observed manifest items/variables. Examples of such approach was recently presented in a research on customer satisfaction drivers (Hallencreutz and Parmler, 2019), customer behaviour utility (Morard and Dimitri, 2016), relations between EPSI scores and financial performance (Eklöf et al., 2017, 2018) and CSR perceptions linked to EPSI model variables (Westin and Parmler, 2020).

To capture different dimensions of the customer experience, variables from the EPSI model are used. All underlying manifest items are included (EPSI items and the complete questionnaire is presented in appendix B), but the structural model of EPSI is disregarded.

The framework of evaluating the construct of the SD index is outlined in Figure 1. *Model 1* is a PLS-PM model where the SD index (SDI) is treated as an exogenous latent variable with independent direct paths towards all EPSI latent variables (see appendix B). The estimation of latent variables is performed by a reflective methodology allowing the internal consistency of the SDI to be tested in relation to the consistency of the EPSI variables. Moreover, the direct linear relationship between the SDI and the EPSI variables are also evaluated. After estimating the SDI in *Model 1,* the construct will be further used as a result in *Model 2.*

Model 2 comprises the direct sustainability items (11 questions, see appendix B) as well as the latent variable of the SDI. A multiple regression is applied where the SDI is treated as an independent variable explained by the direct items. Nonsignificant direct items, 5% significance, and Variance inflation factor (VIF) values over 5 simply is excluded from the model.

Finally, data is further divided into industrial subsets. Each industry SDI is regressed against the EPSI model variable *Customer satisfaction*. Thus, the strength of the relationship is tested in different industrial segments.

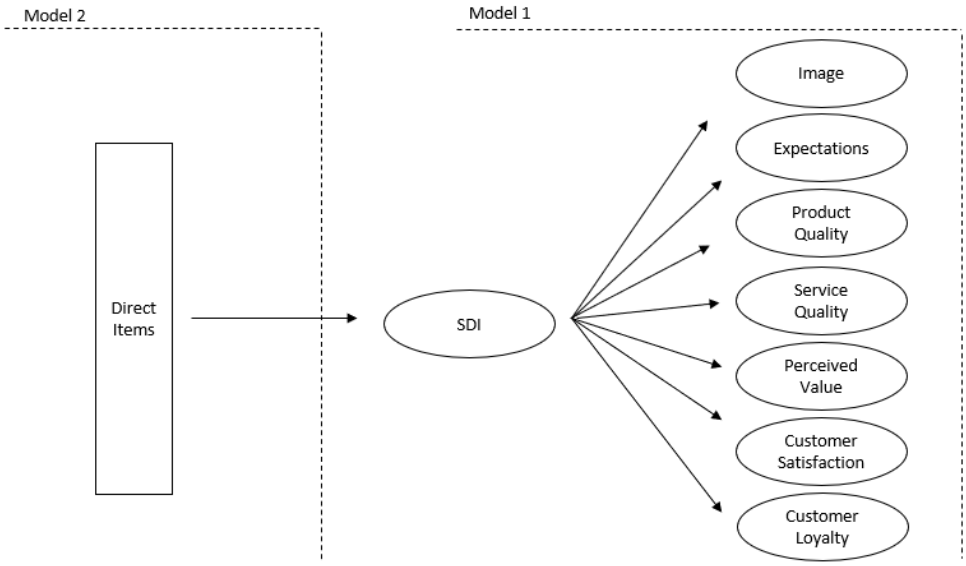

Figure 1, *Model 1 describes the proposed casual structure of the PLS-PM setup for SDI and EPSI variables. Model 2 tests the relationship between SDI and previous researched items of sustainability. Arrows indicate the direction of the proposed path relationships. Square blocks are consistent of direct items and circles indicate latent variables.*

Items summarising earlier developed multidimensional scales, as well as items capturing parts of the Sustainable development goals (SDGS) are mainly adapted from the results of Moisescu (2015) and Martinez et al. (2013). All direct items are treated independently but a general distribution based on TBL has been adopted from Martinez et al. (2013). Moreover, a mixed category of two items is suggested. The direct sustainability items are outlined in Table 1.

Table 1. Direct sustainability items

Dimension	Item	Adaptation
Economic	Pursues long term success/activity.	(Maignan, 2001; Garcia de los Salmones et al., 2005; Moisescu, 2015; Martínez et al., 2013)
Environmental	Tries to offer services that are compatible with the environment.	(Wagner et al, 2008; Turker, 2009; Öberseder et al, 2014; Pérez and Bosque, 2013; Knowles et al., 1999)
Environmental	Does everything possible to eliminate or reduce the negative effects on the environment.	(Turker, 2009; Öberseder et al, 2014; Singh and Bosque, 2008)

Environmental	Reduces its consumption of natural resources	(Martínez et al., (2013); Knowles et al., 1999)
Environmental	Strives to minimize the consumption of resources that affect the natural environment (negative).	(Moisescu, 2015; Turker, 2009)
Social	Working to prevent child labour and unfair working conditions.	(Wagner et al., 2008; Singh and Bosque 2008)
Social	Improving the general well-being of society	(Maignan et al., 1999; Maignan, 2001; Garcı´a de los Salmones, et al., 2005; Singh et al, 2008; Mobin et al., 2014)
Social	Treat their employees without prejudice with regards to their gender, ethnicity, and religion.	(Wagner et al, 2008; Öberseder et al, 2014; Pérez and Bosque, 2013; Singh and Bosque, 2008; Wagner et al., 2008; SDG 5; Martínez et al., 2013)
Social	Actively work to improve the equality within the organisation.	(Mandhachitara and Poolthong, 2011; Wagner et al., 2008; Öberseder et al, 2014)
Economic/Social	Creates and sustains jobs in the region	(Öberseder et al., 2014; Martínez et al., 2013)
Economic/Social	Contributes to limiting poverty	(SDG 1; Wagner et al, 2008; Öberseder et al, 2014)

The three listed holistic manifest items are proposed to capture the latent construct of the SD index:

- ***Organisation XX invests in a sustainable growth considering future generations***, is an item targeting the customer's perception of a provider's overall long-term thinking with regards to several dimensions of sustainability. The item is adapted from Turker (2009) and Ösberger et al., (2014).

- ***Organisation XX strives for economic success without compromising social or environmental factors***, is an item influenced by several other items probing the customer's perception of a provider's financial focus in relation to social and environmental dimensions of sustainability. This item is mainly adapted from Martinez et al., (2013) and Ösberger et al, (2014).

- ***Organisation XX demonstrates societal responsibility socially, environmentally, and financially***, is the third manifest item, where the respondent may zoom out and reflect on all three combined dimensions. The item is adapted from the dominant graphic literature of sustainability as an intersection between the TBL dimensions (Purvis et al., 2019). Thus, an actor excelling in sustainable development should by its customers be perceived as strong in all three aspects.

The data comprises computer assisted web interviews from multi-industrial private customers in Sweden collected during fall 2020. To enable tests of similarities and differences between industries, the data set contains evenly distributed customers from banking, telecom, insurance and energy, all present in the public domain and engaging a large national representation of private consumers.

All questions/items, used in the analysis, are set on a scale from 1-10 which later is transformed into a 0-100 scale. Moreover, an additional option of "don't know" is included for all items. To limit possible estimation biases (Greene, 2012), with regards to missing values ("don't know"-answers), the data is

cleaned for respondents which had not answered all SDI manifest items. Moreover, a strict criterion was implemented to exclude respondents which did not have the knowledge to give a score on more than 50% of the direct items. Thus, the original data was reduced by 35% making the final data consist of 667 individual observations. The largest drop of respondents occurred in the telecom and insurance industries, where around 40% of the respondents were excluded. In banking and energy approximately 30% of the original data set was omitted. Remaining missing values were replaced with cross-industrial mean imputation.

3. Results

The following results are based on the PLS-PM *Model 1* and comprise multi-industrial data. The SD index (SDI) is considered to be an exogenous latent variable with direct paths towards all driving aspects as well as Customer satisfaction in the EPSI model framework.

Table 2. Summary statistics of latent variables in Model 1

Variable	Mean	Standard deviation	Range	Standard Error
SDI	58.3	22.0	100	0.9
Image	69.1	21.3	100	0.8
Expectations	74.5	20.7	100	0.8
Service quality	60.3	23.3	100	0.9
Product quality	72.6	20.1	100	0.8
Perceived value	65.5	22.0	100	0.9
Customer satisfaction	65.1	21.1	100	0.8
Customer loyalty	67.2	24.3	100	0.9

Table 3. Unidimensionality analysis of latent variables from Model 1

Variable	Cronbach alpha	Dillon-Goldstein's Rho	1st eigenvalue	2 eigenvalue
SDI	0.93	0.95	2.63	0.22
Image	0.91	0.94	2.54	0.27
Expectations	0.89	0.95	1.80	0.20
Service quality	0.93	0.95	3.31	0.31
Product quality	0.84	0.93	1.72	0.28
Perceived value	0.91	0.95	2.56	0.30
Customer satisfaction	0.92	0.95	2.59	0.23
Customer loyalty	0.94	0.96	2.68	0.22

Table 1 displays summary statistics for all constructed latent variables. SDI receives the lowest mean value score (58.3). The standard deviation varies around 20.7-24.3 units for all latent variables. Result found in Table 2 indicates how well a block of manifest questions reflects an underlying construct. All latent variables have satisfying scores in both Cronbach alpha and Dillon-Goldstein's rho with values

above 0.80. The first eigenvalues are considerable larger than the second and the lowest SDI manifest loading was 0.92 with no cross loadings larger than 0.66. Thus, indicating a good fit.

Table 4. Regression statistics, Model 1, SDI as a driver for EPSI latent variables

Effects path relationships	Coefficients	R2	P-Value
SDI -> Image	0.6	40%	0.00
SDI -> Expectations	0.5	27%	0.00
SDI -> Service quality	0.7	45%	0.00
SDI -> Product quality	0.5	29%	0.00
SDI -> Perceived value	0.6	39%	0.00
SDI -> Customer satisfaction	0.7	44%	0.00
SDI -> Customer loyalty	0.6	40%	0.00

Table 3 displays the direct effect of the final regression stage of PLS-PM in *Model 1*. All paths are shown to be significant and the largest effects from the SDI are found in the paths towards Customer satisfaction, Customer loyalty, Service quality and Image. Moreover, these paths display moderate coefficients of determination, greater than 40%, for the multi-industrial dataset.

Table 5. Regression statistics, Model 1, SDI as a driver for Customer satisfaction by industry.

Industry	Coefficient	R2	P-value
Total	0.64	45%	0.00
Bank	0.66	53%	0.00
Telecom	0.50	28%	0.00
Insurance	0.64	40%	0.00
Energy	0.77	57%	0.00

Table 4 displays the regression results from SDI upon Customer satisfaction divided by industry. All sub models show significant positive linear relationships. The largest effects are found in the Energy and Banking industries where the coefficient of determination also exceeds 50%.

Table 6. Regression statistics, Model 2, Direct items regressed against SDI

Dimension	Item	Coefficient	P-value
Environmental	Tries to offer services that are compatible with the environment.	0.13	0.00
Environmental	Strives to minimize the consumption of resources that affect the natural environment.	0.34	0.00
Social	Treat their employees without prejudice with regards to their gender, ethnicity, and religion.	0.08	0.00
Social	Improving the general well-being of society.	0.16	0.00
Economic	Pursues long term success/activity.	0.13	0.00
Economic/Social	Creates and sustains jobs in the region.	0.07	0.00
Economic/Social	Contributes to limiting poverty.	0.18	0,00

Table 5 shows the result from Model 2. After exclusion of non-significant (5%) and expected multicollinear items (VIF>5), seven remaining items are shown. Items from all suggested dimensions are represented. The overall model has a coefficient of determination as well as the adjusted coefficient of determination around 84%.

4. Discussion

This study has evaluated a new methodology for measuring perceived sustainability. In contrast of using an extended list of items, thoroughly reflecting each sustainability dimension, one latent construct of three underlying manifest items is proposed. Thus, the SD index presented in this study could be seen as a result in line with previously researched and established dimensions and items of sustainability. Moreover, as the perception of a sustainable actor, from the viewpoint of an individual customer, may be mainly influenced by only one of the dimensions, a manifest SD index item is proposed to capture the overall customer perception. Hence, the SD index does not have to strictly reflect all TBL dimensions, but rather indicate a general interpretation, such as the top of mind of the customer. Further, to extend the use of an SD index as a managerial tool it must also be possible to measure its effect, directly or mediating, towards EPSI variables and thus financial performance, as previous research has shown (Eklöv et al., 2017, 2020).

Results from the unidimensionality tests shows strong internal consistency of the SD index as an independent construct, but also in a combined model with the latent EPSI model variables. As such, the proposed manifest block provides a good fit for an unobserved construct. Moreover, the SD index receives the lowest mean score in comparison with the EPSI model variables. This indicates a general customer dissatisfaction regarding these industries sustainability efforts. However, it may also be seen as an area of opportunity for actors wanting to stand out and distinguish themselves from other market competitors.

M*odel 1* extended the use of the SD index as an exogenous variable directly related to all EPSI latent variables independently. This approach yielded significant and strong effects in all paths. Thus, it may be concluded that integrating a SD variable in an extended EPSI model, directly pathed towards one of the stronger drivers, would yield substantial effect on *Customer satisfaction* and *Customer loyalty*. This result may be seen as a useful extension of our previous research (Hallencreutz and Parmler, 2019; Hallencreutz et al., 2020; Westin and Parmler, 2020). Moreover, *Model 1* shows weak to moderate coefficient of determination. The result indicates that the model might be suffering from omitted variables/information, such as the EPSI models structural relations, or customer groups with different preferences.

Looking closer at the specific industries, the results show that the linear prediction power and the effect of the SD index increase in both banking and energy which indicate that sustainability matters are of greater importance to these customers. The banking and energy industries also yielded less "don't know" percentages for manifest SD index items compared to telecom and insurance. As noted in previous research (Westin and Parmler, 2020), large proportions of "don't know" responses might indicate insufficient and unclear market communication by the industry actors rather than faulty items – the customers actually do not know.

It is thus reasonable to assume the existence of a variety of customer segments, within industrial and societal sectors, where the interest in SD is of even greater importance for customer satisfaction and loyalty. A possible Response Based Unit Segmentation PLS-PM approach is suggested for future research to identify such customer segments and learn more about SD maturity in different parts of society.

Finally, *Model 2* evaluates the relationship between the sustainability direct items and the SD index. In contrast to previous research, each item was treated independently and no separate TBL latent variables were constructed. This approach was used to prevent relevant items from being disregarded in a TBL categorisation. To prevent multicollinearity and spatial effect, strict rules of exclusion were implemented. However, the remaining *Model 2* items should not be interpreted as the "best" items. Instead, the result shows that each TBL dimension had at least one item represented, which indicates that the SD index reflects all TBL dimensions. Moreover, the high coefficient of determination shows that the latent construct of the SD index works as a strong indicator for the direct sustainability items. Thus, enabling the SD index to function as a construct for customer perceived sustainability. Interpreting the coefficients, the largest effect was found in an environmental item. This seems feasible since climate change and environmental concern have been a top of mind during the 21st century.

5. Conclusions

Sustainable development has been on the global agenda for decades. The concept has been thoroughly researched and discussed. Nonetheless, there is still a gap between academic theories, political rhetoric, and actual deployment in practice. However, new research indicates that a greater management focus on sustainable development is crucial to prosper in the new Post Covid society. The understanding of different stakeholder perceptions about brands, products, and services will most likely play a greater role in defining sustainable success and drive change. Recent research also indicates that issues of sustainability and corporate social responsibility have become increasingly important for both employers, employees and customers as well as other societal stakeholders. The need for deeper research on the integration of corporate sustainability with core business processes has also been previously emphasised. This study could be seen as a contribution to that research.

This paper proposes a workable Sustainable Development Index (SDI) by identifying three underlying manifest questions based on previous research, reflecting customer perceptions of sustainability. The analysis shows that the proposed SD index variable has a strong internal consistency and high predictionary power from direct sustainability items. Thus, it could serve as an important non-financial performance indicator. Customer perception measurements such as the EPSI Rating initiative have for long been recognised as important indicators for future financial performance, and this study indicates that the addition of a SD index variable would strengthen that importance. Future research will further explore causal relationships between the SD index variable and existing EPSI model variables.

There is also ample empirical evidence that suggests a positive association between employee engagement, customer satisfaction, and financial outcome. Our contribution is to now introduce a robust PLS-SEM approach to measure SD efforts through the customers' eyes and hopefully make it more meaningful and workable from a practitioner's point of view. The proposed EPSI model development could offer an effective way of capturing important customer feedback and guide organisations forward in their quest to improve their sustainability efforts beyond just a verbal communication or formal reporting. We do not claim to have all the answers but believe that the model development presented in this study could assist in decoding and selecting non-financial indicators needed to achieve sustainable success. Although this research is limited to pilot testing based on a narrow data set, there are important causal relationships to consider as previous research has shown – yes, sustainable development is a driver for customer satisfaction. To swiftly understand, sense and respond to different stakeholders demands, needs, expectations and behaviours will be a critical success factor in a volatile Post Covid market economy. We also believe that sustainable success in this new business life will be more about being trusted and irreproachable, more about being local and close to customers (physically as well as digitally), more about communication and cocreation around relevant SD initiatives and more of a long-term economic resource management without compromising social and environmental aspects.

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Appendix A – The EPSI model

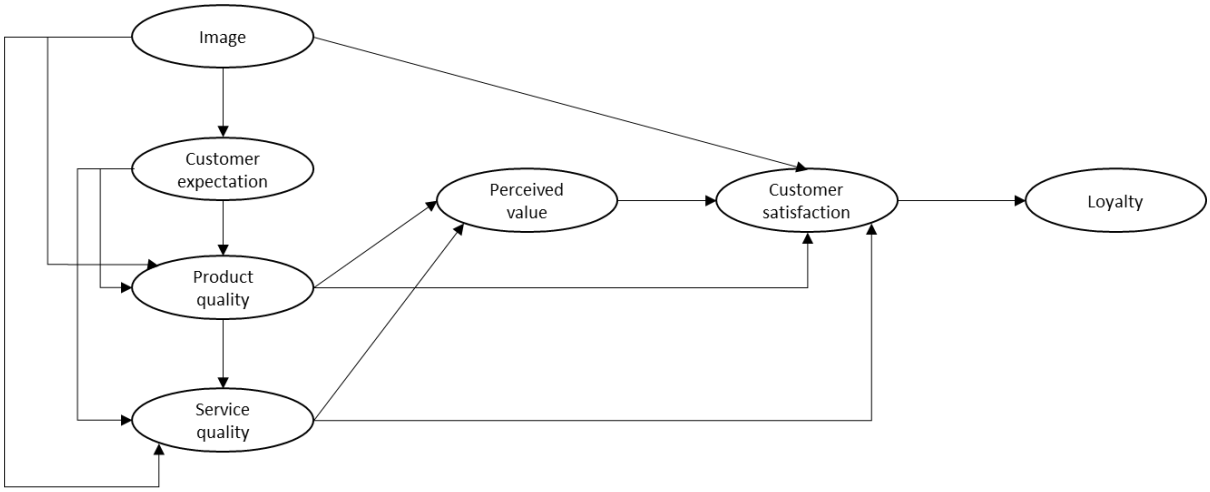

Figure A.1, The EPSI model of customer satisfaction 2020

Appendix B – Questioner

Table B.1, Study questioner.

Model	Category	Latent	Item
Model 2	Direct item		Pursues long term success/activity.
Model 2	Direct item		Tries to offer services that are compatible with the environment.
Model 2	Direct item		Does everything possible to eliminate or reduce the negative effects on the environment.
Model 2	Direct item		Reduces its consumption of natural resources
Model 2	Direct item		Strives to minimize the consumption of resources that affect the natural environment (negative).
Model 2	Direct item		Working to prevent child labour and unfair working conditions.
Model 2	Direct item		Improving the general well-being of society
Model 2	Direct item		Treat their employees without prejudice with regards to their gender, ethnicity, and religion.

Model 2	Direct item		Actively work to improve the equality within the organisation.
Model 2	Direct item		Creates and sustains jobs in the region
Model 2	Direct item		Contributes to limiting poverty
Model 1 & 2	Manifest	SDI	Organisation XX invests in a sustainable growth considering future generation
Model 1 & 2	Manifest	SDI	Organisation XX strives for economic success without compromising social or environmental factors
Model 1 & 2	Manifest	SDI	Organisation XX demonstrates societal responsibility socially, environmentally, and financially
Model 1	Manifest	Image	It is easy being a customer of XX
Model 1	Manifest	Image	XX cares about their customers
Model 1	Manifest	Image	XX is reliable
Model 1	Manifest	Expectations	Expectations of products /goods and services at Actor?
Model 1	Manifest	Expectations	Expectations of the customer service at?
Model 1	Manifest	Product Quality	Products/goods and services suits your needs
Model 1	Manifest	Product Quality	Technical services (app, website, online services)
Model 1	Manifest	Service Quality	To keep you well informed about what affects you as a customer
Model 1	Manifest	Service Quality	You feel valued as a customer of XX
Model 1	Manifest	Service Quality	You receive the help you require
Model 1	Manifest	Service Quality	Proactivity (to take initiative and make relevant offers)?
Model 1	Manifest	Perceived value	The customer service at XX?
Model 1	Manifest	Perceived value	Quality of the products and services XX offered?
Model 1	Manifest	Customer satisfaction	Overall satisfaction of XX
Model 1	Manifest	Customer satisfaction	Fulfilment of expectations
Model 1	Manifest	Customer satisfaction	How well do you think XX" compares with your ideal provider?

Table B.2, Introduction text to each item category

Category	**Introduction text**
Image	Based on what you have seen and heard, how do you agree with the following statements...
Expectations	How are your...
Product Quality	How are your experience with regards to your actors...
Service Quality	How do you experience your actor in terms of...
Perceived value	Given the fees and prices that you pay, how would you rate the...
Customer satisfaction	Given all your experience with your actor, how would you rate...
SDI and Direct items	To what extent do you agree with the following statements...

Building Sustainability

Understanding, Defining and Measuring Building Sustainability

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Abstract

Quality management (QM) is in large part about managing and sustaining change to achieve a desired outcome, improved quality. Integrating sustainable development with QM practices, defining a higher purpose for the business activities, and applying systems perspective are three out of five identified research themes of future importance for the field of QM. Moving from the general synergies between QM and sustainable development, this paper explores the concept of building sustainability based on the five-step logic of understanding, defining, measuring, communicating and leading change. The new Swedish regulation, 'klimatdeklaration' (climate declaration), solidifies the well-established sustainability indicator CO2-emissions and intends to spur a common understanding for life-cycle thinking along the building value chain. Based on the emerging QM scope of stakeholders focus, people and planet are suggested as key stakeholders and profit, the third part of the triple bottom line, is interpreted as a means to satisfy stakeholder needs. The five-step logic of, understanding, defining, measuring, communicating and leading change is used to explain how actors can move from understanding to leading change. With an emphasis on understanding the concept of sustainable development and defining the interpretation of it, previous studies are used to conclude an indicative lack of understanding for building sustainability. The many indicators used in different sustainability performance rating programs, like BREEAM and LEED, and in the sustainability reports of global companies, indicates an inconsistency that hinders comparative analysis. In measuring building sustainability there is no lack of indicators, the challenge lies with the choice of indicators and providing a clear motivation for the choices based on an explicit interpretation of sustainable development. Finding and uniting around a common paradigm for sustainability, with regards to the higher purpose of an actor along the value chain, is suggested as a key activity in accelerating the transition towards building sustainability.

Keywords: Building sustainability, Sustainable development, Sustainable transitions, performance indicators **[Maximum of five words]**

1. Introduction

Quality management (QM) is in large part about managing and sustaining change to achieve a desired outcome, improved quality. The development and discourse around QM is being described through four incommensurable paradigms, the empirical, reference, reflective and emergence (van Kemenade and Hardjono, 2019). It is clear that QM is being applied differently in various context, but the work towards continuous improvements is constant. With the escalating societal challenges like climate disruption, loss of biodiversity, and increased inequalities, the pressure of moving towards sustainable development is increasing on all levels in society. Previous literature on synergies between QM and sustainable development has been identified through three categories, production management, sustainable strategy and a triple-bottom line approach connected to QM tools and practices (Dahlin, 2018). It is also found that many synergies are identified between QM practices and support for sustainable development, however most identified areas are conceptual and there is a lack of empirical evidence to support the ideas (Siva et al., 2016). Integrating sustainable development with QM practices, defining a higher purpose for the business activities, and applying systems perspective are three out of five identified research themes of future importance for the field of QM (Fundin et al., 2020). Moving from the general synergies between QM and sustainable development, this paper explores the concept of building sustainability based on the five-step logic of understanding, defining, measuring, communicating and leading change (Isaksson and Hallencreutz, 2008).

Buildings have become a natural part of society catering for some of the basic human needs such as shelter and security. The industry with all its actors along the value chain all stands for a significant part of economic activity and use of resources. Buildings are estimated to account for some 30-50% of global CO2 emissions (Berardi, 2017; Dixit, 2019). The way buildings are designed, built, used and recycled at the end-of life has great potential to contribute to the achievement of the UN Sustainable Development Goals (SDGs) (Environment, 2017). The built environment affects health, well-being, and social patterns while the cost of living can have detrimental impact on fighting poverty and decreasing inequalities. The industry as a whole is facing a fundamental challenge to transition into a sustainable way of operations. This mode of operations is defined by the limits of our planetary ecosystem combined with the social objectives of increased well-being for all. Based on the substantial impact potential, both negative and positive, building activities have on the environment and social well-being of people the concept of sustainable building is of importance. The change is complex, and it is important that key actors in the building value chain have understood and defined the challenges in the same way. This paper aims to describe the current situation of building sustainability and propose a way forward by assessing building sustainability through the lens of the five-step logic of understanding, defining, measuring, communicating and leading change. Focus is the three first steps. This is done seeking answers to the three research questions:

RQ1: How could building sustainability be understood?

RQ2: How could building sustainability be defined?

RQ3: How could building sustainability be measured?

2. Methods

In this mainly conceptual paper building sustainability is studied and discussed. We use the latest input and our understanding of sustainability and building sustainability to interpret how building sustainability could be understood, defined and measured based on a stakeholder needs perspective. A narrow literature search has been conducted where research as well as recent policy frameworks are scrutinised.

3. Results and Discussion

Understanding building sustainability

Sustainable development is most commonly traced back to the definition stated by the Brundtland Commission (Brundtland et al., 1987) "sustainable development is development that meets the need of the present without compromising the ability of future generations to meet their own needs". The concept has, since then, been defined and interpreted in many different ways (cf. Hopwood et al., 2005). The idea of a triple-bottom line (Elkington, 1998) with the three dimensions, social (people), environmental (planet) and economical (profit), is frequently used to describe sustainable development. Through expanding the customer focus from QM towards a stakeholder focus for sustainable development, Isaksson (2019) suggests a focus on people and planet needs, where profit is interpreted as a means to an end (Isaksson et al., 2015). The same focus on people and planet is used in the concept of doughnut economics where the planetary boundaries (Rockström et al., 2009) define the planetary needs and the social foundation based on the SDGs encompass 'a safe operating space for humanity' (Raworth, 2017). Derived from the concept of planetary boundaries, Isaksson (2019) suggest the atmosphere, biosphere (land), biosphere (sea) and lithosphere as key planetary stakeholders. Following this logic, the key people stakeholders based on the social foundation derived from the SDGs are identified as private individuals, professionals, and citizens. These follows from the three clusters; well, productive, and empowered that was used to identify the social needs (Raworth, 2012).

The framework for strategic sustainable development (FSSD) uses backcasting from principles in order to define and guide organisational work towards sustainable development (Broman and Robèrt, 2017). The eight principles that defines a sustainable society also follow a people and planet focus where the first three regards the degradation of nature through systematically increasing:

1. … concentrations of substances extracted from the Earth's crust.
2. … concentrations of substances produced by society.
3. …degradation by physical means.

The following five describes how people are not subject to structural obstacles to; (4) health, (5) influence, (6) competence, (7) impartiality, (8) meaning making.

FSSD uses negative principles, i.e. defining what not to do, which leaves space for organisations to be creative in finding its own vision, while providing the systemic conditions to ensure a sustainable development. This results in a focus on measuring the 'harm' of each organisation, i.e. the failures to adhere to the eight principles. Committing to a higher purpose to boost business activities is suggested, similarly to the visionary future in FSSD, to be a success factor for sustainable organisations (Fundin et al., 2020). It is however ambiguous how the commitment to a higher purpose is to be considered when assessing sustainability. Raworth (2017) presents the 'corporate to-do list' with five levels of commitment to what is described as a 'living purpose' for an organisation:

1. **Do nothing** – the business of business is business. The responsibility of the organisations lies in profit maximisation for the shareholders.
2. **Do what pays** – an eco-efficiency approach where environmental damage that has a cost to it is minimized.
3. **Do your fair share** – external damages on a larger scale are acknowledge and the organisations' part to it is assessed and accounted for.
4. **Do no harm** – mission zero. The aim and pursuit of sustainability is to be neutral, i.e. not negatively affect the natural or socio-economic system the organisation engage with.
5. **Be generous** – a way of being in the world that embraces biosphere stewardship and recognises that we have a responsibility to leave the living world in a better state than we found it. Designing and working towards regenerative and redistributive solutions to not overshoot any planetary nor social thresholds.

Shifting from a shareholder towards stakeholder focus with people and planet as key stakeholders, is argued to be essential for organisations to maintain their licence to operate (Isaksson, 2019). Sustainability is further understood as a focus on doing the right thing in the right way, where the rate of change towards defined goals is the base for assessment (Isaksson and Steimle, 2009). In order to assess the transition towards a state of sustainability, as defined by the goals, output in terms of both value and harm, from the value creating processes that organisations engage with, is to be measured. This would enable a comparison of the rate of change for which a process and the engaged organisations can be evaluated against, indicating excellence in sustainability.

Defining building sustainability

The definition of a key concept is assumed to mirror the underlaying understanding of the concept. For any interesting topic in scrutiny, the definitions set the frame of reference. An indicative study sampling 23 major organisations in the Swedish housing value chain, found the definitions of sustainability, in

the context of building, to be non-existing at worst and vague at best (Isaksson and Rosvall, 2020). A similar study based on top sustainability-rated global construction companies and ten most cited research papers on building sustainability also indicate a lack of defining building sustainability and the seemingly high uncertainty around the concept (Isaksson et al., work in progress).

In an overview of the common uncertainties of related to sustainable development (Grosskurth and Rotmans, 2005) four main characteristics were identified: it is time dependent, it includes several levels of space (and scale), it has multiple dimensions and it has social dependencies. Based on this Berardi (2013) discusses building sustainability and arrives in the following understanding: "a sustainable building can be defined as a healthy facility designed and built in a cradle-to-grave resource-efficient manner, using ecological principles, social equity, and life-cycle quality value, and which promotes a sense of sustainable community." Here an emphasis is placed on people (social equity) and planet (ecological principles) with a value chain perspective from cradle-to-grave. What is noticeable about the definition is that it is the building that is defined to be sustainable rather than the process for which the building is being used. In defining building sustainability, it apparent that different object of focus can set the scope, for example a focus on the building as an object, the organisation in the building value chain, or the process of providing the utility of the building. QM practice, along systems thinking, applies a process perspective with focus on the dynamic parts of systems, i.e. the activities in where value creation takes place. Transferred to building sustainability, this places the scope along the activities in the value chain.

The current scoping used in the European standard 15978 (EN, 2011) defines the building value chain as starting with raw material extraction followed by material production, construction, use of building and finally end-of-life process with demolition, recycling, and deposit of waste. In each of these main processes there is input, output and outcome that can be measured through indicators derived from a value and harm analysis of the outcome for people and planet stakeholders.

Measuring building sustainability

It is common to separate two phases from this value chain, the construction and the utilization of a building. The assumed reason for this is that the majority of material, energy and costs goes into the building during construction, i.e. majority of harm, while the majority of the value is achieved though out the lifetime of the building. The implication of using a life-cycle approach to the building process is that all the costs during the construction phase is annualized throughout the life-time of the building, adding to the cost of operating the building during the utility phase. With lifespans of 40+ years for buildings it is crucial for the involved organisations conducting the value creating activities to sufficiently being able to measure the value and harm in all parts of the chain but more importantly in the initial processes leading up to the complete building.

Attempts to measuring building sustainability dates back a long time. Various rating tools for buildings sustainability performance, with Building Research Establishment Environmental Assessment Method (BREEAM) and Leadership in Energy and Environmental Design (LEED) as the most well-known examples, are continuously being developed (Díaz-López et al., 2019). The continuous emergence and development of various performance rating systems reflects this expanding and re-scoping of what is included in building sustainability (Doan et al., 2017; Shan and Hwang, 2018).

Looking at the EU, we have the level(s) framework from the European Commission (Dodd et al., 2020) that complements EU-standard 15978 with six macro-objectives with accompanying indicators building sustainability: (1) Greenhouse gas emissions along building life cycle; (2) Resource efficient and circular material life cycles; (3) Efficient use of water resources; (4) Healthy and comfortable spaces; (5) Adaption and resilience to climate change; (6) optimised life cycle cost and value. The six macro-objectives are presented without any further definition of sustainability in a global nor local context. The list is a mix of causes, effects and actions and does not have a defined stakeholder focus for deriving output and outcome in the building value chain. The macro-objectives seem to follow the inside-out development progress similar to the performance rating systems emerging globally, ex BREEAM and LEED. Although the framework is presented as the solution to the ambiguity around sustainability performance measurements, it unfortunately fails in defining the underlaying interpretation of sustainability. The Swedish agency for building regulation and policies does not provide any clear definition of building sustainability and refers the identified areas of sustainability to the Level(s) framework European Standards like EN 15978 (Boverket, 2020).

In measuring building sustainability there is no lack of indicators, the challenge lies with the choice of indicators and providing and clear motivation for the choices based on an interpretation of sustainable development. This is where QM practices and the expanded stakeholder focus becomes useful. With the applied process-focus and identified people and planet stakeholders, frameworks like FSSD and doughnut economics can be operationalized into sets of indicators for assessments of sustainability along the value chain. Some first examples have been conducted using the pareto principle for selection of value and harm indicators, identifying CO2 emissions and cost as main planet and people harm and mPa compressive strenght and m^2 wall area as main people value (Isaksson and Babatunde, 2019; Isaksson and Buregyeya, 2020). An attempt from the Swedish government to establish unified measurements along the building value chain in Sweden is named ‘klimatdeklaration’ (climate declaration). The new law is aimed towards a complete measurement of carbon-dioxide emissions (CO2) that is the result of the total construction phase, filling a void in current reporting policies (Boverket, 2018). The new regulation also explicitly names the purpose of steering towards an increased learning of life-cycle assessments among the actors along the value chain, to create awareness of what is of high and low impact for climate disruption. Serving as a first step towards a unified sustainability

assessment in the building value chain, the climate declaration solidifies the planet-harm indicator CO2-emissions.

Discussion

The underlaying challenge for both policy-makers and private and public organisations is to align in a new paradigm of business activities, where the underlaying purpose of each process is explicitly defined as something on the scale between *do what pays*, *do no harm* and *be generous*. The FSSD framework guides towards the do no harm with its inverse principles, and the SDGs could be used to frame goals to be generous. This opens the discussion of the focus on value and harm in the assessment of sustainability. The presented approach assumes a relation between the value created to the harm done, for the stakeholders people and planet. But if the scope is limited to *do no harm* rather than *be generous* in the value creation, then value generated for both people and planet are to be dismissed. Reporting sustainability (non-financial) performance is heavily influenced by the ambition of pursuing this higher purpose for the organisation. The mix of current reporting, and foremost the lack of reporting, for key performance indicators (KPI) complicates the comparative assessments. The new climate declaration in Sweden shows how the government can take lead in enforcing communication around sustainability indicators, for increased awareness and common understanding. CO2 as a key planet-harm indicator is well-recognised, so the new regulation does not really break any new ground in providing a complete set of both people and planet value and harm indicators. Exploring these indicators for the building value chain and identifying the KPIs for sustainable building, based on global stakeholder needs, is an interesting area of further research.

4. Conclusions

The paper examines the understanding of building sustainability with the purpose of leading change along the building value chain towards sustainability. The five-step logic of, understanding, defining, measuring, communicating and leading change is used to explain how actors can move from understanding to leading change. With an emphasis on understanding the concept of sustainable development and defining the interpretation of it, previous studies are used to conclude an indicative lack of understanding for building sustainability. The many indicators used in different sustainability performance rating programs, like BREEAM and LEED, and in sustainability reports of global companies indicates an inconsistency that hinders comparative analysis. A process-perspective together with a focus on the two stakeholder groups people and planet is suggested to use for finding sustainability indicators for both value and harm. The EUs framework Level(s) is scrutinised and found to be a mix of causes, effects and actions which is meant to work as a unifying framework for the improvements along the building value chain. Both the EU framework and the Swedish regulation of reporting along the building value chain is incomplete in their deduction and presentation of building

sustainability indicators. Finding and uniting around a common paradigm for sustainability, with regards to the higher purpose of an actor along the value chain, is suggested as a key activity in accelerating the transition towards building sustainability.

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Cement and Concrete - Quality and Sustainability

Understanding, defining and measuring opportunities

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Abstract

Shelter is a basic human need. Providing shelter comes with a high climate footprint. Carbon emissions from buildings are estimated to contribute to about 30-50% of global emissions when assessed for the entire building value chain. The use of buildings with heating and cooling contributes with the largest parts but also the building material which is in focus here. Concrete is the most used human-made product in the world. On a global average each person consumes about three tons per year. Cement is the glue in Concrete. Cement contribution to global carbon emissions is about 7-9%. What is sustainable building and how could cement and concrete be part of it? It seems that the question is more difficult to answer than anticipated. Here, we develop a Quality Management inspired model to help us to find opportunities in understanding, defining and measuring sustainability and sustainable development. We then apply the proposed model for cement and concrete sustainability.

Keywords: Cement sustainability, concrete sustainability, Opportunity Study, Sustainable Building, Quality and Sustainability

1. Introduction

The building value process is about providing shelter. The value chain goes from raw material extraction demolishing and reuse. Se Figure 1.

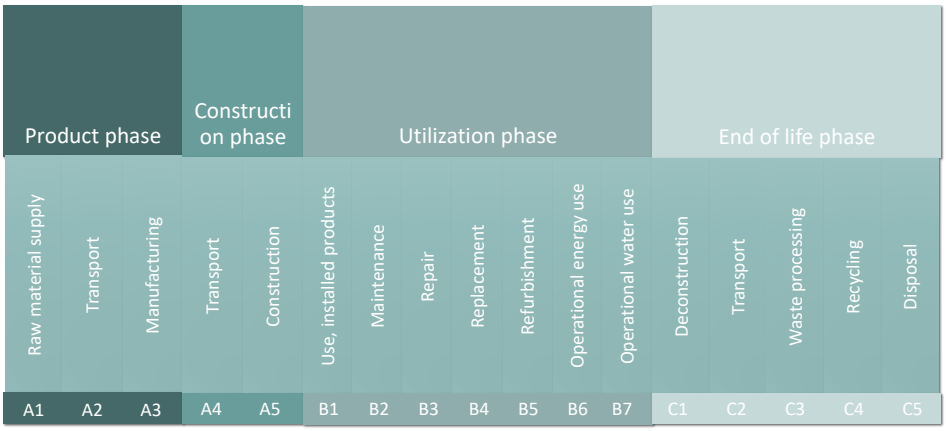

***Figure 1**. Building value chain based on based on the European standard 15978 (2011)*

Within sustainability one of the most critical issues is climate change. Buildings have a significant carbon footprint. Carbon emissions from buildings are estimated to correspond to about 30-50% over the entire building value chain (Berardi, 2017; Dixit, 2019). The building value change can be divided into two main parts, where the first – constructing buildings - consists of the product and constructions phases in Figure 1. This is the process from raw material extraction to a complete building. The second part – using buildings - consists of utilization and end of phases. Traditionally more than 80% of the carbon emissions originated from using buildings and this is still the case where house insulation is poor and where fossil fuels are used for heating and for the electricity generated for cooling. However, technical solutions such as low energy and passive houses and the use of renewable energy is slowly pushing focus on the part of constructing buildings. In Sweden only about 20% of the carbon footprint originates from the building value chain due to mainly a low use of fossil fuels for heating. It could be that the challenges with constructing buildings need more focus.

Concrete is the most used human-made product in the world. On a global average each person consumes about three tons per year. Cement, water, sand and aggregates become concrete. Cement is the glue in concrete and the main driver for price and for the carbon footprint. Concrete is a cheap and convenient building material that is being used globally both in very simple and very complicated constructions. Residential buildings in cities and infrastructure require large quantities of concrete. The Portland Cement used for concrete is produced in most countries in the world. Cement is relatively cheap compared to its weight with prices typically ranging from 60 to 150 US$ per ton. This generally means that land transports are limited in length since the unit price quickly increase with distance. Some cement is traded globally in ships, but the basic rule is that most countries want to be self-sufficient in cement as a matter of national security. Global warming due to global emissions of CO_2 puts pressure on the use of cement and concrete. Cement contribution to global emissions is about 7-9% (references).

In order to assess cement and concrete sustainability we need to understand what these are. In this paper we define sustainability as a condition where the system can continue to exist without destroying the resources it is depending on. We also use the term level of sustainability like level of quality. E.g., cutting down a forest and then leaving it as a desert has 0% sustainability. Doing selective forestry that maintains the biological diversity intact could be seen as 100% sustainability. The modern tree plantation that we call forests have a level of biological sustainability somewhere in the middle of that range. The change towards a level of sustainability is seen as sustainable development. In order to assess what a level of sustainability is we need to agree upon a definition and to have agreed KPIs. With a defined level of sustainability and an agreed goal set in time we can define sustainable development in terms of speed and level of change needed. Isaksson and Rosvall (2020) have done a study titled

"Understanding Building Sustainability – the case of Sweden" in which they have studied how leading Swedish building companies understood, defined and measured sustainability. A total of 23 leading companies were studied. Results found indicate a lack of a common agreement on what building sustainability is and what the scope of sustainability reporting should be. The description in the building standard demonstrated in Figure 1 provides a clear picture of what a value chain based on cradle to grave means. Most of the companies report based on the Global Reporting Initiative guidelines. These guidelines in the GRI standard 101 suggest that the value chain should be used for reporting the main sustainability impacts. This could be seen to provide a clear input for identifying the main sustainability impacts in the entire value chain. However, this is not the case for most of the studied companies. For about 50% of the companies in the Isaksson and Rosvall (2020) study it is impossible to find a clear definition for business sustainability. Without a definition of what sustainability is, relevant measuring becomes very difficult.

Based on generic reasoning we could postulate that individual and organisational understanding for sustainable development goes through the stages of understanding, defining, measuring, communicating and leading sustainable development (Isaksson and Hallencreutz, 2008). Sustainable building could, based on the deduced main sustainability impacts, be seen as affordable with zero carbon footprint (Isaksson and Rosvall, 2020). This is based on seeing humanity (People) and nature (Planet) as the main stakeholders. For People having access to shelter is a fundamental human right, which means to have a reasonable housing standard. This is a need that is often not satisfied in developing countries with millions of slum dwellers. However, even in Sweden, one of the richest and most sustainable countries in the world acceptable housing is not always guaranteed. Shelter should be provided with minimal harm. This relates to two of Garvin's (1984) five quality perspective, the user and value-based ones. The translation from user quality per prices becomes stakeholder value per harm (Isaksson et al. 2015). This could be seen as a further development of Eco Efficiency (WBCSD, 2000) that suggest value per harm, but where the value is seen as sales value. Here, instead we look at user value. For housing the value can be defined as acceptable housing. In a Pareto-context the main harms for People and Planet can be identified as price of housing and its climate effect. This means that residential building sustainability could be defined as affordable with a zero carbon footprint and that Key Performance Indicators for residential building sustainability could be such as m^2 living per carbon footprint and per price (Isaksson and Rosvall, 2020). This overall performance could then be broken down to concrete and cement sustainability using the value per harm logic. The main functional concrete value could be seen as its ability to create building volume with a certain strength. The more m^3 produced the more of value. Also, the more of strength these volumes have the higher the user value provided that the volume can be used to shape adequate buildings. A rough translation from m^2 building value could be to use volume*strength or m^3*MPa (Mega Pascal). Here MPa, denotes the compressive strength which in buildings is a design requirement. Isaksson et al. (2015) suggest MPa*tons which

could be used, but more common in buildings is to describe the volume. The building value in MPa*m^3 can then be compared to harms of price and carbon footprint. The strength in concrete is to a great extent defined by how much cement and to what quality is used. More cement with other conditions similar will result in a higher concrete strength within a chosen range. This means that we could describe cement sustainability in value per harm terms as MPa*tons/price and MPa*tons/tons CO_2. This is nothing which seems to be currently reported (Isaksson et al. 2015; Isaksson and Rosvall, 2020). This could indicate that the main problem still is in creating a common understanding of what cement and concrete sustainability are. It could be that there is an opportunity for improvement in highlighting the current sustainability improvement potential for cement and concrete and in analysing the causes for it and suggesting ways forwards.

In terms of circularity the first question asked is if the product is needed. If it can be avoided, then the problem is solved. But, if not then we need to proceed to see how user value can be maximised while harm is minimised. The purpose of this paper is to discuss cement and concrete sustainability as an important part of the building value chain. We study if core Quality Principles such as customer and process focus can be used to make sense of sustainability and sustainable development in cement and concrete manufacturing.

RQ1: How could we make sense of understanding, defining and measuring sustainability and sustainable development using stakeholder needs focus and process models?

RQ2: How could sustainable concrete development be described?

RQ3: How could sustainable cement development be described?

2. Methods

This is mainly a conceptual paper where the starting point is previous work on cement sustainability and on working with what is called an Opportunity Study (Isaksson, 2015). The Opportunity Study goes through the stages of Diagnosing, Analysing and Solving and could result in an opportunity for improvement. The Opportunity Study forms a prerequisite for a full improvement process which could be defined as Diagnosing, Analysing, Solving, Improving, Anchoring, Studying (DASIAS). The Opportunity Study could be done on consultancy basis or as an analytical exercise. The results for the Opportunity Study should then be presented for the management to decide on any actions. If any actions are decided this would probably include a new iteration of the DAS followed by the other steps. In Figure 2 the role of the Opportunity Study is described as something that supports “establishing a sense of urgemcy”..

The theory development work carried out to propose an answer for RQ1 consists of combining the Opportunity study steps of Diagnosing, Analysing, Solving, with the logic of Understanding, Defining

and Measuring. These two concepts form a matrix as presented in Table 1. This matrix is interpreted in general terms using quality practices and tools resulting in a matrix which is tested for answering RQ3 – "How could sustainable cement development be described". The RQ2 of sustainable concrete is answered using a brief literature review focusing on if concrete can be substituted in buildings.

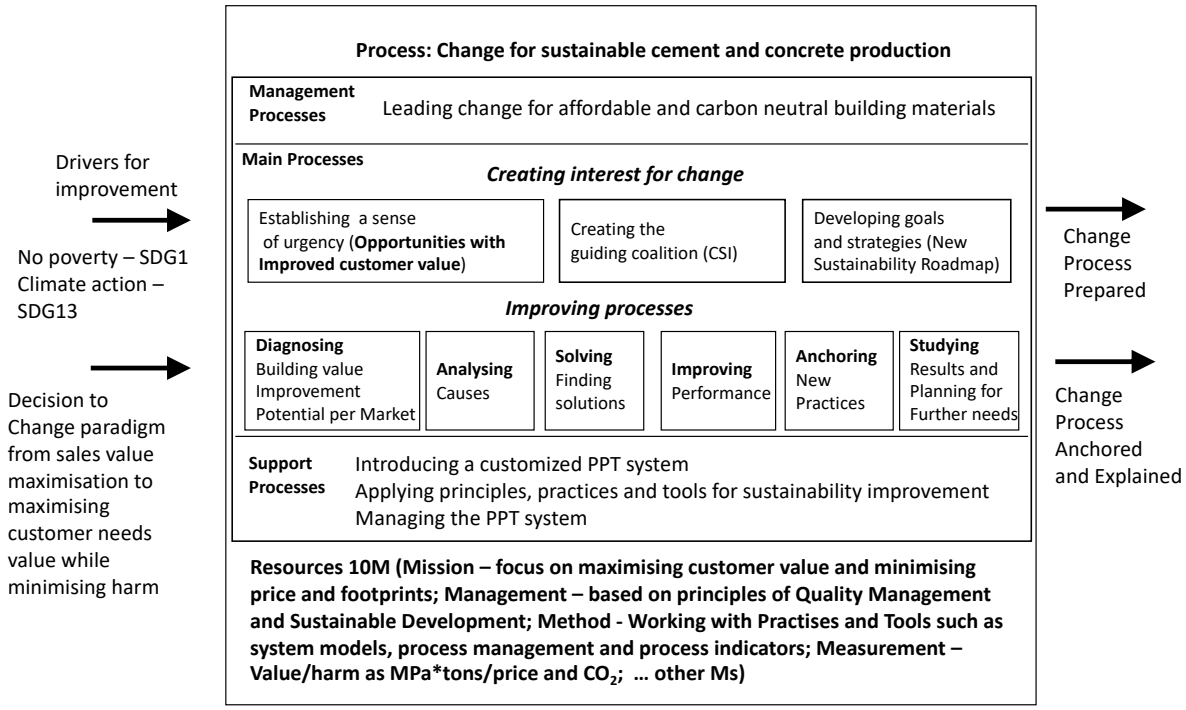

Figure 2*. The Process Based System Model (PBSM) applied for sustainable cement and concrete development, adapted from Isaksson (2019).*

The indicative answer to this is no which puts focus on cement sustainability. RQ3 is described using the proposed matrix from RQ1.

Table 1. *A template for the matrix used to relate the components of an opportunity study with the stages of maturity in understanding, defining and measuring sustainability and sustainable development.*

	Understanding	Defining	Measuring
Diagnosing			
Analysing			
Solving			

For the combination **Analysing-Understanding** a generic cause checklist is used. This is originally based on the specific case of a 7M Fishbone diagram categorising common causes for existing problems or an existing improvement potential (Isaksson, 2016). The 10Ms are used as a base for a qualitative analysis of what could explain the diagnosed improvement potential. The 10Ms are indicative and could

be adapted for the context. The Ms are resources and form part of the PBSM in Figure 2 as internal resources. Each M can be assessed based on relevance and current performance.

Table 2. *A template for the 10 M checklist, (Isaksson, 2016)*

M – parameter	Criteria & comments	Relevance (1-5)	Level of performance (1-5)	Priority nr and ranking
Mission	Purpose of the studied process - is it clear what it does and why and is this accepted and understood?			
Management	Policies, goals and strategies for improving process performance in all relevant process dimensions? Maturity level of agreed principles. Organisational culture?			
Method	Organisation of the process – is it managed as a process based on the principles of good process management – process maturity? Definition of competencies needed (Manpower specification). Organisational structure for carrying out strategies and achieving goals? Are there clear management systems and are they integrated?			
Manpower	Competency for the required tasks. Competency could be seen as education, experience and attitude compared to specifications. Maturity of agreed principles.			
Measurement	Maturity of measurement system and communication of performance results. Level of Measurement Information Systems (MIS).			
Machine	Adequacy of equipment and premises for the intended use (specifications). Note that this also includes hardware and software for MIS and could also include service agreements.			
Material	Methods for controlling incoming material and information. Level of specifications, deployment of these and results.			
Milieu	Level of physical (effects both personnel and equipment) and social working environment.			
Market	Customer base in the form of established relations, competition and general development level of the market. Includes also suppliers and relations to these.			
Means	Availability of funds for operations, investments and improvements.			

The relevance goes from 1 to 5 with 1 being not relevant and 5 being very relevant. Performance has an inverted scale where 1 signifies very high performance and 5 very low performance. Level and performance are multiplied to a priority number which ranges from 1 to 25 with a higher number indicating higher priority

3. Results and Discussion

In Table 3 the results of the conceptual review are presented.

Table 3. *A proposed matrix to relate the components of an opportunity study with the stages of maturity in understanding, defining and measuring sustainability and sustainable development.*

	Understanding	Defining	Measuring
D	Setting scope for value chain and parts of it by using the PBSM (ref) Identifying main sustainability stakeholders and main impacts on them by referring to the UN SDGs, the Planetary Boundaries Framework and the system principles from the Framework for Strategic Sustainable Development (FSSD) (ref) Defining the qualitative improvement potential as the difference between possible and/or required performance and current performance	Based on the Pareto principle define the vital few stakeholders and impacts on them in terms of stakeholder needs that can measured Focus on People and Planet needs and convert this to a proposed definition that can be operationalised	Measure sustainability as a state and sustainable development as change Identify value and harm indicators – the KPIs (y-values) that can be used to describe current sustainability and the sustainability performance over time Value and harm are expressed in terms of impacts on People, Planet and Profit KPIs should be expressed in absolute and relative terms Assess the quantitative improvement potential for chosen y-values in terms of level and rate of change
A	A qualitative review of main causes by using the 10 M checklist (ref) Five Whys Qualitative process analysis	Identifying the main Ms that seem to explain the improvement potential – a qualitative identification of the main x-values (both direct and indirect)	A quantitative review, provided data exist for $y=f(x_1, ..x_n)$
S	Working with elements from the Principles, Practices, Tools Model (PPTM) (ref) Using brainstorming for process and product innovation	Defining solutions and strategies for these	Setting targets for level of sustainability and rate of change that corresponds to sustainable development

The work started with understanding diagnosing of sustainability and sustainable development in the generic process of cement manufacturing. The logic is working with the matrix line per line from left to right. The reference used has been both the global cement manufacturing process and, in some parts, the Swedish cement manufacturing process. Since the purpose is on an overall level to see if the matrix makes sense and can support in understanding sustainability this is judged to be OK. The work then proceeded with defining and measuring.

Diagnosing with understanding, defining and measuring provides a basic understanding of the current level of sustainability using the identified KPIs for performance (y-values) and an understanding of the speed of change and to what extent change is sustainable development defined as reaching a state of sustainability before the system that the process is depending on has deteriorated unacceptably. After this analysing was subjected to the maturity stages of understanding, defining and measuring and finally same was done for solving. Earlier more work has been done at the level of Diagnosing which has led to a more extensive content for understanding, defining and measuring Diagnosing.

When assessing the current use of concrete to meet the demands of societal construction and infrastructure it becomes apparent that concrete has no substitute. Many parts of our current infrastructure, e.g., bridges, dams, skyscrapers, roads and railways, are dependent on the use of concrete. The abundance of the raw material needed for its composition makes it the only viable option for meeting the growing demand for shelter, construction and infrastructure globally. In addition, cementitious materials generally have a lower environmental footprint compared to other building materials, such as bricks and steel. Cement and concrete's significant contribution of global carbon emissions is therefore a result of the huge consumption of the materials.

The percentage of the urban population is growing, and most new buildings are built in developing countries. The increasing cement and concrete use are not only driven by urban population growth but also from a more intensive use. During the last 65 years, the global population has almost tripled. Meanwhile, the cement production increased almost 34-fold (Scrivener et al., 2018), which indicates that improved living standards in many parts of the world also is a driving factor. Furthermore, in the urban centra in South America, Asia and Africa different concrete applications are dominating and alternatives are few. Timber could in some cases in Sweden and in some other countries in the Northern Hemisphere be used instead of concrete. But even here foundations and part of the work requires concrete. The simple answer to if concrete can be substituted is, no.

Concrete sustainability in terms of climate sustainability is highly dependent on the Portland Cement carbon footprint. Could this be lowered, or could the Portland Cement be substituted? This question has been discussed using the matrix in Table 2 where areas of interest, which could be seen as areas of future research, have been identified. Some particular parts have been chosen for more detailed discussions. These are Solving-Understanding which include product innovation or substituting

Portland Cement with other materials that can either be ground into cement or used directly in concrete production. These materials are called Supplementary Cementitious Materials (SMCs) which typically are Fly Ash from coal firing, Ground Granulated Blast Furnace Slag from steel production, Silica Fume a by-product of producing silicon metal or ferrosilicon alloys, Ground Limestone, Natural Pozzolans - such as volcanic ash, calcined clays, shale, and metakaolin. All materials except limestone have some hydraulic binding properties. Limestone is an inert material, a filler, put could contribute to better packing and could be of benefit in concrete production. Limestone is the main raw material of cement and in most cases cement plants have access to limestone that is also suitable for inter grinding with cement clinker. Global mapping of SCM availability shows that both slag and fly ash are already widely used for the current cement production. Three other materials, calcinated clay, limestone fillers and engineered fillers are presented as potential resources that based both on their abilities could reduce clinker content.

Another part in focus is the Solving-Measuring where targets for strategies are defined. This part can be interpreted based on interpretation of goals set by a leading cement manufacturer. The Swedish Cement manufacturer Cementa belonging to the Heidelberg Cement group has one of the globally most ambitious programs for reducing the carbon footprint. This is the CemZero project. The Zero vision for carbon emissions is presented in Figure 3. This presentation provides input for which strategies have been chosen and which have not. New types of cement seem to play a minor role which indicates that at the level of cement manufacturing there is little focus on SCMs and on new types of cement. The main strategy is Carbon Capture and Storage where the plan is to clean and then liquidify the combustion gases including the carbon dioxide and then pump them into old oil wells outside of the Norwegian coast.

Some comments to the overview presented in Table 3. **Diagnosing-Understanding** includes setting the scope for the entire value chain. The Figure 1 European Building Standard has been translated into process language. The phases have been written as processes and some of the steps such as B2-B5 which are support processes have been placed as such in Figure 4.

The B6 and B7 that are measurement indicators have also been interpreted as support processes. Cement and concrete manufacturing are found under the process of “producing materials”. This puts cement manufacturing into the entire scope of providing accommodation. Producing cement has then in the “box in the box” model been highlighted in Figure 5. The Process Based System Model (PBSM) has been used to set the scope for the building value chain and for cement production, See Figures 4 and 5 (Isaksson, 2016). The PBSM has two main processes as default, these are producing value and marketing/communicating. In sustainability communication it is important to get the balance right between keeping stakeholders informed and greenwashing. Cement plants are mainly

reporting carbon emissions, not the value produced as building value. The price of cement is also not reported, which means that there is a gap. It is difficult to find a fair cement benchmark price.

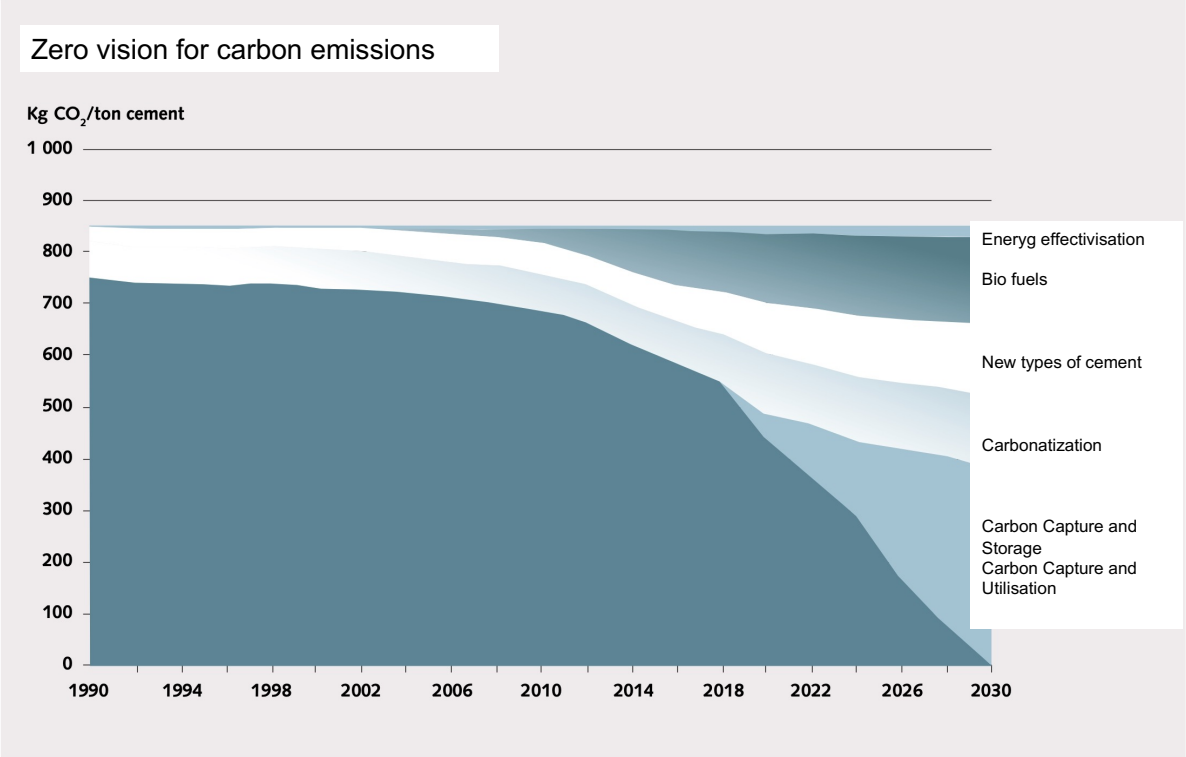

Figure 3*. The Cementa Cemzero project, translated from Cemzero (2021)*

Diagnosing-Defining results in defining cement sustainability as producing cement building value for an affordable cost and with zero climate impact. **Diagnosing-Measuring** indicates that only the level of carbon emissions and the change of them can be assessed. The benchmark rate of change for sustainable cement development could be assessed based on using Sweden as benchmark. Sweden has the target of becoming carbon neutral in 2045. Based on this a rate of change can be calculated. The ambitious Cemzero target of Cementa being carbon neutral in 2030 has not been used since current performance already lags behind the target in Figure 3. Results in Figure 6 show that the rate of reduction over a ten-year period is only about 6% for clinker and 3% for cement. A common statement is that the rate of reduction should be at least 50% per each 10 years. This would mean 7% per year. In the plan 400 kg CO_2/ton cement will be handled by CCS. This still leaves 300 kg CO2 per ton. With a 10% yearly reduction from 2019 to 2045 the remaining 300 kg CO_2/ton cement could be down to about 20 kg CO2/ton in 2045. The current rate of reduction based on the last 9 years is about 0.4% per year compared with 10%. Even if there could be a step change when CCS is put into use the current rate of change is farm from sustainable. There is no commonly available information on strength performance or price from Cementa or in public information from other companies.

Table 4. *A matrix for understanding, defining and measuring cement sustainability and cement sustainable development.*

	Understanding	Defining	Measuring
D	The PBSM for the building value chain can be presented as a process-based interpretation of the building value chain in Figure 1. See Figure 4 where cement production is included as a sub-process and Figure 5 where cement production is presented with a Process Based System Model (PBSM) The main stakeholder needs identified are similar to those for the entire building value chain, cement affordability and zero or low climate impact. Defining the qualitative improvement potential as the difference between possible and/or required performance and current performance. This should be done for cement strength performance, price and carbon footprint New cements, as described in Figure 3 could have a potential in higher substitution with calcined clays (LC3) and with higher use of different slags	Based on the Pareto principle define the vital few stakeholders and impacts Focus on People and Planet needs and convert this to a proposed definition that can be operationalised. Cement sustainability is defined as producing affordable user building value (cement strength generating capacity) with zero climate impact. Sustainable cement development is that zero climate impact is achieved latest 2045. Strategy could be CCS and new or alternative cements	Measure sustainability as a state and sustainable development as change (chosen y-values as average, variation and a trend) Identify value and harm indicators – the KPIs (y-values) that can be used to describe current sustainability and the sustainability performance over time Cement MPa*tons Carbon emissions per ton of cement Price per ton of cement MPa*tons/carbon emissions MPa*tons/price
A	A qualitative review of main causes by using the 10 M checklist has been done – see Table 5	The main Ms identified for cement industry generally are: Mission – 1; Management – 2; Measurement – 3; Machine – 4; Manpower (5); Milieu	A quantitative review could consist of calculating how many MPa*tons that could be substituted by using available slag as raw material and as SCM Similarly, the potential of calcine clays could be assessed
S	Product innovation could consist of developing and producing LC3 and slag-based binders	Defining solutions and strategies for these	Setting targets for level of sustainability and rate of change that corresponds to sustainable development

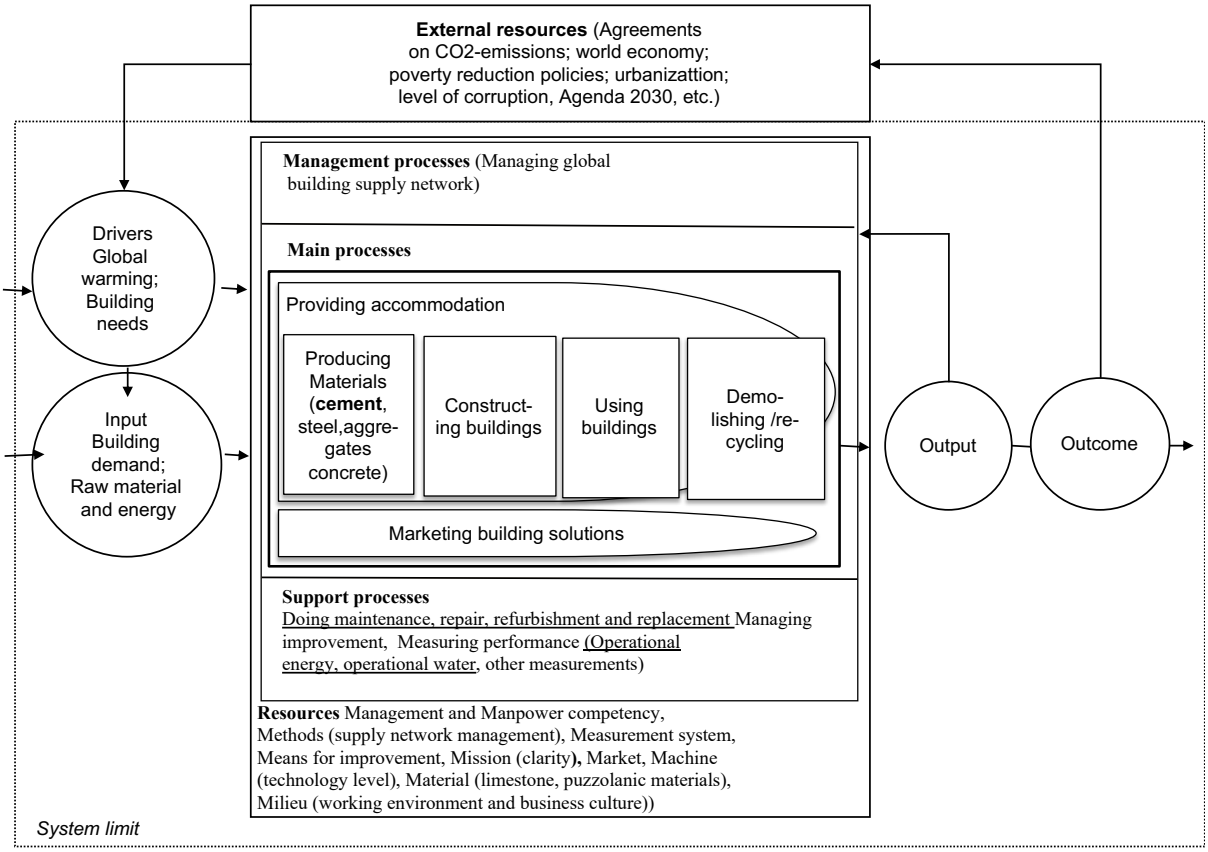

Figure 4*. The Process Based System Model (PBSM) adapted for the global building value chain/network, based on Isaksson (2016) and Figure 1*

Analysing – Understanding is carried out using the 10M checklist which is used to define important internal resources in the studied system which is here exemplified using the global cement industry as example with main input taken from modern Western plants such as the Swedish cement plants, see Table 5. The review is superficial with a purpose to indicate how to work and to identify some priority areas for analysing. The assessment is largely based on the long experience of one of the authors. The 10M checklist can then be used for prioritising the Ms providing input for **Analysing-Defining** by looking at relevance and level of performance. High relevance and low performance indicate high priority. The **Analysing-Measuring** includes quantifying the opportunities of replacing Portland Cement with more sustainable materials. In 2019 around 2.8 Mtons cement and 2.6 Mtons cement clinker were produced in Sweden. The question then arises what SCMs that could be found and to what extent these could substitute cement or clinker raw materials. The production of blast furnace slag in Sweden is about 454 ktons per year, of which only a minor part is ground and granulated making it suitable for clinker replacement. Further research is needed to see if the currently non hydraulic slag with some changes could be converted to hydraulic in steel production. Also, it could be of interest to study how much of the non-hydraulic slag could be used to substitute limestone in clinker production.

Table 5. *The 10M checklist for discussing gaps between current cement performance and sustainable cement production.*

M – parameter	Criteria & comments	Relevance (1-5)	Level of performance (1-5)	Priority nr and ranking
Mission	Purpose of cement manufacturing is mostly business as usual even if some visions for cement sustainability have been presented. The business idea is to produce large amounts of a commodity product while trying to minimise carbon emissions by embarking on large scale CCS and by using more alternative biobased fuels	5	5	25 (1)
Management	Policies, goals and strategies for improving process performance are focused on increasing percentage of alternative fuels and reducing clinker component. Customer value as in terms of building value is not in focus. Focus is in reducing footprint.	5	5	25 (2)
Method	Organisation of the process – The industry is often organised with structured management systems. In spite of ISO 9001 with a process view being common, cement plants are mostly functionally oriented. However, since the main process is clearly visible the common goal of keeping the kiln running is easy to have in focus	4	2	8
Manpower	Competency for the required tasks. Competency for running plants is mostly good. Competence or change is often lower due to a very stable business process	4	4	16(5)
Measurement	Measurement Information Systems (MIS) – For fact-based decisions it is important to have facts available for all those needing it. This varies among plants, but with a measurement focus good data are often available. However, fully utilising this is uncommon	5	4	20(3)
Machine	There has been limited development with cement technology and many plants are what could be called modern. Technologies for dealing with carbon dioxide, electrification or new materials.is generally not available	4	5	20(4)
Material	Methods for controlling incoming material are good. Also, use of alternative fuels and including them is advanced. Possibly some limitations on using alternative raw materials	4	3	12
Milieu	Working environment in modern plants is well managed. Management wise the culture is conservative and working environment is not innovative apart from solving problems	4	4	16(6)
Market	Stable customer and competitor base. High entry levels and stable markets reduce competition	4	3	12
Means	When needed means are there.	2	4	8

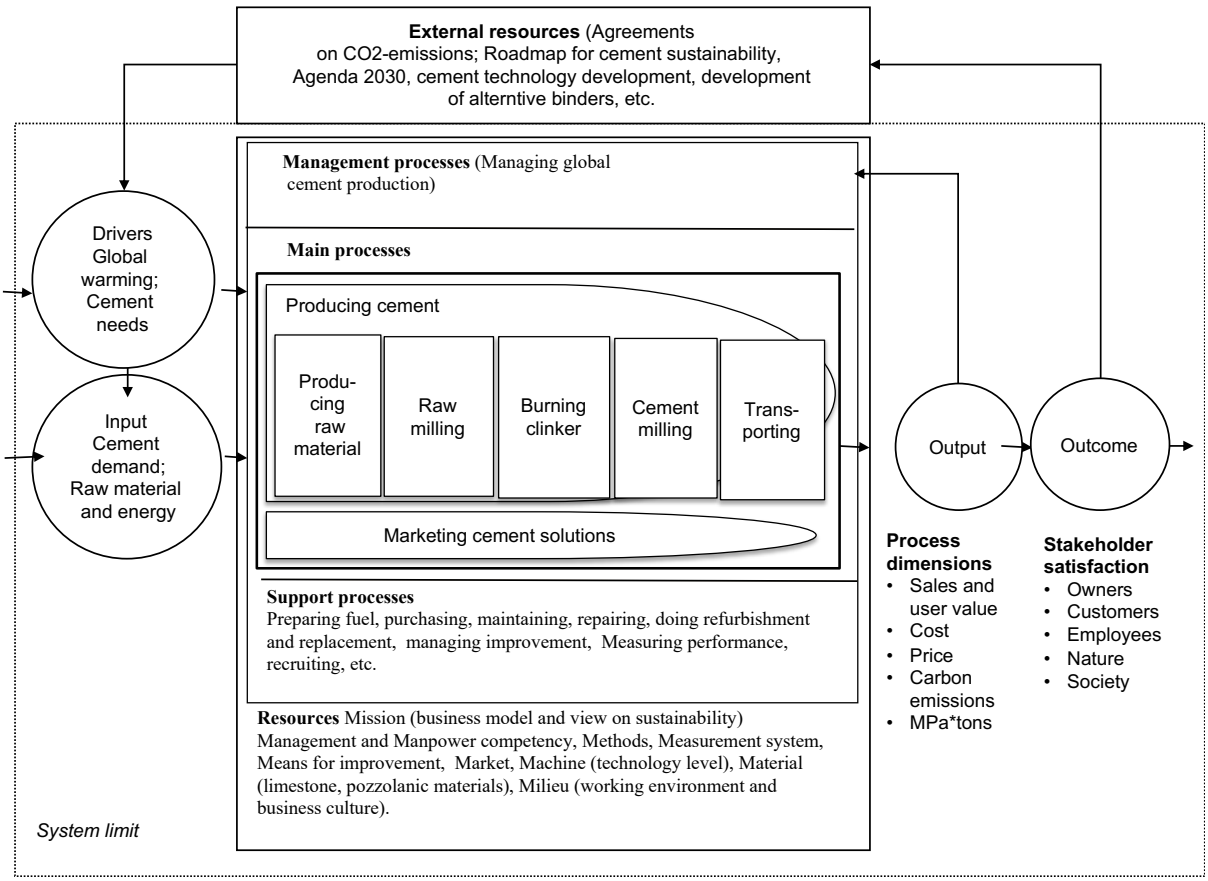

***Figure 5**. A PBSM adapted for cement manufacturing in Figure 4.*

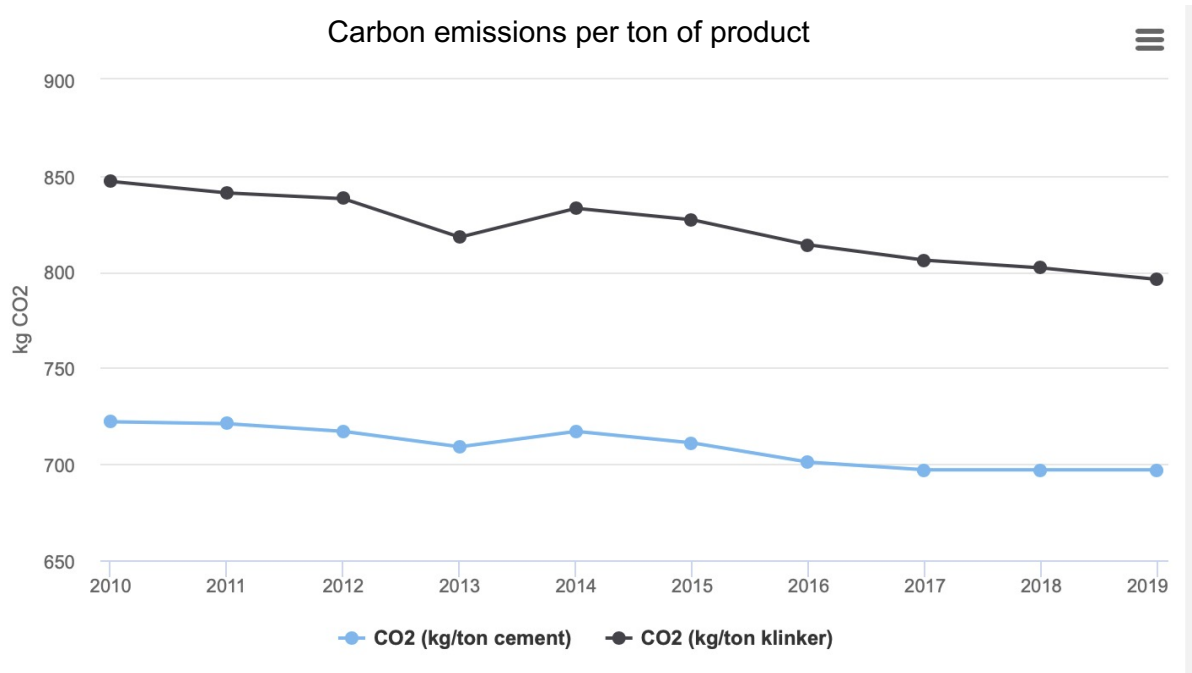

***Figure 6**. Carbon emission reduction from cement and clinker, (Cemzero, 2021)*

The amount of fly ashes is also currently limited and is expected to further decrease in the future due to reduction of coal firing. This is perfectly in line with the global availability of both fly ash and ground granulated blast furnace slag which are far less than the volumes of Portland Cement that are used globally. However, clays that could be made hydraulically active are shown to be available in sufficient amounts to partly replace limestone as binder on a global scale. One such product is the Limestone Calcinated Clay Cement (LC3) (Srivener, 2018). There is also potential to find clays in Sweden, but the potential amounts of clays in Sweden are currently not known. Here, future research could be carried out. Calculating a potential globally or in Sweden based on available MPa*tons could be part of further research. The **Solving-Understanding** is only dealt with briefly. The main issues here are the opportunities with alternative binders based on calcined clays and slag. **Solving- Defining** strategies for this forms part of future research as is **Solving-Measuring** where targets for change are defined.

4. Conclusions

This section presents the conclusions for how Cement and Concrete - Quality and Sustainability – could be understood, defined and measured as a prerequisite for improving performance and leading sustainable cement and concrete manufacturing.

RQ1: How could we make sense of understanding, defining and measuring sustainability and sustainable development using stakeholder needs focus and process models?

Table 6. *A summary of the logic used to identify purpose, practices and tools*

	Understanding	Defining	Measuring
Diagnosing	Scope and topics PBSM and process dimensions Understanding gaps (see Figures 2, 4 and 5)	Defining sustainability (level) and sustainable development (change) in the system studied	Identifying KPIs for level and change and defining targets – y-values Describe y as average, variation and trend
Analysing	Understanding existing gap qualitatively – 10M analysis (see Tables 2 and 5)	Identifying main Ms and x-es affecting chosen y-values	A quantitative analysis of how much of y could be solved with chosen x-es.
Solving	Process and product innovation With Sweden – product innovation identifying new raw materials and new cements	Defining solutions and strategies	A proposed change strategy with clear goals

The proposed result evolves around the idea presented in Tables 1 and 4 that combine two models describing change from a dormant opportunity of improvement to a fact-based proposal for sustainable

change. The proposed logic could be summarised based on the logic of the Opportunity Study of Diagnosing, Analysing, Solving where each phase can be divided into the steps of understanding, defining and measuring.

RQ2: How could sustainable concrete development be described?

Currently there are no substitutes to concrete. Concrete is versatile and easy to use at all levels. It has a high user value. The concrete climate footprint originates from the Portland Cement used. Concrete sustainability depends on cement sustainability.

RQ3: How could sustainable cement development be described?

Diagnosing – understanding-defining-measuring

Cement sustainable development could be described as a state and as a rate of change. There are many components of cement sustainability, but here focus has been on three impacts that we believe must on a global level form part of the sustainability definition. These impacts are in relation to user value expressed I MPa*tons, People harm as price of cement and Planet harm as carbon emissions. Sustainable cement produces affordable building value with zero carbon footprint.

Sustainable development is that change process which takes us from the current level of sustainability to sustainability in the time frame we have. The required rate of change is most likely corresponding to a rate of halving emissions every 10 years. Concerning the affordability improvement, not assessment has been carried out.

Analysing-understanding-defining-measuring

Mainly the main causes for the carbon footprint have been studied and not the cement building value. The raw material limestone is the main cause for carbon emissions and finding substitutes for producing clinker, such as slag would help. Finding new binders with a lower carbon footprint is one interesting areas. There are opportunities but also barriers to realising them.

The 10M-analysis indicates in order of priority:

- Mission – current business ideas is maximising the sales of cement as commodity which takes focus from producing more building value and from reducing volumes. This also could be the main reason for advocating CCS as a solution – business as usual solving problems in the end of the pipe
- Management – hierarchic organisation with conservative views
- Measurement – lack of public performance measurement for cement building value instead only carbon emissions per ton and clinker percentage dealing with all cement as a commodity

- Machine – little renewal in cement plants – new technology is 40 years old – limited options for improvement
- Manpower – often people used to do the same thing and where innovation is focused on solving problems in current production
- Milieu – a culture of do not rock the boat which comes from the monopoly or oligopoly situation which is common in the "consolidated" market

Solving-understanding-defining-measuring

Here, only some idea for the Swedish cement industry have been discussed. One possible solution could be using higher amounts of calcined clay (LC3) and finding out if more of the steel slag could be used. Defining change would be focusing on considerably reducing the clinker content in cement and increasing the proportion of new types of cement indicated in Figure 3.

The overall conclusion is that the approach based in starting from external stakeholder needs viewed as sustainability impacts and then working backwards in the value chain is a feasible way to operationalise sustainability and sustainable development.

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How can School Leaders Leverage Perceived and Attractive Quality to Increase Customer Value to Ensure Organizational Sustainability?

A Systematic Literature Review

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Abstract

The long-term sustainability of private, independent school education in the United States may be on the decline as the industry faces new challenges and opportunities. The purpose of this systematic literature review is to understand how school leaders may leverage the concepts of perceived and attractive quality to create more customer value and contribute to the sustainability of private education in the United States. A systematic literature review was conducted of papers published in academic journals between January 2007 and April 2021. A deductive content analysis was chosen using total quality management values, tools, and techniques as an analytical framework. The review of literature revealed how current research on these subjects has found positive results in the business and healthcare industries. Applied in the correct manner and context, the theories of both perceived service quality and attractive quality could be found to have positive influences in education. It was also found that quality concepts in conjunction with a school culture that assures customer value creation, is of great importance to the short term and long-term sustainability of private education.

Keywords: Sustainability, Leadership, Perceived Quality, Attractive Quality, Customer Value

1. Introduction

Research suggests that the long-term sustainability of the private school education industry in the United States is on the decline (NAIS, 2020). One of the reasons for this decline is that the quality of private education is, in many instances, not meeting the high cost of the tuition associated with it (NAIS, 2020). At the time of writing, the author of this manuscript is actively on an independent school leadership team in Tampa, Florida. In an ever-increasingly competitive market to recruit and retain private school families, school leaders must find novel, creative, and innovative methods of attaining sustainable and prosperous high-quality, independent schools. One possible catalyst for change may be found within the United Nations (UN) sustainable development goals (UN, 2020).

UN sustainable development goal number four seeks to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (UN, 2020). Also connected is the ninth goal: "To build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation." Linking parts of these two essential goals and using them as a guide, this body of research seeks to better understand how independent school leaders can ensure high-quality education that promotes lifelong learning opportunities while fostering innovation within schools in an ever increasingly complex world. One such way to frame and understand these questions is by looking to the literature on quality management to create an analytical framework.

Quality management may provide valuable insights into how schools can develop sustainable, thriving educational organizations that contribute to the public good (Minh Hue et al., 2018). Service quality, as a concept and approach, has particular application in the private school sector. Parasuraman et al. (1985) defined service quality as the degree of discrepancy between customers' normative expectations for the service and their perceptions of the service performance. For example, perceived service quality in education is a measure of how the perceived education of a child meets or surpasses the parent's (the customer's) expectations. From the parent's perspective, the perceived value of independent school education must be of equal or greater than the high price tag associated with it when compared to a child's free public-school alternative. The purpose of this paper is to present findings from a systematic literature that was conducted to understand how the concepts of perceived service quality and attractive quality may contribute to knowledge about how school leaders can develop more customer value, thereby helping schools become more sustainable.

Education in the United States

There exists a universal belief that "all children deserve an inclusive and equitable quality education" (UN, 2020). The US constitution makes no mention of education. However, each state provides that guarantee in some form within its own state constitution. In Florida, for example, the constitution states:

> "It is a paramount duty of the state to make adequate provision for the education of all children residing within its borders. Adequate provision shall be made by law for a uniform, efficient, safe, secure, and high-quality system of free public schools that allows students to obtain a high-quality education and for the establishment, maintenance, and operation of institutions of higher learning and other public education programs that the needs of the people may require." (Constitution of the State of Florida, 1968).

Defining "high-quality education" is a complex task that requires the analysis of multiple viewpoints within the literature. Assessment data shows that only 35 percent of the 176,746 students in Florida who took the SAT in 2018 hit the benchmark scores that indicate they are likely to succeed in college (Ritchie, 2018).

With this low percentage, one might reasonably assume this assessment data does not equate to 'high-quality education' by public schools. We can ask the question using Parasuraman's (1985) definition of quality; with only 35% of students statewide hitting a benchmark score, indicate the state is meeting and/or exceeding customers' expectations? This leads us to a series of new questions. Who exactly are these customers in a school setting? How exactly do these state legislators define "high-quality education"? Similarly, how do we define quality in education? These questions and more will be discussed in this systematic literature review.

It should be noted here that the terms 'private school' and 'independent school' are used interchangeably in this manuscript. Independent schools are independent in philosophy, driven by a unique mission, governed by an independent board of trustees, and primarily supported through tuition payments and charitable contributions. They are accountable to their communities and are accredited by state-approved accrediting bodies (NAIS, 2021).

Quality in United States Education

According to Deming (1986), Total Quality Management (TQM) is a management philosophy that requires a radical cultural change from traditional management to a continuous improvement management style in an organization. A quality culture is a system of shared values, beliefs, and norms that focuses on delighting customers and continuously improving the quality of products and services. Quality culture can foster the TQM principles like continuous improvement, open communication, fact-based problem solving, and decision making (Sohel-Uz-Zaman & Anjalin, 2016).

Over the last 30 years in the United States, there have been attempts to define quality in education. For example, in 1991, the Florida State Legislature created "Blueprint 2000," a plan for school improvement and accountability. A report stated that stakeholders believed that Blueprint 2000 had increased parent involvement in the school improvement process but that it had not significantly affected either the allocation of financial resources or school-based decision-making. School employees continued to dominate the membership of school advisory councils, and one-third of the councils did not reflect the ethnic and racial diversity of their schools (Florida State Legislature, 1996).

In 2001, the No Child Left Behind Act was signed into law to close student achievement gaps by providing all children with a fair, equal, and significant opportunity to obtain a high-quality education (No Child Left Behind Act of 2001). This meant requiring universal standards of achievement for all students before permitting them to move to the next level. Due to some key criticisms, such as relying too heavily on standardized testing and giving schools harsh penalties, No Child Left Behind was replaced in 2015 by The Every Student Succeeds Act (ESSA). This new educational initiative required that all students in America be taught to high academic standards to prepare them to succeed in college and careers. This act also

included a stipulation for access to high-quality preschools. Although quality within schools has taken many different forms, the basic principles of continuous improvement, customer focus, processes, and employee commitment are prevalent throughout.

Snyder (2015) suggests that with a focus on quality management systems and engaged leadership grounded in a value system, schools can become places of healthy learning and work that support student development. Furthermore, developing work cultures that engaged members of the school and community are critical for building schools as learning organizations (Snyder, 2015). In 1993, the Educational Quality Benchmark System (EQBS) was designed (Snyder et al., 2000). The system was designed to assist schools and districts in their in their work to integrate quality management in their educational systems, which was in response to national and state policy reform initiatives, namely, Blueprint 2000 (Snyder et al., 2000). These researchers took the principles of quality management and adapted them for schools, ultimately resulting in the creation of this systematic framework (EQBS) for both defining and measuring quality in education.

Sustainability in Education

"Sustainability is the pathway to the future we want for all. It offers a framework to generate economic growth, achieve social justice, exercise environmental stewardship, and strengthen governance" (Ki-moon, 2013). Education plays a crucial role in realizing this statement by the former secretary-general of the United Nations. Several important frameworks exist today to help guide educators and educational institutions towards a sustainable future for all. One such framework is the Programme for International Student Assessment (PISA). The PISA 2018 Global Competence assessment measures students' capacity to examine local, global and intercultural issues, to engage in open, appropriate, and effective interactions with people from different cultures, and to act for collective well-being and sustainable development (PISA, 2018). The assessment has been widely praised by educational leaders worldwide due to the importance of instilling global competencies in our students.

> Global competence is a multi-dimensional construct that requires a combination of knowledge, skills, attitudes, and values successfully applied to global issues or intercultural situations. Global issues refer to those that affect all people and have profound implications for current and future generations. Intercultural situations refer to face-to-face, virtual, or mediated encounters with people who are perceived to be from a different cultural background. Developing global competence is a life-long process, but it is one that education can shape (PISA, 2018).

In 2006 the not-for-profit International School Connection's (ISC) global community of educators approved its validated set of 10 Global Learning Benchmarks. It recommended that these be a guide for developing students as capable global citizens while integrating global realities into their classrooms and schools

(Sullivan, 2019). The overarching purpose of schooling is to prepare every student, every day and year, in the knowledge, attitudes, behaviors, values, and experiences that are required to live and work in a simultaneous local/global world (Snyder, 2019). Global competence is a vital part of all education in this day and age. The strong connection to sustainability strengthens the idea that educators need to rethink and redesign schooling for this global era.

Challenges and Opportunities for Private School Education in the United States

In order to create high-quality education, we must first create high-quality schools, and in the United States, 25% of pre-kindergarten through twelfth-grade schools are private, equating to 10% of all school-age children (Broughman, 2017). The growing availability of choice in K–12 schooling has increasingly turned parents into consumers, with the ability to influence the fate of different school sectors through their decisions (Barrows et al., 2019). One of these sectors is called charter schools. Charter schools are independently operated public schools with the freedom to design classrooms that meet their students' needs. All charter schools operate under a contract with a charter school authorizer (usually a nonprofit organization, government agency, or university) that holds them accountable to the high standards outlined in their "charter" (Reimagining Education: One school, one classroom, one student at a time, 2021). In their research, Barrows et al. (2019) found that charter schools have closed a substantial portion of the satisfaction gap between the district and private sectors, which may, in turn, erode the size of the private sector. This poses a significant risk to the sustainability of private education in the United States.

Innovations and growth in the public school sector have narrowed the gap between public vs. private education. There exist many reasons for this shift, including the Obama Administration creating a coordinated set of initiatives that unleashed a wave of innovation and reform at the state and district levels while continuing to ensure quality services for the most vulnerable students (Progress in Our Schools, 2021). Florida, in particular, has also come to embrace the idea of "school choice," referring to a state program that allows families to use public resources to receive education outside of their neighborhood school. This removes tax dollars from traditional public schools but opens up access to otherwise unaffordable private education. For example, the Step Up for Students Family Empowerment Scholarship may be used towards private school tuition and fees up to $7000 per student per year. This is significant when considering that the average tuition price tag among private schools in Florida is $7,670 (Educationdata.org, 2021).

Private schools have historically perpetuated inequality. Nevertheless, with a change in mindset, they can advance education without having to leave people behind (Schneider, 2018). For example, Schneider argues, there are three specific targets that private school leaders need to set their sights on to serve what he describes as the public good.

> Firstly, private schools must focus on educational practices rather than status-based outcomes. Schools must ask: are we doing this because it will improve the learning experience, or are we doing it in pursuit of status? Next, private schools must prioritize diversity, not as charitable work but as a core element of their missions. Students in diverse schools will learn more socially, gain new perspectives on the world, get along better with others, and develop a greater ability to empathize. Finally, private schools must prioritize innovation and communication with the broader world of education. Innovative schools that actually share their practices with other schools will benefit the public good (Schneider, 2018).

With the proper resource allocation and leadership focus, these shifting mindsets could differentiate private education significantly from competing public and charter school choice options.

The independence of private schools is spurring innovation that can benefit education for the entire US, not just a tiny swath of privileged students (Tavangar, 2014). Given this phenomenon, innovative independent schools may position themselves as leaders in all areas of education and ultimately cement their place as educational role models from which all other schools can learn. However, it should be noted that filling a private school with costly tuition-paying students can be a difficult task.

As mentioned previously, the author of this manuscript was a practicing independent school administrator at the time of writing. There exists little current research on the specific day-to-day cultural and business aspects of independent schooling and the complex nature of how they are operated. Much of the knowledge expressed in these following few paragraphs is built on conversations with other school administrators and context from working closely with other leaders in the independent school ecosystem in Florida.

There exists a common catchphrase used within and among independent schools in the United States. Recruitment and retention refer to the process of schools finding and admitting mission-appropriate students and families then doing everything possible to retain that family for as many years as possible. Recruitment and retention in the private school sector are tied directly to the organization's long-term sustainability. High enrollment equates to more tuition money, which leads to better facilities and higher teacher salaries which, in turn, attracts better teachers. Independent schools have long fought their steadily growing attrition rates for various reasons, such as geographic relocation, financial reasons, and dissatisfaction with the school's program (NAIS, 2020). In schools with under 500 students, it is crucial for a school to retain as many families as possible in order to continue operations and promote organizational sustainability.

It is the responsibility of an excellent independent school leader to ensure high recruitment and retention numbers and fulfill the role of guaranteeing the kind of education promised in the admissions process, which is, in reality, what is happening in classrooms. In other words, the quality of education that a school says it is providing is being provided. The best-case scenario for a school is that the quality of teaching and

learning in the classrooms meets or exceeds the marketing of the educational experience, and all parents are fully aware and delighted. Any good school leader will state that this is rarely the case. The next possible scenario is that teaching and learning meets or exceeds the school's marketing. However, parents are less aware, which, in turn, can cause the decreased perceived quality of the product they are buying as a result of being less aware of what is happening in their child's classrooms or daily school experience. In this case, a school leader must improve the communication and perspective pipeline between home and school to improve perceived quality. The worst-case scenario for a school is to have both challenges; the teaching and learning at the school do not live up to what has been marketed; thus, a decrease in the perceived quality of the education being provided occurs. This is a challenging position to be located as a school leader, but nonetheless, one which happens to exist, within pockets, of many independent schools.

2. Methods

Literature reviews are research inquiries, and all research inquiries should be guided by research questions. Research questions, therefore, drive the entire literature review process (Kitchenham, 2007). The selection of studies to be included in the review, methodology for data extraction and synthesis, and reporting, should all be geared toward answering the research questions (Xiao & Watson, 2019). Stand-alone literature reviews can serve as valuable overviews of a topic for planning practitioners looking for evidence to guide their decisions, and therefore their quality can have very real-world implications (Templier & Paré, 2015).

This systematic review focused on the question of how can school leaders embrace perceived and attractive quality to create value for customers? Despite differences in procedures across various types of literature reviews, all the reviews can be conducted following eight common steps: (1) formulating the research problem; (2) developing and validating the review protocol; (3) searching the literature; (4) screening for inclusion; (5) assessing quality; (6) extracting data; (7) analyzing and synthesizing data; and (8) reporting the findings (Figure 1) (Xiao & Watson, 2019).

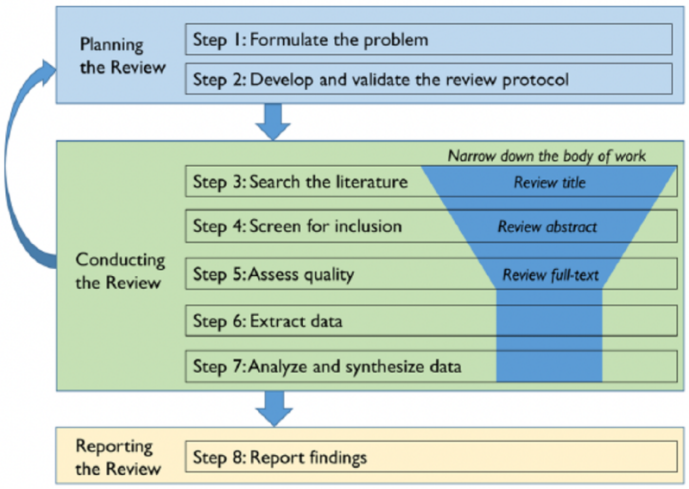

Figure 1. *Steps to conducting a systematic literature review (Xiao & Watson, 2019)*

As stated, this literature review aims to systematically review and analyze the current research on how leaders leverage perceived and attractive quality to increase customer value. An extensive database search took place using specific keywords to find appropriate literature within this research area. As part of the review protocol, a set of eligibility criteria was created to whittle down the vast amount of literature. The following inclusion criteria were present in the search:

1. The publication was an academic and peer-reviewed study,
2. Published between January 2013 and April 2021,
3. Contained full text,
4. Written in English,
5. Focused on perceived quality or attractive quality, or both
6. Focused on customer value

The following exclusion criteria were present in the search:

1. Not a literature review.

The following electronic databases were used to search for literature: Science Direct, Emerald, Eric via EBSCO, and JSTOR. Figure 2 displays the PRISMA model to visually display the methodology of how records were identified, screened, and included.

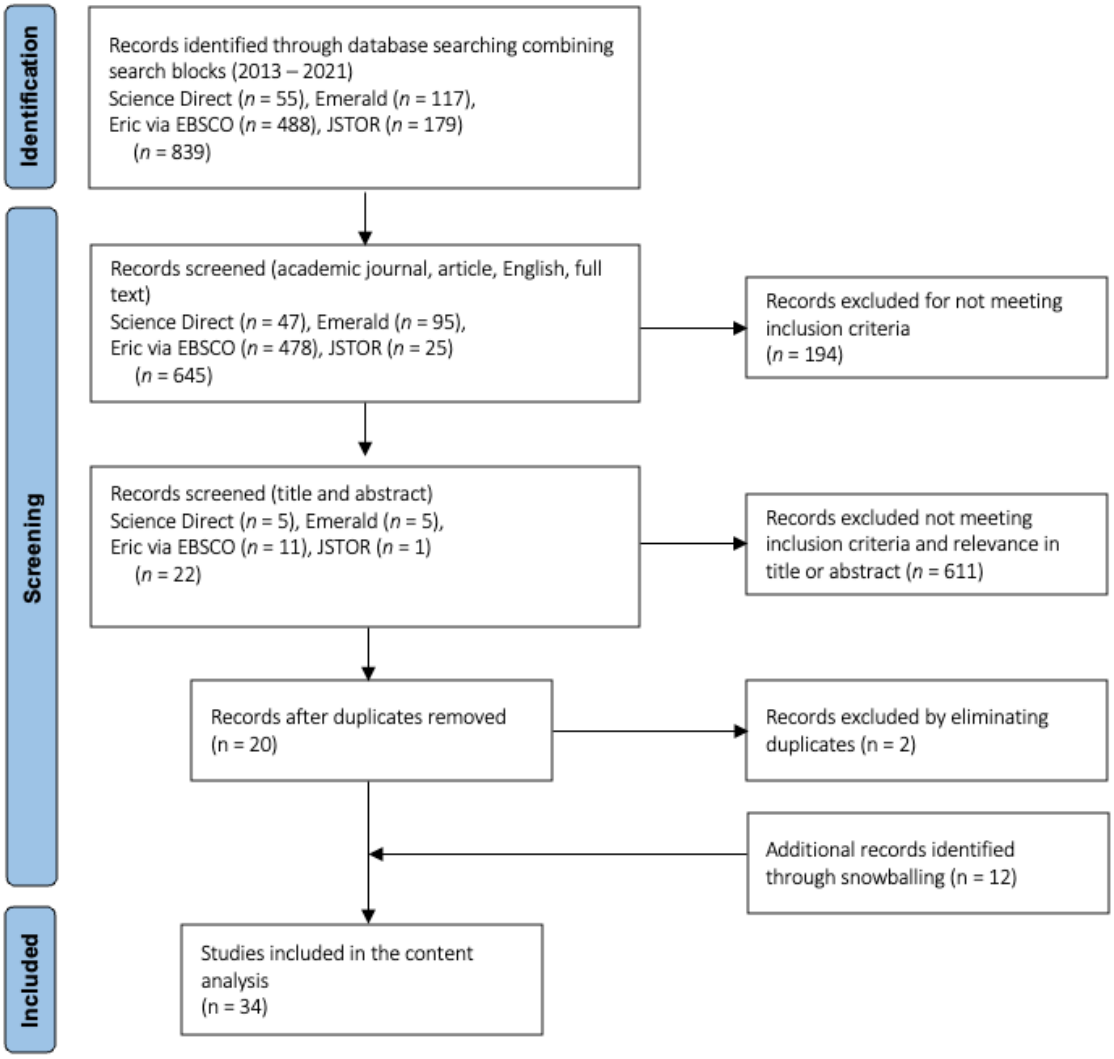

Figure 2. *PRISMA search process for the articles included in the review.*

The systematic literature review is often contrasted with traditional literature reviews because systematic reviews are objective, replicable, systematic, comprehensive, and the process is reported in the same manner as for reporting empirical research (Weed, 2005). Systematic reviews entail a series of techniques for minimizing bias and error, and as such systematic review and meta-analysis are widely regarded as providing 'high-quality' evidence (Tranfield et al., 2003). This systematic literature review specifically explored research results that have explored how perceived quality and attractive quality can increase customer value. To the greatest extent possible, the search within relevant databases identified only the literature on perceived and attractive quality connected to the research question; how can school leaders leverage perceived and attractive quality to increase customer value to ensure organizational sustainability?

Within the search, publications were identified using the inclusion and exclusion criteria outlined within this methodology. Initially, 839 articles were retrieved, which was reduced to 645 after exclusion based on inclusion criteria. Next, publications were screened on their title and abstract based on inclusion criteria and relevance to this study. This further reduced the total number of articles to 22. Duplicates were removed, bringing the total to 20 articles. Additional records were identified through snowballing and advice from doctoral supervisors and other colleagues within the university department. The final sample of articles constituted 34 empirical studies.

Data Analysis

The next stage in conducting the systematic literature review is assessing quality, extracting data, then analyzing and synthesizing that data. A deductive content analysis was chosen using total quality management core values as an analytical framework. According to Deming (1986), total quality management (TQM) is a management philosophy that requires a radical cultural change from traditional management to a continuous improvement management style in an organization. According to Hellsten & Klefsjö (2000), TQM can also be defined as a management system consisting of three interdependent units: core values, techniques, and tools. TQM aims to increase external and internal customer satisfaction with a reduced amount of resources. The essential idea is that core values must be supported by techniques, such as process management, benchmarking, customer-focused planning, or improvement teams, and tools, such as control charts, the quality house, or Ishikawa diagrams, in order to be part of a culture (Hellsten & Klefsjö, 2000). This diagram can be seen in Figure 3.

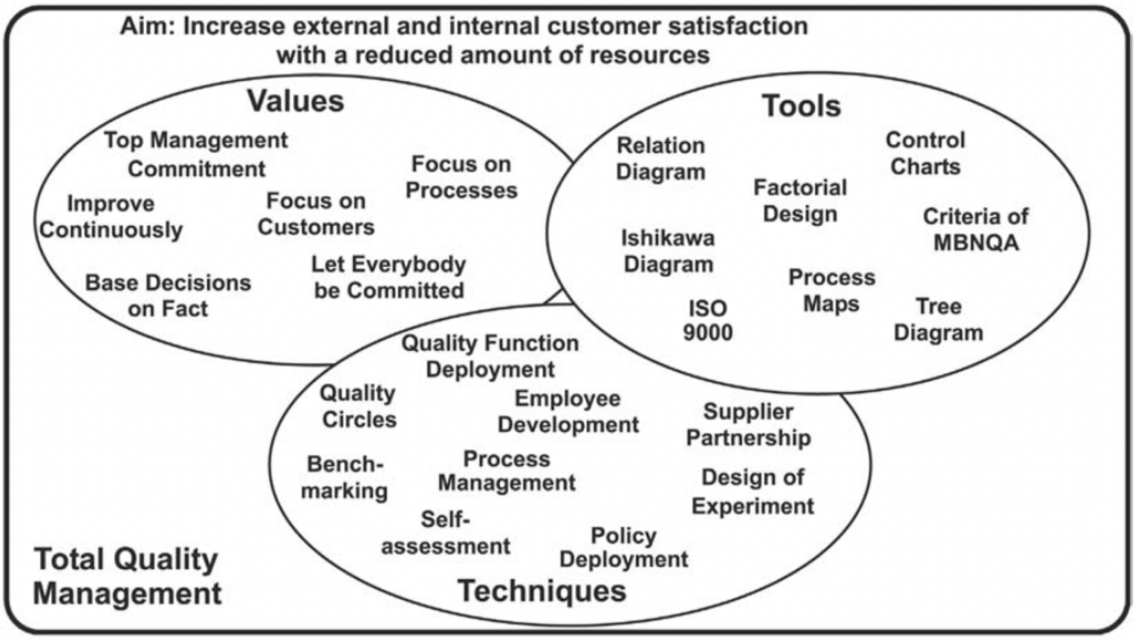

Figure 3. *Total quality management (TQM) seen as a continuously evolving management system consisting of values, techniques, and tools (Hellsten & Klefsjö, 2000).*

For this literature review, the author used a deductive content analysis approach to extract data into a categorization matrix using the three components of total quality management. The central idea here is that the basis for an organization's culture is the core values (Hellsten & Klefsjö, 2000). Within the technique unit, several activities exist that may be performed in a particular order. Total quality management should be viewed as a system. Hellsten & Klefsjo (2000) believe values are supported by techniques and tools to form a whole. "We have to start with the core values and ask: Which core values should characterize our organization?" When this is decided, techniques that are suitable for an organization need to be identified to use and support the values. From that decision, suitable tools have to be identified and used in an efficient way to support techniques (Jafari & Mostafa, 2010). The included articles were read and re-read as part of this deductive content analysis to obtain a good understanding of the literature. The data was then extracted into three different categorization matrixes.

3. Results

The results collected from the identified PRISMA search process can be found in the following three tables. Table 1 displays a structured categorization matrix using total quality management core values, the author, year of publication, and title of each of the articles included in the systematic literature review and demonstrates where each publication connects to TQM. Table 2 demonstrates, within another categorization matrix, the specific TQM values, tools, and techniques found within the data. A literature

review should follow a clear structure that ties the studies together into key themes, characteristics, or subgroups (Rowley & Slack, 2004). These themes were determined by the research question and the specific area of focus within education. The content of each publication was analyzed and synthesized using the following themes: perceived quality, attractive quality, customer value, education, sustainability, and leadership, as can be seen in table 3.

Table 1. *Structured categorization matrix using total quality management system.*

Author	Year	Title	Values	Tools	Techniques
Adams et al.	2016	An Empirical Test of Oklahoma's A-F School Grades			X
Al Qubaisi et al.	2016	An Analytic Hierarchy Process for School Quality and Inspection: Model Development and Application	X	X	X
Åslund & Bäckström	2017	Management processes and management's role in customer value creation	X	X	
Baccarani & Cassia	2017	Evaluating the outcomes of service ecosystems	X		
Barrows et al.	2019	Do Charters Pose a Threat to Private Schools? Evidence from Nationally Representative Surveys of U.S. Parents	X		X
Bloemer et al.	1999	Linking perceived service quality and service loyalty: a multi-dimensional perspective			
Chen et al.	2020	Investigating pharmaceutical logistics service quality with refined Kano's model	X	X	X
Dubey et al.	2020	Entrepreneurial marketing: an analytical viewpoint on perceived quality and customer delight			
Eriksson & Ingelsson	2016	Building an organizational culture when delivering commercial experiences – the leaders' perspective	X	X	X
Frank et al.	2014	Affect versus Cognition in the Chain from Perceived Quality to Customer Loyalty: The Roles of Product Beliefs and Experience	X		X
Goldhaber & Walch	2014	Gains in Teacher Quality		X	
Gupta & Charu	2018	Understanding customer requirements of corrugated industry using Kano model	X		X
Gusc & Van Veen-Dirks	2017	Accounting for Sustainability: An Active Learning Assignment	X	X	X
Howat & Assaker	2013	The hierarchical effects of perceived quality on perceived value, satisfaction, and loyalty		X	
Katz	2016	Growth Models and Teacher Evaluation: What Teachers Need to Know and Do	X		X
Kolster	2014	Academic Attractiveness of Countries; a Possible Benchmark Strategy Applied to the Netherlands		X	
Laplume et al.	2008	Stakeholder Theory: Reviewing a Theory That Moves Us	X		X
Lilja & Wiklund	2007	A Two-Dimensional Perspective on Attractive Quality	X	X	X
Löfgren& Witell	2008	Two Decades of Using Kano's Theory of Attractive Quality			X
Matzier	2000	Customer Value Management	X	X	X
Mikulić & Prebežac	2011	A critical review of techniques for classifying quality attributes in the Kano model		X	X
Niu	2019	Qualia: Touching the inner needs of consumers' hearts	X		X
Notgrass	2014	The relationship between followers' perceived quality of relationship and preferred leadership style	X		
Omar et al.	2009	Parents Perceived Service Quality, Satisfaction and Trust of a Childcare Centre: Implication on Loyalty	X	X	X
Palm	2014	Understanding Innovation as an Approach to Increasing Customer Value in the Context of the Public Sector	X	X	X
Phusavat et al.	2019	Integrating Design Thinking into Peer-Learning Community: Impacts on Professional Development and Learning	X	X	X
Pont	2014	School Leadership: From Practice to Policy			X
Raelin	2018	What are you afraid of: Collective leadership and its learning implications	X	X	
Rönnström	2015	Educating Competitive Teachers for a Competitive Nation?	X		X
Song	2013	An examination of customer satisfaction in an outsourcing relationship using Kanè s theory of attractive quality		X	X
Stylidis et al.	2017	Towards Overcoming the Boundaries between Manufacturing and Perceived Quality: An Example of Automotive Industry	X		X
Teleha et al.	2017	Library Space Redesign and Student Computing		X	X
Tetteh	2015	Improving Learning Outcome Using Six Sigma Methodology	X		
Willems et al.	2016	The impact of customer value types on customer outcomes for different retail formats		X	X

Table 2. *Structured categorization matrix for total quality management values, tools, and techniques.*

Author	Year	Values	Tools	Techniques
Adams et al.	2016			Benchmarking, Policy Deployment, Design of Experiment
Al Qubaisi et al.	2016	Focus on Processes	Tree Diagram, Process Maps	Benchmarking
Åslund & Bäckström	2017	Top Management Commitment, Focus on Processes	Relation Diagram, Process Maps	
Baccarani & Cassia	2017	Focus on Customers		
Barrows et al.	2019	Focus on Customers		Relation Diagram
Bloemer et al.	1999			
Chen et al.	2020	Focus on Customers, Top Management Commitment	Tree Diagram	Design of Experiment
Dubey et al.	2020			
Eriksson & Ingelsson	2016	Improve Continuously, Focus on Customers	Process Maps	Benchmarking, Policy Deployment, Design of Experiment
Frank et al.	2014	Improve Continuously, Focus on Customers		Design of Experiment
Goldhaber & Walch	2014		Relation Diagram	
Gupta & Charu	2018	Focus on Processes		Design of Experiment
Dirks	2017	Focus on Customers	Tree Diagram	Benchmarking
Howat & Assaker	2013		Relation Diagram, Process Maps	
Katz	2016	Focus on Customers, Top Management Commitment		Relation Diagram
Kolster	2014		Tree Diagram, Process Maps	
Laplume et al.	2008	Focus on Customers		Benchmarking, Policy Deployment, Design of Experiment
Lilja & Wiklund	2007	Base Decisions on Fact, Focus on Customers	Self Assessment	Relation Diagram
Löfgren& Witell	2008			Process Management
Matzier	2000	Focus on Customers, Top Management Commitment	Tree Diagram	Benchmarking
Mikulić & Prebežac	2011		Relation Diagram	Relation Diagram
Niu	2019	Focus on Customers		Design of Experiment
Notgrass	2014	Base Decisions on Fact, Focus on Customers		
Omar et al.	2009	Focus on Customers	Relation Diagram	Benchmarking, Policy Deployment, Design of Experiment
Palm	2014	Improve Continuously, Focus on Customers	Relation Diagram, Process Maps	Process Management
Phusavat et al.	2019	Focus on Customers	Relation Diagram, Process Maps	Design of Experiment
Pont	2014			Relation Diagram
Raelin	2018	Focus on Customers	Self Assessment	
Rönnström	2015	Focus on Customers		Process Management
Song	2013		Relation Diagram	Benchmarking, Policy Deployment, Design of Experiment
Stylidis et al.	2017	Base Decisions on Fact, Focus on Customers		Process Management
Teleha et al.	2017		Self Assessment	Benchmarking
Tetteh	2015	Focus on Customers, Top Management Commitment		
Willems et al.	2016		Tree Diagram, Process Maps	Design of Experiment

Table 3. *Structured categorization matrix for perceived quality, attractive quality, customer value, education, sustainability, and leadership.*

Author	Year	Perceived Quality	Attractive Quality	Customer Value	Education	Sustainability	Leadership
Adams et al.	2016				x		
Al Qubaisi et al.	2016	x	x	x	x	x	x
Åslund & Bäckström	2017			x		x	x
Baccarani & Cassia	2017		x	x			x
Barrows et al.	2019					x	x
Bloemer et al.	1999	x		x			
Chen et al.	2020	x	x	x			x
Dubey et al.	2020	x		x			
Eriksson & Ingelsson	2016	x	x	x			x
Frank et al.	2014	x		x			x
Goldhaber & Walch	2014				x		
Gupta & Charu	2018		x	x			
Dirks	2017				x	x	
Howat & Assaker	2013	x		x			
Katz	2016				x		
Kolster	2014						
Laplume et al.	2008			x			x
Lilja & Wiklund	2007		x	x			
Löfgren& Witell	2008		x	x			
Matzier	2000			x			x
Mikulić & Prebežac	2011		x				
Niu	2019	x		x			
Notgrass	2014		x				x
Omar et al.	2009	x		x	x		
Palm	2014	x		x			x
Phusavat et al.	2019				x		x
Pont	2014					x	x
Raelin	2018			x			x
Rönnström	2015				x		x
Song	2013	x	x	x			
Stylidis et al.	2017	x					
Teleha et al.	2017				x		
Tetteh	2015	x			x		
Willems et al.	2016	x		x		x	

Perceived Value & Perceived Quality

To understand the depth of perceived quality, we must first understand perceived value, as it has multiple definitions. Zeithaml (1988) defines perceived value as "the consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given" (Eriksson & Ingelsson, 2016; Zeithaml, 1988). Another definition claims perceived value is composed of all factors: qualitative and quantitative, objective and subjective, that jointly form a consumer's buying experience (Schechter, 1984; Snoj et al., 2004). Furthermore, Slater & Narver (2000) believe product value for a consumer is created when the benefits a consumer gets with a product are greater than the long-term costs a consumer is expected to have with a product. All three definitions are closely connected but add depth to the concept of perceived value. This helps us understand the concept of the perceived quality of a product or service.

The act of paying a school for education is, in itself, a complex version of a service, with the parent as the consumer. The unique challenges facing most service consumers are often explored in terms of the unique nature of services being received. However, within the service domain itself, there are a number of inherent differences between specific service types, and the consumer's experience can vary according to the extent to which they actively participate in the consumption of the service (Hirschman, 1987; Omar et al., 2009) This is further complicated by the nature in which parents of a school's students 'experience' the service they are paying for. Omar et al. (2009) make a case for the complex nature of paid private education:

> In the case of childcare, the parent is the payer of the service, but it is largely the child that uses the service. The decisions of parents regarding childcare are important, and not only does the problem of intangibility appear to increase the risk of pre-purchase evaluation but also post-purchase evaluation is difficult due to the parent being separated from the actual core service delivery or consumption experience (Omar et al. 2009).

Benefits are measured through a perceived level of quality (level of working superiority), a bundle of attributes in comparison with the consumer's expectations. This perspective went even so far, that some authors in the past somehow even equated the concepts of perceived quality with perceived value and that entailed that many practitioners failed to distinguish between the concepts of perceived quality and perceived value and often used the terms interchangeably (Caruana et al., 2000).

The American Customer Satisfaction Index (ACSI, 1999) developed a model of customer satisfaction to determine which drivers of satisfaction would have the most effect on customer loyalty. The ACSI model is a cause-and-effect model with indexes for drivers of satisfaction on the left side (customer expectations, perceived quality, and perceived value), satisfaction (ACSI) in the center, and outcomes of satisfaction on the right side (customer complaints and customer loyalty, including customer retention and price tolerance)(ACSI, 1999). Feng Cheng (2013) states that according to this model, there exists a positive association between perceived customer expectations and perceived quality, and perceived value and satisfaction. As shown in figure 4, customer satisfaction has three antecedents: Perceived quality, perceived value, and perceived expectations (Feng Cheng, 2013).

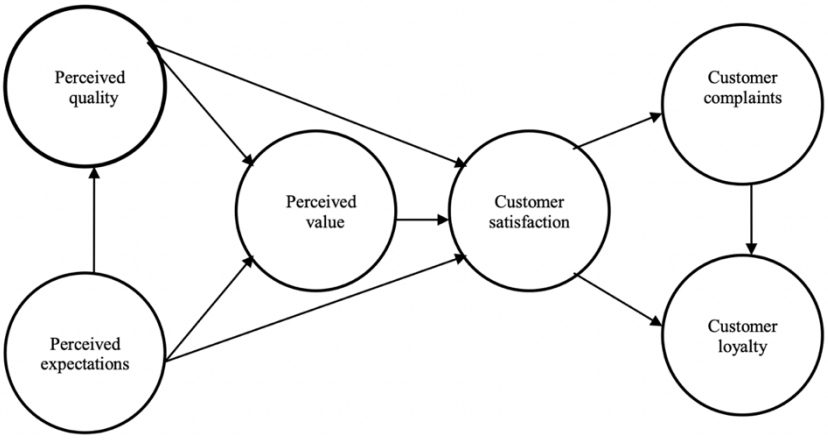

Figure 4. *The Customer Satisfaction Model (ACSI, 1999; Feng Cheng, 2013)*

Service quality is often conceptualized as the comparison of service expectation with actual performance perceptions (Bloemer et al., 1999). However, Brady & Cronin (2001) developed some new thoughts on conceptualizing perceived service quality. The hierarchical and multi-level conceptualization of the service quality model was adopted as the overall perception of service. (Figure 5)

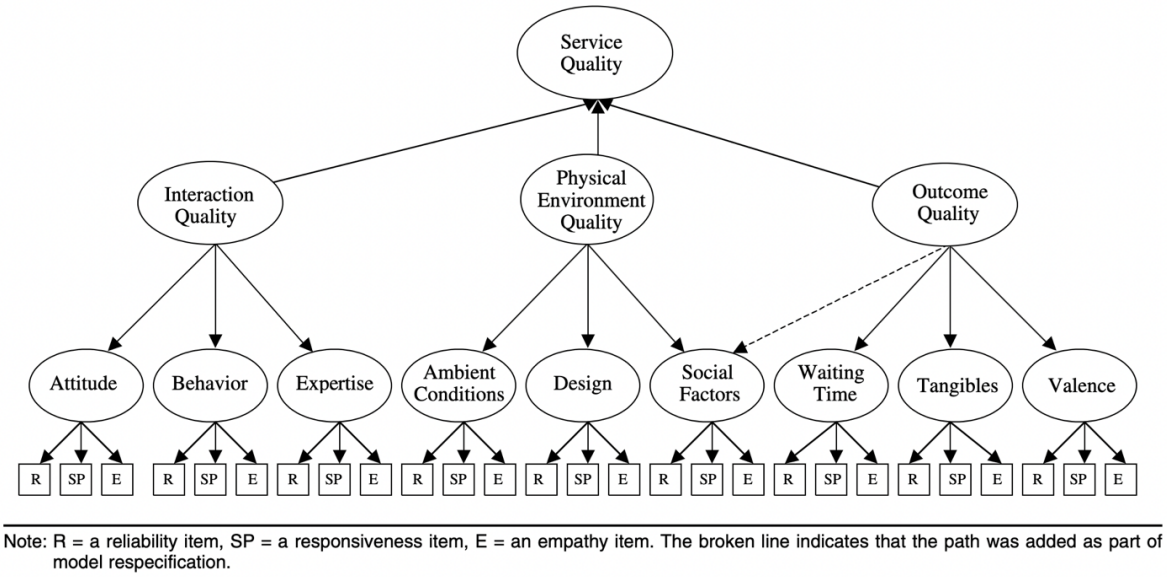

Figure 5. *The service quality research model proposed by Brady and Cronin (2001)*

There exist three dimensions of service quality: interaction, environment, and outcome. The model above has three subdimensions that customers also experience. Brady & Cronin's (2001) research shows that customers aggregate their evaluations of the subdimensions to form their perceptions of an organization's performance on each of the three primary dimensions. Those perceptions then lead to an overall service

quality perception. In other words, customers form their service quality perceptions based on an evaluation of performance at multiple levels and ultimately combine these evaluations to arrive at an overall service quality perception. Furthermore, it is understood that perceived service quality is positively related to satisfaction and trust (Omar et al., 2009).

Attractive Quality

The theory of attractive quality, often described as the surprise and delight attributes when purchasing a product or service, is a strong driver of loyalty, word-of-mouth, and saleability (Lilja & Wiklund, 2007). The theory of attractive quality (Kano et al., 1984) posits five dimensions of perceived quality; attractive quality, one-dimensional quality, must-be quality, indifferent quality, and reverse quality (Ingelsson, 2009; Kano et al., 1984). This model can be used to understand private school customer satisfaction and the overall perceived quality of a customer's purchase and can be seen in figure 6 below.

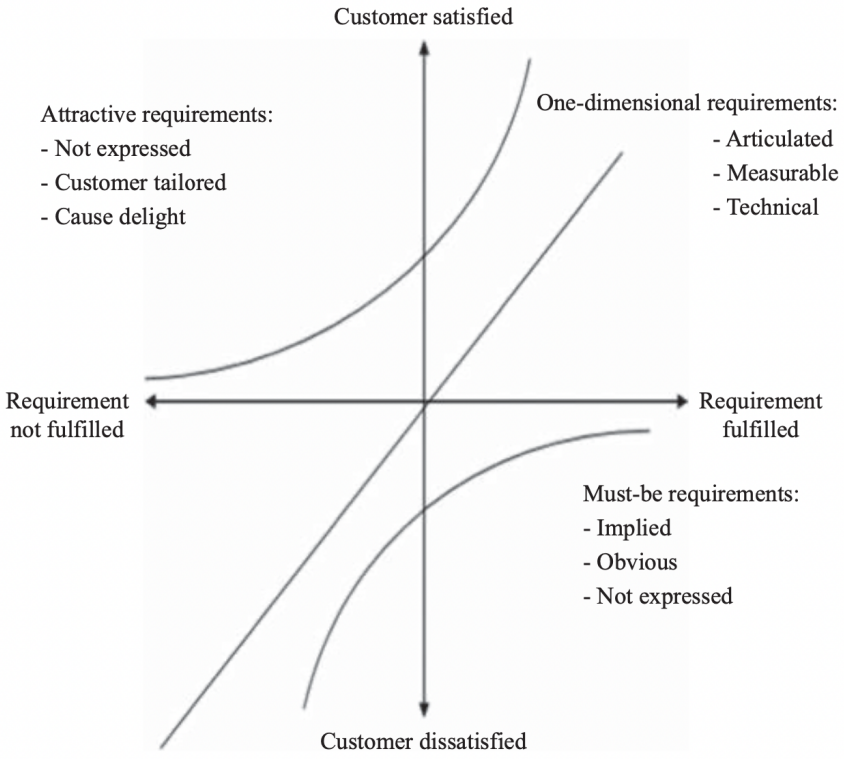

Figure 6. *Kano's model of quality attributes (Adapted from Kano's model) (Berger et al., 1993)*

Dahlgaard et al. (1998) describe attractive quality in most cases as having an enormous effect on customer satisfaction, while the costs are often minimal. The Kano model (Kano et al., 1984) is a popular approach in the areas of product and service design and improvement because it can consider many characteristics of products or services without causing a high expense in the design process (Baier & Rese, 2020). Interestingly, Yang (2005) modified Kano's original model to include quality factors that customers

perceive. Yang (2005) altered the quality elements of Kano's model into the following eight dimensions based on the degree of importance to the consumer: highly attractive and less attractive, high-value-added and low-value-added, critical and necessary, potential and care-free. In the refined model, if two product requirements cannot be met simultaneously, perhaps due to technical and financial constraints, the company will determine which is more crucial to customer satisfaction (Chen et al., 2020; Matzler & Hinterhuber, 1998). Yang's refined model of quality attributes can be seen in figure 7 below.

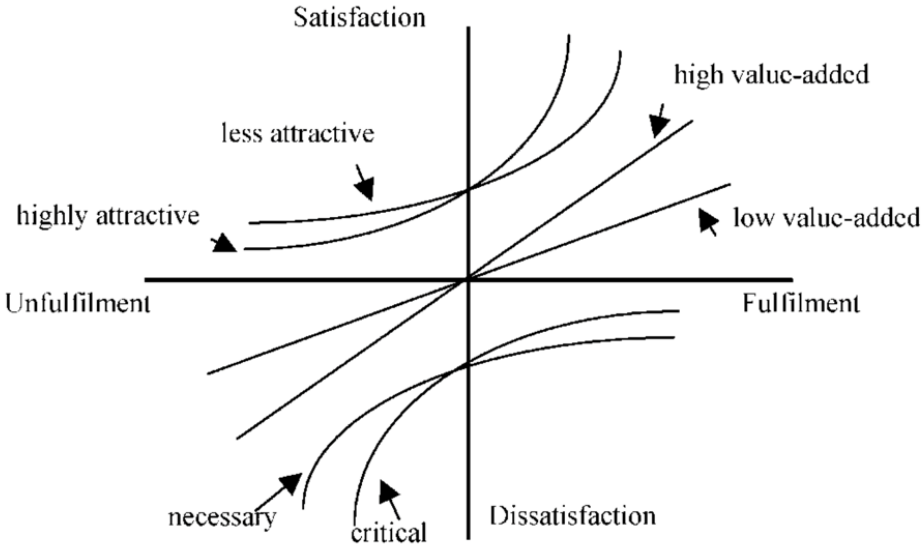

Figure 7. *Refined Kano's model of quality attributes (Yang, 2005)*

Customer Value

The concept of customer value is a cornerstone of quality management. The evolving roadmaps of TQM (i.e., Six Sigma and Lean Production) have reached a consensus that creating value for customers is the aim of quality management (Setijono, 2008). It is somewhat common for business owners or suppliers not to have the methods and tools required to create customer value. Although quality management has provided the fundamentals for creating value, further development is required in order to reduce or close the gap between the strategic and the tactical implications of customer value (Setijono, 2008). Measurements of customer value are not only an indication of the company's competitive advantage but also a driving factor to continuously improve product and process quality (Eriksson & Ingelsson, 2016; Setijono & Dahlgaard, 2007).

The agricultural, industrial, and post-industrial service economy consumption patterns of the late 19th and 20th centuries have given way to the experience economy. 'Qualia' addresses the inner needs of consumers' hearts by providing them with the value of happiness and being gratified, e.g., the frenzy for Apple products (Niu, 2019). Philosophers often use the term 'qualia' (singular 'quale') to refer to the introspectively

accessible, phenomenal aspects of our mental lives. In this broad sense of the term, it is difficult to deny that there are qualia (Tye, 2018). Only goods with “style” and “aesthetics” can outshine others; that is, generally so-called “taste” goods. It is also because design and aesthetics have gradually become an important element of the commodity itself, and matched with its own “quality” and the “brand” element that can enhance the added value, and then the "Qualia" is gradually focused and constructed (Bi et al., 2018).

Leadership

Leadership is defined by Yukl (2006) as the process of influencing others to understand and agree about what needs to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish shared objectives (Åslund & Bäckström, 2017). Many managers tend to see quality as a physical, objective, and utilitarian aspect of products and services (Homer, 2008). However, subjective consumer interpretations of quality include an important emotional dimension, which influences consumer behavior not only directly but also indirectly as consumers rationalize hedonic beliefs (Frank et al., 2014). The present research contributes to the literature by demonstrating that the provision of high-value-added and crucial quality attributes by leaders can give their business an edge in the market. In addition, when service providers understand their customers’ attitudes toward innovative service, it can enable them to strengthen their tactics in a competitive market (Chen et al., 2020).

Discussion

Although there is plenty of research available on perceived and attractive quality, only seldomly is it connected explicitly and applied directly to education and the complex nature of schools. When a prospective family receives a high-quality admissions tour by a qualified admissions director, their perceived quality and attractive quality related to the experience should hopefully be at an all-time high. However, the school must deliver on these promises and experiences year over year to ensure a particular family's re-enrollment. The literature identified in this systematic review points to many essential capacities in which quality management concepts can be applied to improve customer value and increase sustainability.

The Kano model (1984) can be used to understand private school customer satisfaction and the overall perceived quality of the customer’s experience. Threshold attributes (basics) are the basic features that customers expect a product or service to have. For example, parents expect their children to be safe at school and receive good math and language arts instruction. Performance attributes (satisfiers) are not absolutely necessary, but they increase a customer's enjoyment of the product or service. For example, as a parent, your child may love going to school and jumps out of bed and into the car in the morning, excited to see what the day brings. Excitement attributes (delighters) are the surprise elements that can boost a

product's competitive edge. They are the features that customers do not even know they want but are delighted with when they find them. For example, a child will miss two days of school because of a family emergency. The doorbell rings, and there stands the child's teacher with a smile on her face. The teacher hand delivers all the materials and work the child will need for these two days. This is a clearly an surprise element that delights the customer (parent) and adds to overall customer value and loyalty.

According to the research, attractive quality equates to higher customer retention and loyalty. If attractive quality becomes central to a school's organizational culture, it could also improve recruitment and retention of mission appropriate families and highly qualified faculty and staff. All of this contributes to the organizational sustainability of a school and the long-term sustainability of the private school industry in general.

4. Conclusions

This systematic literature review has given way to real-world implications connected directly to the original research question: How can school leaders leverage the concepts of perceived and attractive quality to create more customer value and contribute to the sustainability of private education in the United States? TQM offers insight into how independent schools can increase external and internal customer satisfaction with fewer resources. Creating a school culture that assures customer value creation is of great importance to the long-term sustainability of private education. Furthermore, the concept of perceived quality is vital for all faculty and staff to know and understand. With a firm grasp of this concept, faculty and staff will have new perspectives on how they impact the larger operation of a school. The 17 United Nations Sustainable Development Goals also present an exciting opportunity for schools to impact the world in which they exist positively. Linking parts of the two UN goals identified in this paper, it may be possible for school leaders to better understand how they can both ensure high-quality education that promotes lifelong learning opportunities while also fostering innovation within their schools to adapt to this ever-increasingly complex world. Additionally, research points to the concept of global competence as a critical indicator of sustainability. This multi-dimensional construct requires students and educators to combine knowledge, skills, attitudes, and values to understand and positively contribute to global issues and intercultural situations.

Independent schools have a pivotal role to play in advancing education for the public good. Educational innovations, prioritizing diversity as a core element of their missions, and the open sharing of these modernizations can benefit education for the entire United States. School leaders must find novel, creative, and innovative methods of attaining sustainable and successful high-quality independent schools to advance the future of education as a whole. The review of literature revealed how current research on these subjects has found positive results in the business and healthcare industries. Applied in the correct manner and

context, the theories of both perceived service quality and attractive quality could be found to have positive influences in education. It was also found that quality concepts in conjunction with a school culture that assures customer value creation, is of great importance to the short term and long-term sustainability of private education.

School culture and value co-creation need to be further researched within the unique independent school business model. Although customer value is a cornerstone of quality management, and there have been attempts to weave quality management tools, techniques, and values into education over the last thirty years, there exists a clear opportunity for TQM and education to reengage with one another. Education has evolved, as has the concept of quality, and future research into how one can inform the other is needed to ensure the sustainability of quality education, both public and private, for years to come.

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Staying power: how colleagues and customers influence the sustainability and culture of an organization with a focus on retention and the intention to stay – A systematic literature review.

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Abstract

Employees and customers can positively influence the sustainability and culture of an organization. It is highly regarded that there is a connection between the positive social and economic interactions of employee retention and creating a successful dynamic organization. This includes the retention of both loyal employees and a strong returning customer base. Why do employees and customers stay loyal to certain organizations? Put simply, why do they stay? This systematic literature review will assess the latest evidence of the connections between stakeholders, organizational sustainability, culture and retention of employees and customers, published between January 2016 and April 2021. A systematic search of SCOPUS, ERIC, Business Source Complete, and Academic Search Premier databases using predefined criteria. A total of 127 studies met the criteria and were considered for initial review. Additional criteria refined the articles for review to 32. The data collected shows colleagues and customers, job satisfaction, personal organizational fit, turnover, job embeddedness, and may also suggest a greater understanding of the complex phenomenon of employee's intention to stay.

Keywords: Organizational sustainability, intention to stay, job satisfaction, job embeddedness, quality management.

1. Introduction

The current COVID-19 pandemic has impacted organizations in new and unprecedented ways. Organizations, more than ever before, need to have a focus on sustainability combined with growth and retention of business (Ikram et al., 2021). Quality and control often have a human and social element that is often unable to be controlled by physics, chemistry or mathematics (Ishikawa, 1985). People want to feel empowered and valued in their workplace (Laloux, 2014). Ishikawa (1985) proposes putting quality control in the hands of all workers from all divisions. This idea is echoed and enhanced by Laloux (2014) who proposes that organizations embrace self-managing systems that employees are

proud to be a part of. Total engagement leads to satisfaction in life, autonomy, mastery and overall purpose (Pink, 2009).

Both intrinsic and extrinsic motivation are influential in creating a positive working environment (Brinia et al., 2020). According to Fundin et al. (2018), the ultimate driver behind achieving quality management needs to be the leadership culture, the knowledge of a products life cycle, innovation, and a knowledge of total quality management. Connections and interactions often build, change and have changing levels of both positive and negative power connections (Kershner & McQuillan, 2016; Snyder et al., 2008).

It is highly regarded that there is a connection between the positive social and economic interactions of employee retention and creating a successful dynamic organization. This includes the retention of both loyal employees and a strong returning customer base (Gordon et al., 2019; Sanchez-Cardona et al., 2021). The retention of employees is essential for the success of organizations (Sanche-Cardona et al., 2021) with the retention of employees for longer periods of time to contribute effectively to the organization's success (Dechawantanapaisal, 2018). Through retaining well-trained employees, organizations recoup some of what has been invested in an employee from recruitment to further training and development (Dechawantanapaisal, 2018; Rodrigues et al., 2020).

An educational organization is often affected by the inner climate of the culture and development of satisfactory human relationships (Brinia et al., 2020). This can be also be interpreted as total job satisfaction. Education, from the point of view of quality management Deming (2018), should be a system in which both students and teachers take joy from learning and teaching. The systems in place will always include planning for the future, and include investing in training and development (Deming, 2018). The effects of training may not be felt immediately, but rather can occur later, months or years later (Crosby, 1984; Deming, 2018). Crosby and Deming both stress that the benefits of investing in training and development will outweigh the costs. This is an investment in quality improvement that results in all employees understanding the essence of quality within the organization (Crosby, 1984). Employees and other stakeholders can positively influence the sustainability and culture of an organization (Ikram et al., 2021).

An important ingredient for fostering both growth and retention within an organization are stakeholders. Internal and external stakeholders and interested parties hold an influence on what develops with global and organizational sustainability (Dechawatanapaisal, 2020). The current needs and expectations of the stakeholders. both within and external, have a direct impact on the culture of sustainability and quality management (Ikram et al., 2021). Why do employees and customers stay loyal to certain organizations? Put simply, why do they stay?

The Swedish report on Agenda 2030 describes quality management being in the fifth generation, with a focus on sustainability. Looking towards the future, Agenda 2030 has developed quality management

research themes including 1. systems perspective applied, 2. stability in change, 3. models for smart self-organizing, 4. integration of sustainable development, and 5. higher purpose as quality management booster (Fundin et al., 2020). These themes are providing a focus for research for now and the future. The sustainability of a business through the longevity of employees is essential. The future research study will also connect to the UN Sustainable Development Goals for 2030, specifically goal 8 with the promotion of sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all (United Nations, n.d.). The connections between quality management and sustainability of an organization may be key to the future of human kind.

The purpose of this paper is to present findings from a systematic literature review to examine and assess the latest evidence of the connections between colleagues and customers, organizational sustainability and culture, and retention of employees that were published between January 2016 and April 2021.

2. Methods

A systematic search of four databases, SCOPUS, ERIC, Business Source Complete and Academic Search Premier. A predefined search string was used to search each database. The search string – employee AND retention AND organizations AND intention to stay was performed with publication date parameters of the last 5 years (2016-2021). Further restrictions were performed including scholarly/peer reviewed articles and English language publications. This search produced a total of 127 articles for review. From this point the abstracts were analyzed to be fit for purpose, the quality of the journal was assessed, duplicates removed, and finally some articles were discarded due to a lack of access to the full text. All articles were written in English, were peer reviewed and published in journals, included access to full text, and using the predefined search string "employee AND retention AND organizations AND intention to stay", and published between 2016 and April 2021. This left a total of 32 individual articles reviewed in this paper.

3. Results and Discussion

The systematic literature review examined and assessed the latest evidence of connections between organizational sustainability and culture, and retention of employees and customers published between January 2016 and April 2021.

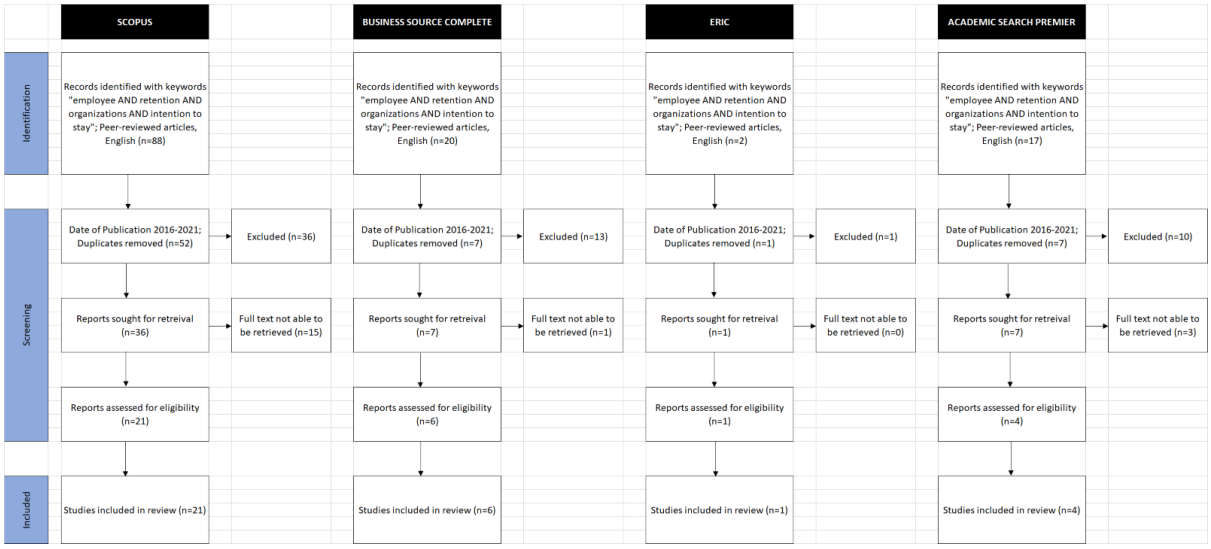

Figure 1*. Flow chart of systematic literature review.*

Date	Article Title	Journal	Industry	Location	Sample	Method	Findings
2021	The effect of on-the-job shocks on employees' intention to stay: an investigation of organizational embeddedness	Chinese management studies	Multi-industries	China	304 employees	questionnaire	Intention to stay can be affected negatively by on-the-job shocks. Human resource practices for increasing intention to stay in employees are discussed.
2021	Psychosocial influences on psychological distress and turnover intentions in the workplace	Safety science	Multi-industries	New Zealand	867 workers	cross sectional survey	Focus on workplace bullying. When there is high inclusion in an organization this can negate some of the workplace bullying. PSC is important in retaining employees.
2021	Internal corporate responsibility as a legitimacy strategy for branding and employee retention: A perspective of higher education institutions	Journal of open innovation: Technology, market, and complexity	Higher education	Pakistan	377 college faculty	survey data	Internal branding has an impact on an employees intention to stay. The internal branding creates the internal culture and leads to enhancing the dynamics of open innovation.
2021	Job resources and employees' intention to stay: the mediating role of meaningful work and work engagement	Journal of management & organization	Multi-industries	Puerto Rico	217 employees	cross sectional survey	Meaningful work is positively associated with work engagement. Indirectly job resources are linked to intention to stay through meaningful work and work engagement.
2021	Anomalies of the healthcare sector using workplace safety and job satisfaction: a case study of Pakistan	Journal of Asian finance, economics and business	Healthcare	Pakistan	394 medical doctors	questionnaire	Job satisfaction is an essential aspect of why people stay with an organization. A dissatified employee may also stay with an organization as they have limited other options. Organizations that encourage a sense of safety may encourage employees to stay longer.
2020	The criterion-related validity of a short commensurate measure of personality-based person-organization fit	International journal of selection and assessment	Human Resources	Netherlands	637 representative sample of professionals	questionnaire	When there is a perfect fit between the organization and employee both job satisfaction and intention to stay are found to be higher.
2020	The relationship between talent management practices and retention of generation "Y" employees	Economic Research-Ekonomska Istraživanja	IT divisionUSA	Pakistan	372 employees	questionnaire	Generation Y employees may be positively motivated to stay with an organization through mentoring, strategic leadership, and social media. Knowledge sharing had no significant effect on Generation Y and the intention to stay.
2020	Reasons for staying with your employer: Identifying the key organizational predictors of employee retention within a global energy business	Journal of occupational and environmental medicine	Energy	Multinational	30,094 employees	annual employee survey	Based on an annual employee survey to identify significant factors predicting employees intention to stay with the organization. Factors indentified relating to intention to stay were organizational engagement & relationship to supervisor. Factors influencing work engagement and organizational commitment were supervisor support and communication.
2020	Psychological diversity climate, organizational embeddedness, and turnover intentions: A conservation of resources perspective	Cornell hospitality quarterly	Hospitality	USA	1028 restaurant employees	online survey	Positive diversity climate may result in employees staying with an organization through organizational embeddedness.
2020	Perceived learning opportunities, behavioral intentions and employee retention in technology organizations	Journal of workplace learning	Technology	Brazil	440 employees	secondary data from survey	New and constant learning opportunities may influence the culture of an organization and encourage positive intentions to stay with an organization.
2020	Millennials' intention to stay and word-of-mouth referrals	Evidence-based HRM: a global forum for empirical scholarship	Multi-industries	Thailand	2649 millennial employees	questionnaire	Millennial (Generation Y) specific research. Managers should assess and monitor person-organization compatability regularly. Commuication of corporate cultures, values, and norms need to be mutually shared.
2020	Empowering leadership: leading people to be present through affective organizational commitment?	The international journal of human resource management	Multi-industries	USA	294 full time employees	online survey	Empowering leadership may affect forms of employee attendance. Empowering leaders create an environment that allows employees to feel commitment to the organization.
2020	Employer brand to leverage employees' intention to stay through sequential mediation model: evidence from Indian power sector	International journal of energy sector management	Power sector	India	224 executive level employees	questionnaire	Employer brand can have a direct and indirect effect on an organization identification and employee retention.
2020	Evaluating the employability paradox: When does organizational investment in human capital pay off?	The international journal of human resource management	Multi-industries	UK	429 recent graduates	survey data	Exploratory study on the investment into employees training which is necessary too obtain high performance and the threat of loss employee to another organization before the original organization has achieved a positive return on the employee.
2020	Employer branding: a strategic tool for employee retention in IT industry	The IUP journal of brand management	IT	India	100 employees	questionnaire	Employer branding and belongingness positively affects the intention of the employees to stay in an organization.
2020	Exploring onboarding success, organizational fit, and turnover intention of software professionals	The journal of systems and software	IT	Ireland	102 software professionals	cross sectional survey	A successful onboarding program is key to talent management and retention of employees. A supportive environment is important at the start of an employees journey within an organization.
2020	Should I stay or should I go? Multi-focus identification and employee retention in post-acquisition integration	Human relations	Medical	Germany	41 employees	mixed-method study	Organizational and occupational identification do not entice an employee to leave or stay with an organization. Rather when combined with an employee disappointment this may trigger an employee to leave.
2019	Supervisor support and turnover in hotels: does subjective well-being mediate the relationship?	International journal of contemporary hospitality management	Hospitality	USA	234 non-managerial hotel employees	survey	Employees who perceive higher levels of support from their supervisors are less likely to leave an organization. Improvement of employee well-being and support can then reduce turnover and may increase employee satisfaction, guest satisfaction and profits.
2019	The psychological mechanism linking employee work engagement and turnover intention: a moderated mediation study	Work	Media organizations	Pakistan	418 employees	survey data	Work engagement negates turnover intention. Promotion of improving employee work engagement, trust and embeddedness reduces turnover intention.
2018	Commitment to social justice and its influence on job satisfaction and retention of nonprofit middle managers	Human service organizations: Management, leadership and governance	Nonprofit	USA	107 middle managers	online questionnaire	Organizational commitment is essential in the relationship between social justice, job satisfaction, and intention to stay.
2018	A contextual work-life experiences model to understand nurse commitment and turnover	Journal of advanced nursing	Nursing	Sri Lanka	own experiences	own experiences	The impact of work-life experiences to nurses' motivation to remain at an organization.
2018	The relationship between perceived training and development and employee retention: the mediating role of work attitudes	The international journal of human resource management	7 industries	UK	1809 employees	questionnaire	Model of job related affect. Studies that examine employee retention should include a wider range of work attitudes that highlight pleasant forms of affect.
2018	The anatomy of retention in the U.S. federal government: Exit, voice, or money?	International public management journal	Federal government agencies	USA	37000 employees of government agencies	questionnaire	Public employees often have an intrinsic motivation for staying. Also addresses the contagion of affect of employees leaving an organization.
2018	Employee retention: the effects of internal branding and brand attitudes in sales organizations	Personnel Review	Construction	Thailand	702 business to business salespeople	questionnaire	The establishment of an internal brand leads to a positive effect on brand orientation which in turn has a positive impact on brand attitudes, brand commitment, and brand identification. This also connects positively to employee retention.
2017	Exploring the level of job embeddedness among college faculty	Journal of arts and social sciences	Higher education	Pakistan	459 college faculty	questionnaire	Demographics can impact on job embeddedness which then impacts of retention of employees.
2017	Can a flexibility/support initiative reduce turnover intentions and exits? Results from the work, family, and health network	Social problems	IT divisionUSA		977 randomized field sample	survey data, personal interviews	Focus on a flexibility/supervisor support initiative (STAR) and the effect on turnover intentions and voluntary turnover within an organization.
2017	The mediating role of organizational embeddedness on the relationship between quality of work life and turnover	International journal of manpower	Healthcare	Thailand	422 healthcare professionals	questionnaire	Organizations may improve the retention of employees through offering intrinsic resources such as growth opportunities and healthy and caring work life quality.
2017	Mediator analysis of job embeddedness. Relationship between work-life balance practices and turnover intentions	Employee Relations	Multi-industries	India	209 employees	survey, structured questionnaire	Job embeddedness is a mediating variable between work-life balance and an employees intention to stay. Work-life balance practices can be used to embed employees in an organization and enhance their desire to stay.
2017	Retaining professionally employed new mothers: the importance of maternal confidence and workplace support to their intent to stay	Human resource management	Multi-industries	USA	40 first time mothers	multi-method study	Work-family conflict is an important cross-domain mechanism that combines confidence in a non-work role to a woman's intention to stay with an organization.
2016	What type of leadership in higher education promotes job satisfaction and increases retention?	Journal for leadership and instruction	Higher education	USA	59 higher educators	questionnaire	Intention to stay plays a moderator role between servant leadership variables and job satisfaction.
2016	Labor supply and productivity responses to non salary benefits. Do they work? If so, at what level do they work best?	Personnel Review	Higher education	USA	462 college faculty	online survey	Through offering non-salary benefits such as tuition discount this may increase retention and productivity in employees.

Figure 2. *Articles included in paper sorted by descending date.*

Within the up-to-date literature review the following main themes or ideas were found:

- *Colleagues and customers*
- *Job satisfaction;*
- *Personal fit;*
- *Turnover;*

- *Job embeddedness;*
- *Intention to stay.*

These themes will be discussed in the next section.

Colleagues and customers

Colleagues and customers are essential elements within organizations. Within large organizations there is often a diverse level of employees and employment requirements; reasons for employees staying and leaving an organization can vary between job roles (Steiner et al., 2020). As an organization changes over time so too might the organizational culture and this may change the demands and expectations of the employees (Steiner et al., 2020). Changes in organizational identity can cause discomfort, anxiety, conflict, and possibly loss of self-esteem for the employee (Iyer et al., 2020). Supervisors, managers and line managers often have a high-level role as to how an employee feels about their job and the organization (Gordon et al., 2019; Steiner et al., 2020). Managers who create favorable brand orientation experiences foster a sense of belonging and psychological attachment from an employee to the organization (Dechawantanapaisal, 2018; Tripathi et al., 2020). Improvement in support from supervisors to employees can increase engagement and retention (Gordon et al., 2019; Steiner et al., 2020). Improvement of employee well-being and support can then reduce turnover and may increase employee satisfaction, guest or customer satisfaction and lead to greater profits (Gordon et al., 2019; Tripathi et al., 2020).

Long term planning by the organization to improve and create inclusion models will help develop affective retention strategies (Steiner et al., 2020). Steiner et al. (2020) also draws attention to the bidirectional transactions that occur between an organization and an employee, where one favorable treatment or action by one participant leads to a favorable response, treatment or action by the other participant. This on-going "conversation" can lead to mutually beneficial arrangements and support for an employee's intention to stay.

Leaders who have successfully empowered subordinates have been associated with positive work outcomes (Kim & Beehr, 2020). Empowering leadership appears to be a valid and effective leadership style that benefits employees and organizations (Kim & Beehr, 2020). The employees are more likely to feel an intrinsic motivation of commitment to the organization (Kim & Beehr, 2020). Within the workforce the stakeholders may be represented by the employee, leaders within the organization and community (Vincent & Marmo, 2018). Employees who share the dedication of the employer may strengthen the mission, stability and focus of the organization (Vincent & Marmo, 2018). Building a strong internal brand that is believed in by the employee then creates positive attitudes that support the organizational brand and in turn then supports retention strategies (Dechawantanapaisal, 2018). The constant building and renewal of the organizational brand both internal and external should be the responsibility of all employees at all levels (Dechawantanapaisal, 2018).

The internal branding of an organization is suggested to be as important for internal stakeholders, e.g., employees of an organization, as the external branding for stakeholders outside of the organization, e.g., customers, vendors, communities (Dechawantanapaisal, 2018 & 2020; Ikram et al., 2021). This is due to the importance of retention of human capital or employees within an organization (Ikram et al., 2021). Through making the internal branding stronger the organization engages employees and incentives for high job performance (Ikram et al., 2021; Nandy & Rai, 2020; Tripathi et al. 2020). The organization brand should be seen as an important aspect of the organizational culture (Dechawantanapaisal, 2018). Both internal and external communication should be used regularly, and often run simultaneously, to strengthen both the internal and external stakeholder connections to the organization (Dechawatanapaisal, 2020; Nandy & Rai, 2020). This also helps to develop a brand-oriented culture from within the organization, or from the inside out (Dechawantanapaisal, 2018; Nandy & Rai, 2020).

Publicly funded organizations often lack high powered incentives to attract and retain employees over that of private organizations (Langbein & Stazyk, 2018). Employees of public organizations are often led to stay with due to more intrinsic motivations, this can include the employee voice within the organization (Langbein & Stazyk, 2018). The threat of loss of intrinsic motivators can become a deterrent on the turnover of an employee (Jolly & Self, 2020). The intrinsic resources can become a powerful tool to both employees and organizations, especially if they are unique to that particular organization (Jolly & Self, 2020). Intrinsic motivators listed by Jolly and Self (2020) included job security, autonomy, high quality leader-member exchange relationship, transformative leadership, psychological safety climate, a fair organization, organizational, team and job characteristics. The true loss of any of these areas is often not felt until after the employee has left the original organization and started at a new job/organization (Jolly & Self, 2020).

Healthcare organizations, such as hospitals and medical facilities, are by and large social institutions that have direct service to patients (Aluwihare-Samaranayake et al., 2018). Retention of the nursing staff within a healthcare organization is essential to the quality and future of the organization (Aluwihare-Samaranayake et al., 2018). Nurses may stay within an organization because of a commitment they feel to their immediate work environment. Aluwihare-Samaranayake et al. (2018) includes the following in the immediate work environment patients, families, profession, community and or country. Aluwihare-Samaranayake et al. (2018) focused on the smaller county of Sri Lanka and discussed that there are limited studies on the commitment of nurses to organizations outside of North America.

Retention of different generations of employees is important because each generation is characterized by different skills or attributes (Dechawatanapaisal, 2020) and they can both mentor and support each other through reverse mentoring (Younas & Bari, 2020).) Dechawatanapaisal (2020) states that

generation Y employees are typically passionate, have high expectations for themselves, are self-reliant, independent and prefer to work within a team environment.

Generation Y employees (born between 1980-2000) are the first digital generation, they are technologically savvy, energetic, and have an emphasis on learning and high expectations of career success (Dechawatanapaisal, 2020; Younas & Bari, 2020). Generation Y is also poised to take the roles left by the retirement of Generation X and Boomers (Langbein & Stazyk, 2018; Younas & Bari, 2020). Dechawatanapaisal (2020) and Tripathi (2020) also state that if a member of Generation Y finds little to no opportunities within their current organization, they will prefer to switch jobs and seek new career opportunities. Steiner et al. (2020) highlights that although traditionally financial reward was seen as motivational for encouraging employees for staying with an organization, this view is not necessarily shared by the new generation of employees, millennials and post millennials. More research in this area is needed.

Managers in organizations need to pay attention to current industry, region and competitor dynamics (Yang et al., in print). This enables them to stay competitive with salary, career development and increase employee's attachment to the organization through the perspective of suitability (Yang et al., in print). Steiner et al. (2020) found that financial rewards was not a key driver for organizational commitment or retention, rather recognition was linked with engagement and satisfaction. Steiner et al. (2020) also highlighted the role of perception of caring from an organization regarding an employee's health and well-being as this has been shown to enhance employee engagement within an organization. This leads to the understanding that quality colleagues and customers are important to the development of longevity in employee connections to an organization.

Job satisfaction

Many nonprofit organizations believe that job satisfaction is of critical importance to the overall success of the organization (Vincent & Marmo, 2018). Job satisfaction is a relative and subjective feeling that Vincent and Marmo (2018), describe as being a complex interaction of personal characteristics, including beliefs, desires, aspirations, work culture, work environment, the community in which the work is located, the social and even political environment. Vincent & Marmo (2017) used an online cross-sectional survey to examine middle managers orientation to social justice and if that was associated with job satisfaction, the intention to stay with the agency or organization, and if their commitment was impacted by these. They found that organization commitment has a critical role in the relationship between job satisfaction, social justice, and intention to stay.

Harris et al. (2016) defined job satisfaction as happiness at work. They conducted a quantitative study predicting happiness at work and employee intention to stay with an organization. An 84-item questionnaire survey was used to assess servant leadership practices including valuing people, developing people, building community, providing leaderships, displaying authenticity, and

sharing leadership. Servant leadership is described by Harris et al. (2016) as a social relationship that emphasizes employee's personal growth, involvement for all in decision making, and supporting the quality of organizational life. When employees are energized by their work, they are more likely to stay with an organization (Harris et al., 2016).

Sanchez-Cardona et al. (2021) studied the connections between meaningful work and work engagement in the relation between job resources and the intention to stay at work. They described job resources as including task variety, skill variety, and task significance, and found these factors to be positively related to meaningful work. From there Sanchez-Cardona et al. (2021) connected meaningful work to work engagements, all of which supported intention to stay with an organization. Gaining personal satisfaction through their work engagement and job resources creates motivation and a positive psychological connection to the organization and the employee's intention to stay (Aman-Ullah et al., 2021; Rafiq et al., 2019; Dechawatanapaisal, 2020; Sanchez-Cardona et al., 2021). A positive diverse organizational environment can decrease an employee's intentions to leave an organization (Jolly & Self, 2020).

Fletcher et al. (2018) found that employees are more likely to stay with an organization when they are engaged, have job satisfaction and have the additional tools of access to training and development. Organizational investment into career development helps to create sustainable employment through a stronger attachment to the organization when the employee is proactive in engaging in career self-management (Rodrigues et al., 2020). When a lack of attention is given to an employee's perception and reactions, this may affect the level of organizational obligation that the employee feels and may increase their tendency to leave the organization (Dechawantanapaisal, 2018).

Providing employees with the ability to have a voice in how an organization functions is an important factor in retention (Yang et al., in print; Langbein & Stazyk, 2018). The question then from the research is how much voice is too much voice before it affects the organization negatively and becomes ill-suited or unnecessary (Langbein & Stazyk, 2018). The positive effect of job satisfaction can be seen to have an impact on the employee's retention and intention to stay within an organization.

Personal fit

Person-organization fit refers to the compatibility between people, including employees and other parties, and the organization (Iyer et al., 2020). Trust is a concept that is reciprocal in the supervisor and subordinate role. Kim and Beehr (2020) suggest that further research could focus on trust as both the cause of leader empowerment and a result of it. Rafiq et al. (2019) states that trust along with employee work engagement, and job embeddedness is a way of improving employee retention. Leadership development opportunities supports the personal and professional growth of an employee (Vincent & Marmo, 2018). Employers need to be mindful and strategic in offering development opportunities (Vincent & Marmo, 2018)

Psychosocial safety climate (PSC) is used by Bentley et al. (2021) to discuss the psychological well-being of employees at an organizational level, specifically regarding work place bullying and the turnover intention of the employee. Bentley et al. (2021) used a cross-sectional online survey as part of the larger New Zealand Workplace Barometer (NZWB). The overall findings by Bentley et al. (2021) found that inclusion and positive diversity climate were linked to employee retention and turnover intentions. From an organizational level the positive psychological safety, culture and inclusion of an organization can powerfully change the experiences and intentions of an employee's desire to stay or leave an organization (Bentley et al., 2021). A sense or understanding of safety may encourage employees to stay with an organization (Aman-Ullah et al., 2021). Bentley et al. (2021) suggest future research could use longitudinal data collection to examine the impact of a psychosocial safety and inclusion climates on the workplace, as well as both the individual and organizational outcomes over time.

Iyer et al. (2020) created a personality measure that will measure the Big Five personality traits from Goldberg (1990, cited in Iyer et al., 2020) of emotional stability, extraversion, openness to experience, agreeableness, and conscientiousness. Person-organization fit is posed as a career variable, it impacts on workplace and career outcomes as well as career choice for an individual (Iyer et al., 2020). Iyer et al. (2020) and Sharma and Stol (2020) both found that person-organization fit is especially important in the process of the recruitment. The onboarding process of new employees is especially important in the first 90 days, this time period may be essential to the successful establishment of the new employee in the organization (Sharma & Stol, 2020). Iyer et al. (2020) also suggests that consideration is given to personality when forming teams or reworking teams, specifically finding complementary fit rather than a supplementary fit. The complementary fit would work especially well when a team is needing a specific trait or abilities. Iyer et al. (2020) also highlighted that future research could be formed around the role of tenure, or staying power, within an organization based on personality perceptions and organizational outcomes.

Diversity and inclusion within in an organization can have a positive effect on the employee's intention to stay (Jolly & Self, 2020). This is an increasing area of psychological interest that is both valuable to an organizations performance and becoming an ethical obligation to society (Jolly & Self, 2020). For many employees, the importance of work engagement and organizational commitment support the feeling of personal fit with the organization (Dechawatanapaisal, 2017; Steiner et al., 2020). There is a high connection between positive and well-being employee mindsets as a predictor of the employee's intention to stay at an organization (Sanchez-Cardona et al., 2021). Continuous internal employee feedback is essential for understanding in the employee organization fit (Rai & Nandy, 2020).

Turnover

Turnover of staff, voluntary or not, is costly to an organization, both in terms of training and recruitment (Sanchez-Cardona et al., 2021; Sharma & Stol, 2020; Vincent & Marmo, 2018; Yang et al., in print). Not all staff who demonstrate an intention to leave actually do leave (Aman-Ullah et al., 2021; Yang et al., in print). This also coincides with the idea that many dissatisfied employees will still stay with an organization (Aman-Ullah et al., 2021; Yang et al., in print). When this happens, what is the cost to the organization in terms of quality, culture and sustainability? This issue is not explored within the research scope of this paper.

Talent management is a term being used to describe the attraction, identification, development, and maintenance of talent and ability in employees within an organization (Younas & Bari, 2020). Through talent management practices such as mentoring, strategic leadership, and social media used by software companies and applied to generation Y (1980-2000 birth year) employees are more likely to remain or intend to stay with the same organization (Younas & Bari, 2020). Later born baby boomers are heading into retirement, more up and coming leaders are needed to fill the leadership ranks as this occurs (Vincent & Marmo, 2018). Generation Y or millennial workers have been transforming the workplace for the past decade or so (Dechawatanapaisal, 2020). This is influencing organizations and changing both organizational behaviors as well as turnover within an organization (Dechawatanapaisal, 2020).

Part of what was found by Moen et al. (2017) is that work is now about managing change. The organizational change is coming from both employers and employees with the traditional seniority managerial system being linked to job security disintegrating (Moen et al., 2017). Employees with positive responses to well-being, flexibility, and job satisfaction are more likely to stay connected to the organization (Moen et al., 2017). Flexible work policies and support for employees personal and family lives may reduce turnover intentions especially when clearly stated and with broad access for all (Moen et al., 2017; Yang et al., in print). Empowering all employees to work in a flexible manner with co-workers increases the effectiveness of employees both on and off the job (Dechawatanapaisal, 2020). Ladge et al. (2017) found that work-family conflict is an important cross-domain mechanism that combines confidence in a non-work role to a woman's intention to stay with an organization. A sense of safety strengthens the connections between employees as they feel taken care of by the organization, which in turn encourages employees to stay with the organization longer (Aman-Ullah et al., 2021; Ladge et al., 2017).

The engagement and retention of higher education employees is important for the academic organization (Harris et al., 2016). This can reduce or eliminate instability, time and cost involved with recruitment of high-quality staff (Harris et al., 2016). Harris et al. (2016) argues that leaders within an organization should maintain a healthy working environment that allows for empowerment of the employees. Providing incentives for professional development and growth adds to the well-being and feelings of work-based happiness for the employee (Harris et al., 2016).

Reducing turnover within an organization may inspire others to stay. Langbein and Stazyk (2018) put forward the idea that turnover intention may be contagious within an organization. That is when one person leaves an organization it will sometimes have a snowball effect of more employees choosing to depart. Further indirect costs might be felt by the remaining staff, including loss of morale, collaboration, pressure on remaining staff and loss of organizational knowledge (Dechawantanapaisal, 2018; Tripathi et al., 2020). Employee turnover also has the potential to decrease customer service quality, which then can lead to decreased customer satisfaction and decreased overall revenue (Jolly & Self, 2020).

Job embeddedness

Job embeddedness focuses on the retention of an employee rather than the turnover and recruitment (Ghaffar & Muhammad, 2017). Organizational embeddedness is often more complicated than simply listing resources and a more wholistic view needs to be taken with in combining the resources into a powerful tool for the organization (Jolly & Self, 2020). There is often a web of resources that is created over time (Thakur & Bhatnagar, 2017).

The creation of an organizational culture with a shared vision of social justice may influence the desire of employees to stay within a publicly funded organization (Vincent & Marmo, 2018). Employees who identify with the organizations values and behaviors are more likely to stay connected to that organization (Steiner et al., 2020). Organizations can increase the level of employee embeddedness by designing programs that instill and strengthen company values and culture (Steiner et al., 2020).

Embedding the mission, culture and philosophy of the educational institution improves job satisfaction and employee retention (Yang et al., in print; Harris et al., 2016). A positive attitude held by the employee towards the organization and its values adds to the employee engagement (Fletcher et al., 2018). Highly engaged employees are more likely to stay with an organization due to the strong personal connections that in many cases become a mutually beneficial relationship for both the employee and organization (Fletcher et al., 2018; Rafiq et al., 2019; Thakur & Bhatnagar, 2017). The work-life balance of an employee also essential to embedding the employee by building deeper contextual and perceptual forces (Thakur & Bhatnagar, 2017).

Both on the job and off the job factors influence and employee's decision to stay within an organization (Ghaffar & Muhammad, 2017). Research on job embeddedness is small compared to turnover and other topics of organizational behavior (Ghaffar & Muhammad, 2017). Employee embeddedness when combined with work-life balance practices encourages employees to stay in order to receive resources and accumulate more (Thakur & Bhatnagar, 2017). Internal communication increases employee embeddedness, especially when done in a humorous and relaxed style (Yang et al., in print) or through encouraging stories (Dechawatanapaisal, 2020).

Within the field of higher education, Spencer et al. (2016) found additional benefits to employees, such as reduced tuition for the employee and their dependents, could positively influence an employee's decision to remain at an institution and positively influence their productivity. This benefit would be of low-cost to the higher educational institution but could have a big effect on the life of the employee and their dependents (Spencer et al., 2016). Spencer et al. (2016) did state that this benefit also appears to be connected to the original base salary of the employee with low salary employees are more likely to be in favor of this particular benefit. Higher education was also studied by Ghaffar and Muhammad (2017). Demographic factors such as gender, work experience, locality and designation showed a significant effect on job embeddedness of college faculty members (Ghaffar & Muhammad, 2017). Job embeddedness was found to be significantly more if the college teacher had experience of 11-15 years. College faculty members located in rural areas were also found to have more job embeddedness that those located in urban areas (Ghaffar & Muhammad, 2017). Male employees were also found to have more job embeddedness than female employees (Ghaffar & Muhammad, 2017).

Dechawatanapaisal (2017) found a positive effect on an organization is quality of work life. Quality of work life is multi-faceted including motivation, expectation, well-being, and satisfaction (Dechawatanapaisal, 2017). This is a human resource management strategy that can be applied to many organizations. Dechawatanapaisal (2017) studied the opposite question to this study "why do people leave?". Finding that organizational embeddedness in the case of healthcare professionals impacts the employee's intention to stay and turnover. The quality of work life becomes very significant in impacting organizational embeddedness. Factors affecting the quality of work life include career opportunities, the perception of quality of work life, work life balance, and job characteristics (Dechawatanapaisal, 2017). The quantity of time that people work is superseded by the quality of work produced, with greater engagement being a much-needed priority (Rafiq et al., 2019).

Training and development are important during periods of organizational or economic instability as it assists in achieving organizational agility and employee engagement (Fletcher et al., 2018; Rodrigues et al., 2020). Training and development when combined with three different forms of work attitude: job attitude, job satisfaction, and an employee's engagement of change related anxiety (Fletcher et al., 2018). Going further from job embeddedness is organizational embeddedness, building on why employees stay through a combination of forces that keep an employee loyal to a certain organization (Jolly & Self, 2020).

Intention to stay

Fletcher et al. (2018) concludes that future research into an employee's intention to stay should consider a broader range of attitudes and affects as within an umbrella affect rather than approaching the concept as individual options. This was echoed by Sanchez-Cardona et al. (2021) with future research on

multiple job resources and job demands to find connections with meaningful work to understand the motivational process of staying with an organization. A key difference in studies on retention and turnover in organizations is the focus on the pull or push of the relationship (Fletcher et al., 2018). The focus is on the positive aspects of pull factors that attract and retain employees within an organization (Fletcher et al., 2018).

Empowering leaders enables employees to have autonomy and developmental support (Kim & Beehr, 2018). It also appears that empowering leaders also encourages participation of the employee with the organization (Kim & Beehr, 2018). Through empowering employees Kim and Beehr (2018) found that employees were more likely to be dedicated to the organization and are more likely to stay with the organization. Empowering leadership was also found to be connected with positive work outcomes that benefitted both employees and organizations (Kim & Beehr, 2018). The confidence that is passed to the employee promotes more positive experiences and emotions surrounding their working within a particular organization (Kim & Beehr, 2018). Strategic leadership can influence an employee to stay within an organization this includes recognizing individual abilities, career development and alignment of the employees to the strategies of the organization (Younas & Bari, 2020).

Employees whose personal mission matches that of the organization are more likely to stay with that organization (Vincent & Marmo, 2018). An employee's commitment to an organization is critical to the employee's job satisfaction and intention to stay within the organization (Vincent & Marmo, 2018). Vincent and Marmo (2018) found that as middle-managers organizational commitment increased, so did their job satisfaction and the intention to stay. Work-life experiences influence nurses' motivation to remain, or leave, an organization (Aluwihare-Samaranayake et al., 2018). A nurse's intent to stay is influenced by organizational commitment, job satisfaction, work-group cohesion, collaboration and age (Aluwihare-Samaranayake et al., 2018).

Training and development have been linked with an employee's positive intention to stay within an organization (Fletcher et al., 2018; Rodrigues et al., 2020). Through the stimulation of meaning and engagement, managers and other human resource professionals can create jobs that encourage employees to stay (Sanchez-Cardona et al., 2021). When looking specifically at encouraging employees from Generation Y to remain within an organization, Younas and Bari (2020) found it was necessary to think of innovative ways to inspire, which could include reverse mentoring where the mentee is responsible for assisting the mentor in areas such as technology and social media.

Dechawatanapaisal (2017) found that intrinsic factors, such as opportunities, values and time, were better motivators for employees to remain within an organization as opposed to extrinsic factors such as money. A sense of identity within the organization through specialized or individualized assignments also meant employees felt a sense of obligation to the organization (Dechawatanapaisal, 2017). In contrast, Steigenberger & Mirc (2020) found that organizational and occupational identification do not

entice an employee to leave or stay with an organization. Rather when organizational and occupational identification is combined with an employee disappointment this may trigger an employee to leave (Steigenberger & Mirc, 2020).

Designing jobs when combined with development strategies for employees may stimulate meaning, motivation, and well-being and may contribute to an employee's retention (Sanchez-Cardona et al., 2021). Long term career road maps or succession planning help an employee to recognize and realize growth and potential within an organization (Dechawatanapaisal, 2017). This includes lateral movements with greater levels of specialization and skill development (Dechawatanapaisal, 2017). The development of younger employees is necessary to an organization to ensure acquisition of skills, aptitude and learning for an organization to remain competitive in the current business world (Younas & Bari, 2020).

Internal branding has an impact on an employee's intention to stay (Ikram et al., 2021; Tripathi et al., 2020). The internal branding helps to create the internal culture of an organization (Dechawatanapaisal, 2020; Nandy & Rai, 2020; Tripathi et al., 2020) and this then leads to enhancing the dynamics of open innovation (Ikram et al., 2021). Dechawantanapaisal (2018) believes that part of the answer to "what makes people stay?" is internal branding. The right mindset, brand identification and commitment, and right attitudes all support the internal brand and therefore the employees will feel proud, supported and are more likely to be loyal to the organization (Dechawantanapaisal, 2018).

Interestingly, Tripathi et al. (2020) found that factors such as growth opportunities, work culture, creativity and learning, socio-ethical responsibility, compensation and recognition do not motivate an employee to stay with an organization. Rather the above factors were only important when they were notably absent from the organization and the employee was dissatisfied with their work (Tripathi et al., 2020). Fully satisfied employees are more likely to remain at an organization and recommend it to others (Tripathi et al., 2020).

This systematic literature review compiled the latest evidence of the connections between stakeholders, organizational sustainability and culture and retention of employees and customers. There was a wealth of information sourced from multiple industries and from multiple levels within an organization. The research was focused around the seemingly simple question - why do people stay loyal to a certain organization?

From the research, the answer is multi-layered but there are clear ideals that can be utilized in many industries starting with recruitment. A successful start to a relationship is essential, therefore the first 90 days and the on-boarding of a suitable employee to a complimentary skilled team needs to be a positive experience with some training, but not too much (Fletcher et al., 2018; Iyer 2020 et al., 2020, Rodrigues et al., 2020; Sharma & Stol, 2020). Opportunities for continuous development and

learning for both advancement and lateral career moves is also important (Dechawatanapaisal, 2017 & 2018; Rodrigues et al., 2020; Sanchez-Cardona et al., 2021; Younas & Bari, 2020). These opportunities are noticeable in their absence when an employee is disappointed and may be motivated to leave an organization (Tripathi et al., 2020). Organizations with systems in place for ongoing training and development will feel the benefits of improved quality and organizational focus, job embeddedness with the benefits outweighing the financial costs (Crosby, 1984; Deming, 2018; Yang et al., in print).

Financial rewards are not always a key motivator for encouraging employees to stay (Steiner et al., 2020). More research is needed in the area of financial reward and motivation with Generation Y employees (Dechawatanapaisal, 2020; Steiner et al., 2020; Younas & Bari, 2020). Additional rewards of being associated with an organization, including intrinsic motivation, positive brand association, job satisfaction, and other resources that have been created as a complicated web over time, are seen to be of higher importance to an employee's intention to stay (Dechawantanapaisal, 2018; Ikram et al., 2021; Nandy & Rai, 2020; Tripathi et al. 2020; Thakur & Bhatnagar, 2017; Vincent & Marmo, 2018). Organizations can increase the level of employee embeddedness by designing programs that instill and strengthen company values and culture (Fletcher et al., 2018; Steiner et al., 2020). The employee's personal embeddedness within an organization makes leaving a difficult prospect (Jolly & Self, 2020). Improvement of employee well-being and support can then reduce turnover and may increase employee satisfaction, guest or customer satisfaction and lead to greater profits (Gordon et al., 2019; Tripathi et al., 2020).

This has led to new questions: How does loyalty and a long-term relationship to an organization impact the quality and business sustainability of that organization? When investigating this question both positive and negative aspects of this long-term relationship need to be considered to provide a balance of understanding. Generational differences may also be assessed regarding the intention to stay with an organization. Finally, does the intention to stay with an organization really come down to happiness at work?

4. Conclusions

The purpose of this paper was to present findings from a systematic literature review to examine and assess the latest evidence of the connections between colleagues and customers, organizational sustainability and culture and retention of employees published between January 2016 and April 2021. Limitations were purposely placed within this study to examine studies that were published in the English language, peer-reviewed journal articles, and had text available to the author. This systematic literature review has been conducted to answer the question of why employees stay dedicated to an organization for long periods of time and the effect this dedicated has on the quality and sustainability of the business. It was mentioned by Yang et al. (in print) that there are limited studies on

why people stay with an organization or retention of staff as previous research has been focused on turnover of employees. This demonstrates that there is a gap for future research that of focusing on intention to stay and retention of employees and why this has been successful in different organizations. Multiple factors were found to influence employee's intention to stay across a variety of base industries including construction, hospitality, higher education, energy, medical, non-profit, and the information technology industry. Main factors that were extracted and expanded upon from the research papers included colleagues and customers, job satisfaction, personal organizational fit, turnover, job embeddedness, and the intention to stay.

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Posters

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How can School Leaders Leverage Perceived and Attractive Quality to Increase Customer Value to Ensure Organizational Sustainability

Introduction

The long-term sustainability of p-rivate, independent school education in the United States may be on the decline as the industry faces new challenges and opportunities. In an ever-increasingly competitive market to recruit and retain private school families, school leaders must find novel, creative, and innovative methods of attaining sustainable and successful high-quality independent schools.

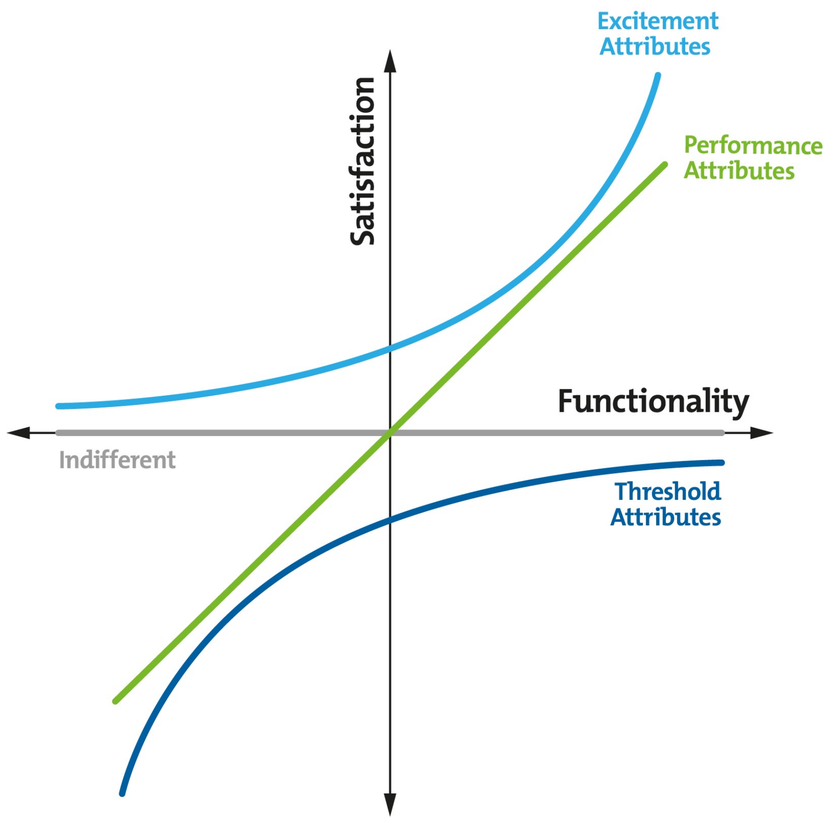

Figure 1: The Kano Model of Attractive Quality (Kano, 1984)

Figure 2: Six Key Themes within the Literature

Purpose

The purpose of this systematic literature review is to understand how the concepts of perceived and attractive quality may be leveraged by school leaders to create more customer value and contribute to the sustainability of private education in the United States.

Results & Conclusions

A systematic literature review revealed how current research on these subjects has found positive results in the business and healthcare industries. Applied in the correct manner and context, the theories of both perceived service quality and attractive quality can be found to have positive influences in education, and especially on the short-term and long-term sustainability of private schooling.

Method

The objective of this literature review is to systematically review and analyze the current research on how leaders leverage perceived and attractive quality to increase customer value. An extensive database search took place using specific key words to find appropriate literature within this research area. As part of the review protocol a set of eligibility criteria was created in order to whittle down the vast amount of literature. a deductive content analysis approach using the three components of total quality management to extract data into a categorization matrix.

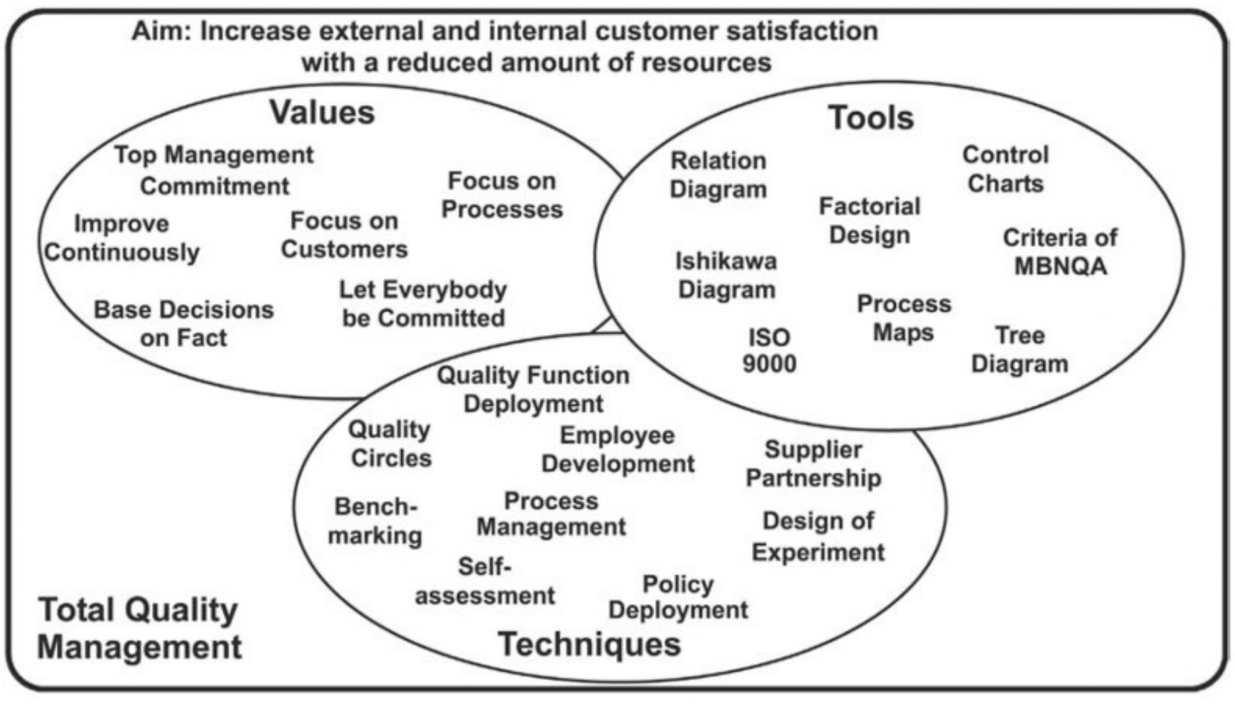

Figure 3: Total quality management (TQM) seen as a continuously evolving management system consisting of values, techniques and tools. (Hellsten & Klefsjö, 2000)

Images: MindTools.com, Hellsten & Klefsjö, 2000

10. Special Themes

10d. Nordic Bioresources and Biorefinery Technology

Abstracts

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Environmental performance of bioethanol production based on the BioRen case study

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Abstract

Environmental performance of bioethanol production based on the BioRen case study. Significant mitigation of climate change is only possible when the use of conventional fuels from crude oil is reduced in favor of biobased materials production. The efficient conversion of organic waste into biofuels has significant potential to contribute to reducing resource depletion and climate change. The BioRen project funded by the European Commission through its Horizon 2020 research program aims to develop the competitiveness drop-in second-generation biofuels such as bio-ethanol from the organic fraction of municipal solid waste (OFSMW)**.** Conversion of organic fraction consists mainly of residual paper and cardboard residues which cannot be recycled into bioethanol the anaerobic digestion is used. Traditionally in Europe, this waste stream is still being landfilled, incinerated, or incinerated with energy reconversion. This type of BioRen technology seems to have an abundant potential to convert a variety of low-value municipal organic wastes. Once sufficient results have been obtained, the project also involves the ongoing conversion of lignocellulosic biomass to GTBE and isobutanol. However, the economic and environmental results will define the final product in the production chain. The environmental analysis of bioethanol production from OFSMW was carried out to identify the environmental hotspots in a whole production chain. The analysis was based on the Life Cycle Assessment methodology. Regarding the level of advancement of the BioRen project, the Life Cycle Inventory analysis was based on literature and empirical data. The study also compares the results with data found in the literature for different types of biofuels production. The system boundaries include waste sorting and transportation, pretreatment, enzymatic pretreatment, distillation, and hydrothermal carbonization of biomass residues. The functional unit was defined as one liter of bioethanol produced from OFMSW. The results show that the highest environmental impact is caused by electricity consumption and waste transportation. However, the trade-off between effective reuse and conversion of this waste stream into second-generation biofuel is more environmentally preferable than the traditional use of fossil fuels or first-generation biofuels in transportation.

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New Sustainable Method to Produce Pulp Fibres - Deep Eutectic Solvent-Assisted Mechanical Pulping

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Abstract

Mechanical pulps are widely used in the manufacture of printing paper grades and also to a lesser extent in packaging materials and hygiene products. An advantage of mechanical pulps in general is the high yield (95-97%) of the production processes, which implies a resource efficient way of producing fibre-based products. A major drawback when producing mechanical pulps for printing qualities is the high electric energy consumption needed. However, the mechanical action associated with the liberation of fibres from the wood matrix can be facilitated if the middle lamella lignin is softened, leading to lower energy input and less fibre damages. The lignin can be softened by chemicals and high process temperatures, like in the chemi-thermomechanical process (CTMP) and the high-temperature-chemi-thermomechanical process (HT-CTMP), where sodium sulphite is utilized. The pulps from these processes are best suited for packaging materials and tissue products.

In this study, an alternate chemical treatment using deep eutectic solvents (DES) was explored. The DES used was bio-based, non-toxic, non-corrosive, and could be recycled. The main goal was to facilitate the refining process and possibly create a new quality of mechanical pulp, not to remove lignin or hemicellulose. Wood chips were pre-steamed and then soaked in DES, to ensure a sufficient impregnation. The conditions of the DES treatment were much less severe than those of a chemical pulping process, i.e. low temperature, neutral or nearly-neutral pH, and a short residence time. The excess DES was removed by washing the chips with water before the chips where fed into a refiner. According to fibre quality analyses, the DES-treated fibres were longer and less damaged than the control. The DES-treated fibres also demonstrated significantly higher dewatering capacity than fibres without DES-treatment produced at the same specific energy input in the refiner. These facts indicate that the fractures during fibre liberation to a higher extent occurred in the middle lamella, similar to when producing CTMP. A maintained high yield of the DES-treated pulp was confirmed by chemical analysis. In conclusion, this initial study show that DES-assisted mechanical pulping appears to be an interesting alternative for producing a mechanical pulp with different fibre properties. An aim for future work would be to tailor the DES-treatment to alter fibre properties in a more controlled manner preferably so that market shares could be taken from the today dominating low-yield (<50%) processes.

Full papers

Improve the competitive advantages of pulp fibre based products over fossil-based materials

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Abstract

To improve the competitive advantages of pulp fibre based materials such as tissue and packaging products over the fossil-based products, it is of key importance to improve the knowledge of the selectivity of the cooking process. There is also demand to expand the fundamental scientific understanding of pulp and paper manufacturing systems because of growing demand for replacing plastics. However, it is challenged to improve the selectivity of the cooking process by optimizing unit operation such as impregnation, cooking and refining. For pulp production based on chips regardless of chemical (kraft or sulphite) or high-yield (chemimechanical or semi-chemical pulp) pulping process, the efficiency of the impregnation is always crucial. To improve impregnation uniformity, we need to study how even distribution of lignin releases down to fibre level via easily impregnated wood chips. It can be achieved, using classic measures such as; equalized hydroxide ion concentration, increased initial sulphide ion concentration, low sodium ion concentration and low boiling temperature combined with oxidative and reductive environment to understand how the chemicals quickly enter and distribute in the chips. However, we have studied the uniformity of impregnation at fibre level by the possibilities of accurately measuring S and Na content by collimating the X-ray beam into a ~200 µm spot in diameter using an energy-dispersive X-ray fluorescence (ED-XRF) spectrometry. In addition, we have also studied improved impregnation by selective cooking systems for sulphate pulp in oxidative (polysulfide) and reductive (sodium borohydride, $NaBH_4$) environments. Our aim is to develop standard measurement methods to improve the smoothness of fibre properties for tissue and packaging products to reach the sustainable development goal (SDG) stated by the UN at target 9.5 *"Enhance research and upgrade industrial technologies"*.

Keywords: CTMP, ED-XRF, Hemicellulose, Impregnation, polysulfide.

1. Introduction

Today huge sustainable packaging and hygiene product demand due to attention of corporate social responsibility, reducing carbon footprint, reducing waste and use recycled material instead of plastic lead to increase the manufacturing of the chemical pulp (kraft or sulphite pulp) and chemithermomechanical pulp (CTMP). Therefore, the pulp and paper industry needs further attention by improving their processes to get more material and energy efficient product properties. They need to increase the knowledge of selectivity over characterization and optimization of the method aspects of packaging and hygiene products.

The majority of the pulp is produced in processes where wood chips are impregnated with chemicals containing sulphur (S) and sodium (Na). The size of wood chips varies with a length ~20 mm, thickness 3-4 mm containing fibres of width 20-40 µm and length 1.5-5 mm. So, it is hard to achieve even chemical distribution in the wood chips of sodium sulphide (Na_2S) and sodium hydroxide (NaOH) for chemical pulping and sodium sulphite (Na_2SO_3) and sodium hydroxide (NaOH) for chemithermomechanical pulping process. Generally, in production of CTMP pulp, wood chips are sulphonated at slightly alkaline condition by using 2-4% Na_2SO_3 charges prior to refining (Lindholm and Kurdin 1999). The significant chemical mechanism at CTMP pulp for the sulphonation of wood is here the introduction of sulphonate groups on to the benzylic carbon atom of phenolic units of lignin (Gallerstedt 1976). Thus, the introduction of sulphonate group in the lignin affects the dynamic mechanical properties of wood. Especially the sulphonation under CTMP conditions, fibre separation shifts towards the middle lamella (Lai and Iwamida 1993). For the production of paperboard or tissue, middle lamella is favourable for the fibre separation where the target is to produce pulp with high bulk and low amount of shives (Höglund and Wilhelmsson 1993). So, the basic strategy is to obtain well separated fibres at minimum possible shives content and thus, ultimately link to maximizing of wood softening prior to defibration in the chip-refiner. The softening is accomplished by sulfonating the lignin of the wood with sulphite (SO_3^{2-}) at high temperature (130-180°C) and lower pH 4 in preheating and refining. However, it is important to study the distribution of sulphur (S) and sodium (Na) in cross sections of wood chips or in individual fibres to improve the process control and to obtain homogenous fibre properties.

To the best of our knowledge, there are no easy and fast methods to measure S or Na distribution on a micro scale due to the linear energy response of the full-field pixel detector is usually above 3 keV (Jakubek, J. 2011). The commercial Micro-XRF instrument for light elements has beam collimator size from 0.5-4.5 mm, which seems above the required resolution for detecting elements in fibre level (BRUKER webpage, 2021). Few scientific studies have been done but very time consuming to know the degree of unevenness on a micro scale. However, in 1988 Göran Bengtsson did publish thorough studies on the impregnation of birch wood blocks under various conditions (Bengtsson et al. 1988). The longitudinal distribution of sodium and sulphur was studied at different points by means of an SEM

(scanning electron microscope) equipped for energy-dispersive X-ray analysis. The distribution of Na and S obtained by this method correlated with measurements of S from ion chromatography and of Na by atomic absorption spectroscopy. As expected, the amount of sulphite was the same at both ends of the wood block but decreased at the middle (Bengtsson et al. 1988).

To address this problem and to improve the knowledge of whether we can achieve better uniformity in properties down to fibre level in pulp production by measuring the distribution of Na and S frequently and accurately. We developed an industrially applicable technology to measure S and Na content at fibre level with X-ray fluorescence method (XRF). Our newly built miniature XRF method has the potential to contribute a solution for how to improve the impregnation through high-resolution measurements of mainly S with possibilities of Na distribution in samples from a few millimetres to micrometre in size. This technology studies various strategies for wood chip impregnation and is linked to chemical and chemical mechanical processes where sulphur and sodium-containing chemicals are used. This method used a collimated X-ray source and an energy-dispersive X-ray spectroscopy under development. The sample like wood chips, pulp or handmade sheet was placed in a titanium (Ti) box with helium (He) gas to reduce the air absorption. The sample surface was scanned in two-dimensions to make an elemental distribution image. However, this method can help to maximize the efficiency of wood chip impregnation for further study of even distribution of sulphonation to reduce specific energy demand in chip refining at certain shive content.

In further study of selective cooking to improve the impregnation, we investigated sulphate pulp (kraft pulp) properties for tissue application. During the Second World War, it was needed for efficient packaging material for the transport to remote seats of war, thus, promoted to development of packaging products while kraft pulp was the best suitable choice (Annergren, G. and Gremgård, U. 2014). After that, the development of kraft cooking characterization gradually increased both from an environmental and economic perspective. One important reason kraft pulp has the ability efficiently use different wood species. Today kraft pulp has become a strong competitor to softwood bleached sulphite pulp.

In this paper, we studied the modification of softwood (mix of spruce 70% and pine 30%) kraft pulp in an oxidative and reductive environment to achieve high quality fibres for producing better tissue paper (Rahman, H. 2018). The methodology that we used was already described in 1965 (Rydholm, S. 1965) using either polysulfide or sodium borohydride to increase the pulp yield. In our case, the total yield from 48% to 53% due to a higher retention of hemicellulose (Rahman et al. 2017). These pulps with higher yield gave a paper with higher tensile index than conventional softwood kraft pulp, especially at lower degrees of refining. However, the question is to what extent this approach can negatively affect dewatering while dewatering properties are important for tissue production processes. On the other hand, an increase in hemicellulose content can make dewatering more difficult because water retention value (WRV) of the pulp increases. On the other hand, an overall increase in pulp yield could improve dewatering because a sheet of certain weight will contain fewer fibres, giving a more open sheet

structure. So, we set out to address this question by measuring the dewatering properties of low grammage hand sheets (20g/m^2) under conditions mimicking the tissue paper machine dewatering processes and studying sheet strength properties. Our results showed how the positive influence of overall yield increase exceeds the negative influence of an increase in hemicellulose content on the dewatering properties, particularly at lower reefing energy levels.

2. Methods

For the study of uniformity of impregnation at fibre level, CTMP pulp and kraft pulp were selected for XRF set up. The image of the miniature XRF method is shown in Figure 1. The titanium (Ti) shield box was covered for upholding the helium gas by a titanium cover palate (200 mm x 200 mm). The Ti box was connected to a two-dimensional (2D) stepper motor unit to make scan of the sample in two direction of X and Y at stable condition of X-ray tube (Moxtek® MAGPRO X-ray sources) and spectrometer (Amptek, X-123 SDD). The pulps sample was placed inside the Ti box and scanned with the movement with these two stepper motor units, making an image of the element of interest. In practic whole setup was put into a stainless- steel box covered with adhesive lead (Pb) sheet (thickness 1 mm) to avoid radiation leakage.

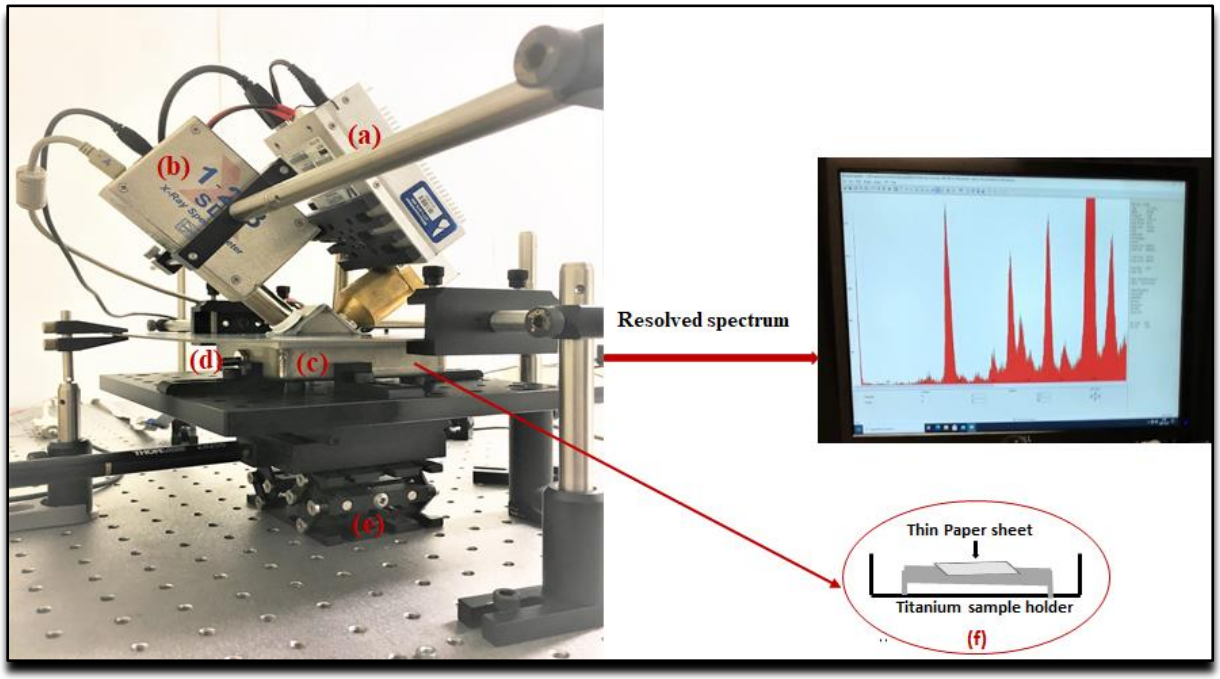


Figure 1*. Image of XRF measurement setup by a moveable Helium atmosphere Ti box.*

In Figure, **(a)** X-Ray Source (Moxtek) **(b)** Detector for the analyse of the spectrum of Na and S, **(c)** Titanium Shield box (10x10x2.5 cm) at Helium atmosphere, **(d)** Helium gas connection **(e)** 2D Stepper Motor (XY directional movement) and (**f)** Image of inside Titanium box with sample.

A paper sample from CTMP pulp was investigated by the newly built miniaturized XRF setup at 10 keV fluorescence energy at 700 µA with a 100-µm pinhole. For primary study, a line scanning measurement

in air environment was considered. In the XRF setup, 1 mm length sample was marked in between Ni foil and Cu wire, in total 2.4 mm was scanned (scanning step size: 100 µm), as shown in Figure 2.

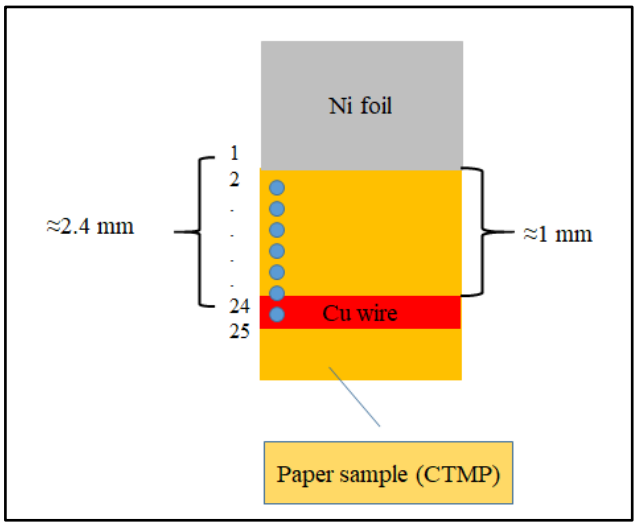


Figure 2. *Schematic CTMP sample setup in between Ni foil and Cu wire.*

For the study of a selective cooking system, a laboratory digester (1L) with a capacity of 100g of dry chips was used. Industrial chips as a mixture of Spruce (*Picea abies*), 70%, and Pine (*Pinus sylvestris*), 30%, were obtained from SCA Östrand mill, Sundsvall, Sweden. The liquor/wood (L/W) ratio was 4:1 for 1 L digester. The chips were impregnated with cooking liquors (black liquor and white liquor) by increasing the temperature from 70°C to 160°C at a rate of 1°C/min. The temperature was kept at 160°C for the remainder of the cooking time until the H-factor for a specific kappa number was reached. The experimental setup is shown in Figure 3.

The kappa number (ISO 302:2014) was measured as of each pulp according to the standard SCAN-C 1:77 method. However, three types of softwood pulps were produced in laboratory 1) conventional softwood kraft, 2) same with oxidizing additive, polysulfide and 3) same with reducing additive, sodium borohydride.

Bleaching was carried out in a single chlorine dioxide (ClO_2) stage for all three laboratory prepared kraft pulps followed by drying of the pulps (Rahman et al. 2017). Bleached Kraft pulps (Ref, PS and $NaBH_4$-kraft pulp) were refined in a PFI mill at refining levels of 0, 500, 1000 and 2000 revolutions according to ISO 5264-2:2011. 20 g/m^2 hand sheets were prepared according to the ISO 5269-2:2004 standard with tap water using a conventional sheet former of surface area 0.021m^2 (Rahman et al. 2018).

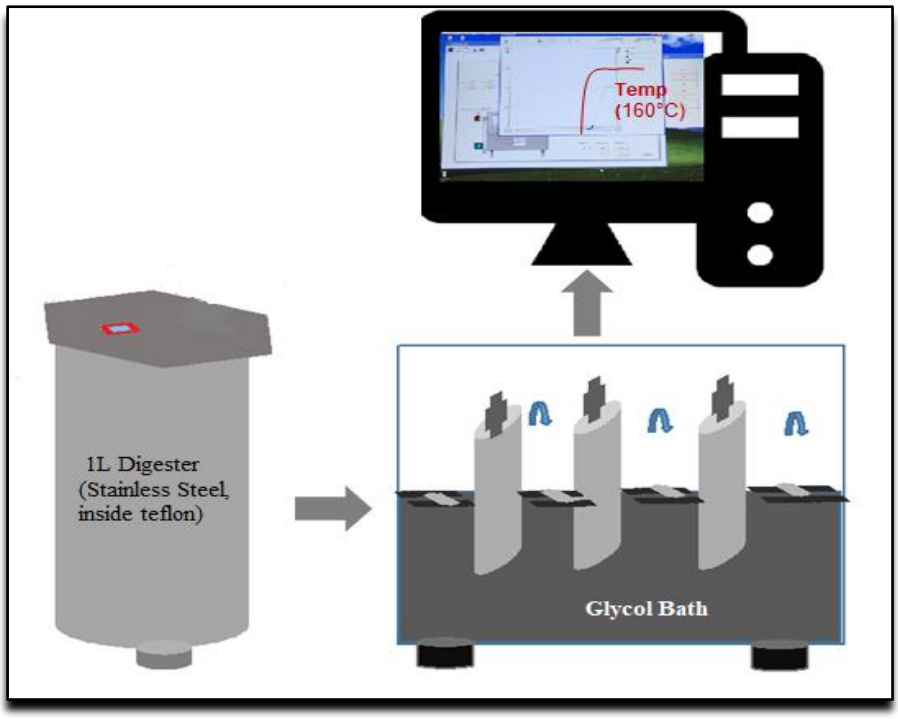


***Figure 3**. Sketch of laboratory setup for kraft pulping process.*

3. Results and Discussion

3.1 The uniformity of impregnation at fibre level

For the study of traditional pulp manufacturing technology, it is important to improve the knowledge of uniformity in properties at the fibre level. The strategy is for us to know by measuring often and accurately, in this case the distribution of S and Na at the fibre level. This is to be able to optimize wood chip impregnation before cooking and chemical mechanical processes where sulphur and sodium-containing chemicals are used. Therefore, we studied how we develop a prototype and validation the setup to measure light elements distribution, such as S and Na, down to the fibre level.

For primary study on a paper sample from CTMP pulp, at Figure 2, a line scanning measurement in the air environment was considered. According to the setup, for each point, the acquiring time was 4 hours. We extracted three points from different locations and plotted these spectra in Figure 4. We resolved the S, Cl, Ca peak in the paper sample, as well as other materials, such as Ti, Ni, and Cu. However, Na was not observed in the spectra due to the low concentration and strong absorption for light elements by air. The peak value of S ($K\alpha_1$ 2.3 keV) is about 35-40 counts after 4 hours acquiring time. By increasing the measurement time for each point, the peak value can be increased correspondingly, resulting in a better signal-to-noise ratio. However, the total measurement time will be increased exponentially. An alternative way could be using polycapillary lenses instead of pinhole collimators to gain higher beam intensity and to reduce the measurement time.

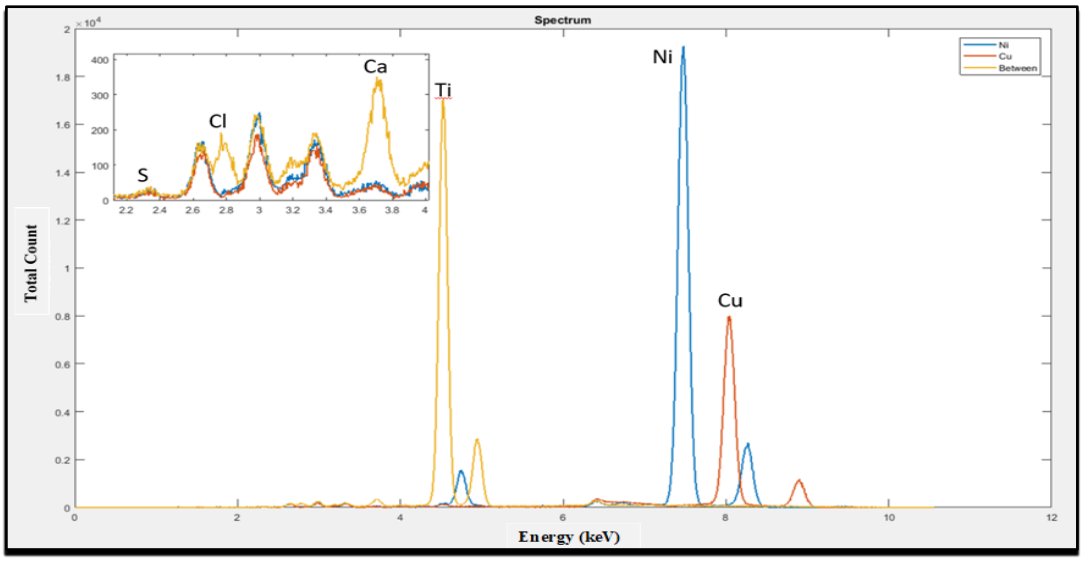


Figure 4. *XRF spectrum from 3 points observation*

In the XRF spectrum, the peak area was related to the element concentration, thus, the photon counts of Ni, Cu, and S characteristic peaks in all measured spectra were integrated respectively. Elements distribution map of Ni, S and Cu is shown in Figure 5a. The X-axis is the scanning step number and Y-axis is the photon intensity. The standard deviation was calculated from the square root of the sum of the total count and background counts. In Figure 5b, the high total counts around 2.3 keV in the Ni sheet (step 1 to step 6) and Cu wire (step 18 to step 24) indicate there is a noise peak interfering with the S peak since no S is expected in these regions. The noise signal might come from $M\alpha_1$ of Pb in the housing material. However, the S peak from the paper sample is higher than the background noise. The variance of S counts on the paper sample area (step 7 to step 17) is not significant, which is close to the standard deviation. It might be due to a big area of the sample being irradiated at resolution 200-300 µm, which gives an average S signal from a large area. However, we observed the spatial resolution was limited for XRF measurement by the scanning step size. It might also take a long time for a large image area of any specific element of interest, like Na, at high spatial resolution. To obtain sulphur mapping, the resolution should be improved, which requires a smaller pinhole size. Hence, there is a trade-off between a higher resolution and a shorter measurement time.

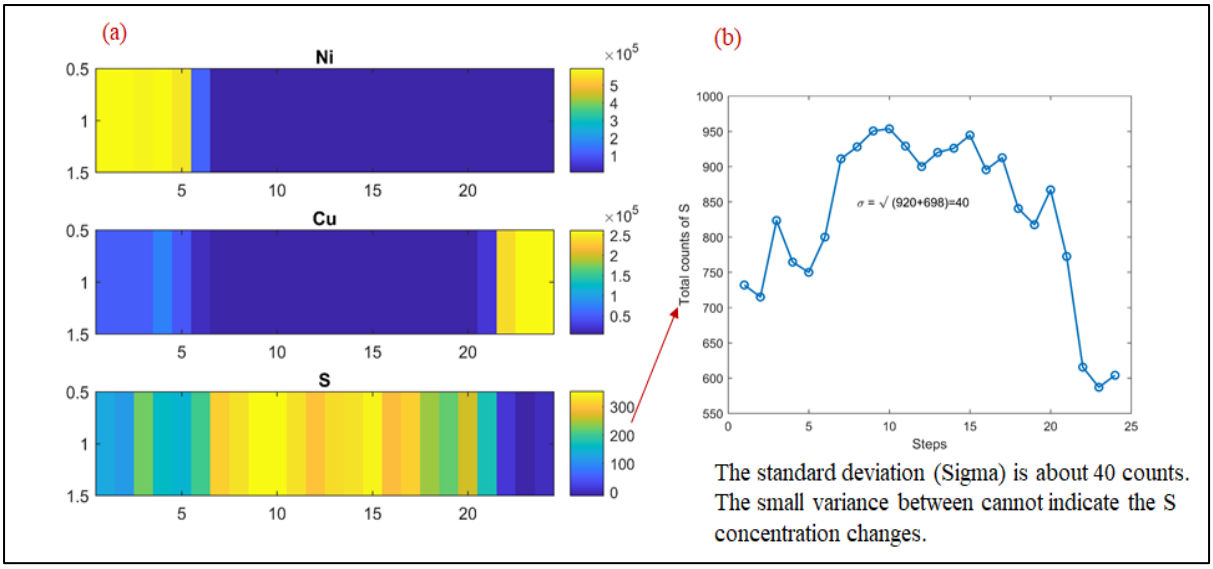


Figure 5. *Extraction XRF signals of Ni, Cu and S peak*

In order to reduce the air absorption, kraft pulp was also investigated in a helium gas environment at 8 keV fluorescence energy at 700 µA with a 50-µm pinhole for 7 hours. An aluminium foil was used to cover the gap between the X-ray tube and Ti box to shield the Pb M-line photons. Thus, in the blank measurement, the background peak close to S peak is removed. We perceived a well sulphur peak in comparison with the air environment at our XRF setup, as expected. Unfortunately, Na peak is not obtained clearly as well, at Figure 6. The Na peak was not resolved in the spectrum due to the small-irradiated area, low beam intensity and low Na concentration of CTMP and kraft pulp sample. Moreover, it should be noted that the He gas needs to be continuously supplied during the measurement due to the density of helium gas being lighter than air, and they can easily escape from the Ti box in dozens of seconds.

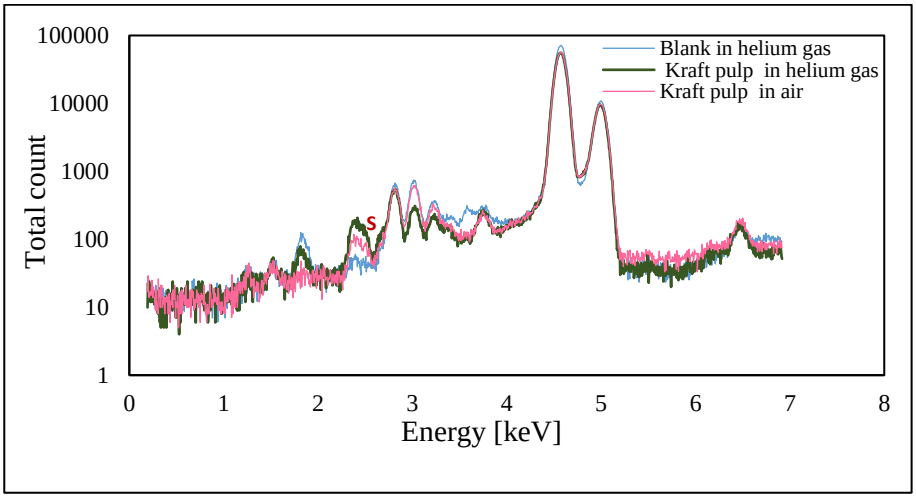


Figure 6. *Kraft pulp at helium gas environment by using a 50-µm pinhole*

At helium gas environment, air background absorption can be reduced, which is important for the XRF detecting of lower energy element like Na and S. It is also suggested to use a high spectral resolution detector and a synchrotron beam like PHONIX I in PSI (Paul Scherrer Institute), Switzerland. For XRF mapping mode at PHOENIX I, the synchrotron radiation measurements at low exciting energy is 0.4-8 keV, thus possible to obtain Na (1.04 keV and 1.07 keV) and S (2.31 keV and 2.43 keV). However, using the 1 x 10^4 energy resolution at PHOENIX I, it is possible to scan a 2.5 µm x 2.5 µm area of any paper sample within a few minutes (PSI webpage, 2021).

3.2 Impregnation improvement by high selectivity cooking

We studied how kraft pulp can be modified and optimized by increasing the yield by retaining hemicellulose in the fibre walls. The purpose was to improve the bonding capacity to the pulp fibres further so that the need for refining was discussed to achieve good tissue and packaging paper properties. The effect on the pulp yield of adding sodium borohydride ($NaBH_4$) or polysulfide (PS) during the first part of the softwood kraft cook was studied. *Table 1* shows that at a kappa number of 34-41, the total yield of the PS - kraft pulp and the $NaBH_4$- kraft pulp increased from 48.2% to 51.0 % and from 48.2% to 52.0% respectively. However, in both cases, the yield increase was related to an increase of hemicellulose content (Rahman et al. 2017). The major chemical mechanism is that reducing agent sodium borohydride ($NaBH_4$), reduce the aldehyde end group of hemicellulose to stable the alcohol end groups and oxidizing agent polysulfide (PS), oxidises the aldehyde end groups to carbonyl end groups (Wang et al. 2005).

Table 1 The effect of Yield at modification of kraft pulps

Kraft Pulp	Kappa Number	Total Yield (%)
Reference Pulp	41	49.0
	36	48.2
Polysulfide (2%) Pulp	41	50.4
	33	51.0
$NaBH_4$ (1%) Pulp	39	53.0
	34	52.0

The increased yield of both PS and $NaBH_4$ kraft pulps results in higher tensile index, corresponding to 15-32% higher value compared to reference kraft pulp at lower refining energy, at Figure 7.

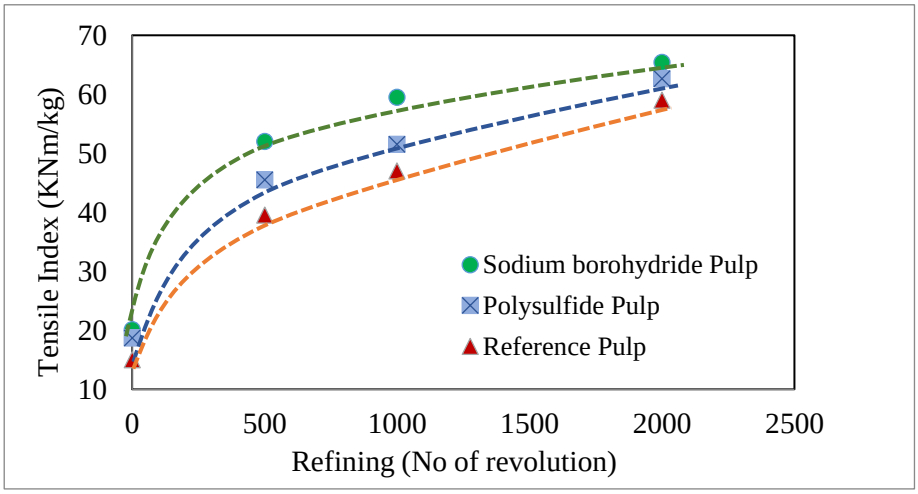
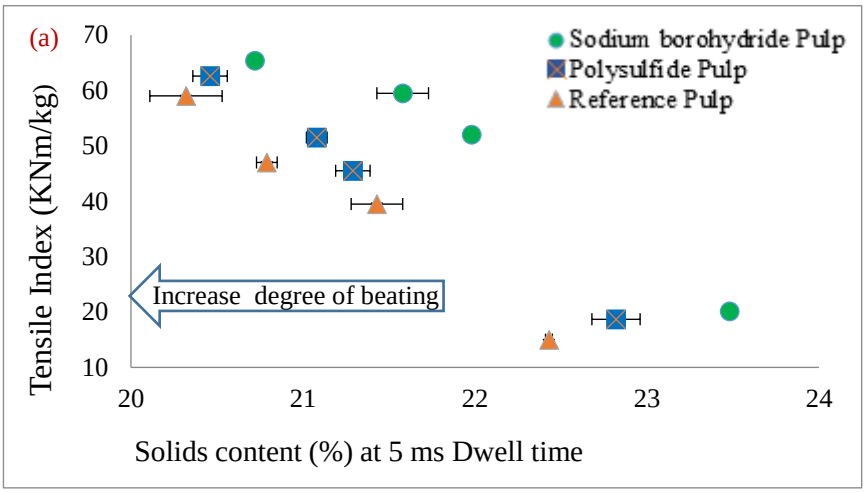


Figure 7. *Tensile index versus number of refining revolutions for 20 g/m^2 sheets, Redrawn (Rahman et al. 2018.)*

According to Saukkonen 2014, increase of hemicellulose is generally considered the swelling of the fibre and thus promotes refining efficiency. On the other hand, an increase in swelling improves the adhesion between fibres (Molin, Teder 2002; Danielsson, Lindström 2005) and can help soften the fibre wall and fibre joint strength (Laine, Stenius 1997). Kraft pulps with higher hemicellulose content is therefore interesting for the studies of tissue paper dewatering properties.

Figure 7 shows that at low degree of refining, for example, 500 PFI-revolutions, the $NaBH_4$ and PS-kraft pulps had a tensile index of 45.5 and 52 kNm/kg respectively. But the solids content remained almost same at 500 PFI-revolution and it was about 21.5% at 5 min dewatering dwell time and 23% at 10 min dewatering dwell time for all three kraft pulps, Figure 8(a, b).



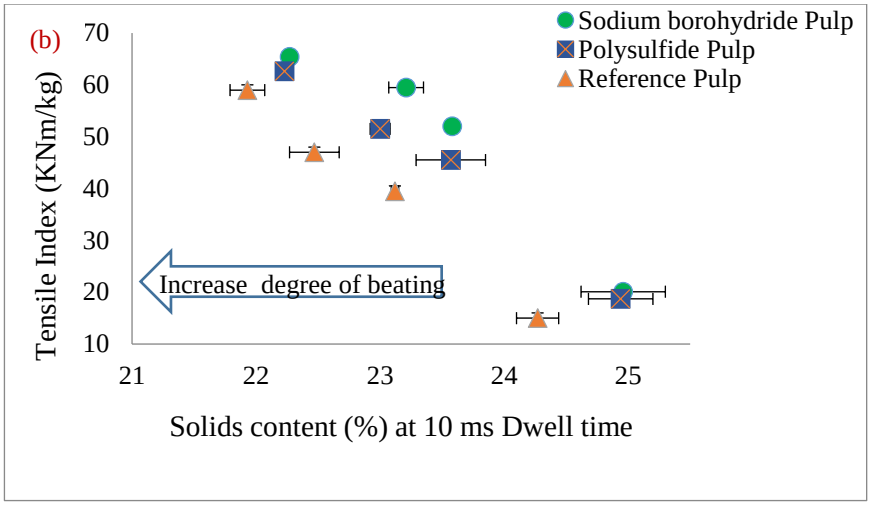


Figure 8. *Tensile index after a dewatering dwell time of 5 and 10 ms as a function of solids content.*

However, we can claim that the $NaBH_4$-kraft pulp followed by PS- kraft pulp, clearly exhibits better dewatering i.e. a higher dryness at a given tensile strength due to higher hemicellulose. Kraft pulps produced using either $NaBH_4$ or polysulfide addition can thus give either a higher strength for a given amount of refining or the same strength with less refining energy.

4. Conclusions

The miniaturized XRF imaging system primary showed that it has the capability of imaging the light element, especially S for the study of sulphonation degree. The ED-XRF technique provides a new method for the pulping industry to investigate the degree of sulphonation and modification to improve the spatial resolution of the setup. This helps to improve the controlling of process efficiency, product properties and to find solutions to process problems in future. This method can be further validated by XRF on synchrotron facilities. In that way, low concentration Na mapping can also be achieved. In addition, we demonstrated the possibility of modifying the sulphate pulp (Kraft pulp) process could improve fibre properties and reduce costs in the manufacturing of tissue and packaging products. The result already indicates that modifying the kraft pulping process to increase yield and hemicellulose content results in a pulp that has the potential to improve tissue paper quality.

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Environmental performance of bioethanol production based on BioRen case study

Introduction:

The objective of the BioRen project funded by The European Commission through its Horizon 2020 research program is the development of competitive drop-in second generation biofuels such as bio-ethanol from the organic fraction of municipal solid waste (OFSMW). To converse the organic fraction consists mainly of residual paper and cardboard residues which cannot be recycled into bioethanol the anaerobic digestion is used. The environmental performance of bioethanol production from OFSMW was carried out to identify the environmental hotspots in a whole production chain. The analysis was based on Life Cycle Assessment methodology.

Table 1. Life cycle Inventory data

Input	Output
electricity and heat from waste, processing water, phosphoric acid, yeasts, catalysts,	PRODUCTS: bioethanol, biocoal OTHER: waste, emissions to air, residues

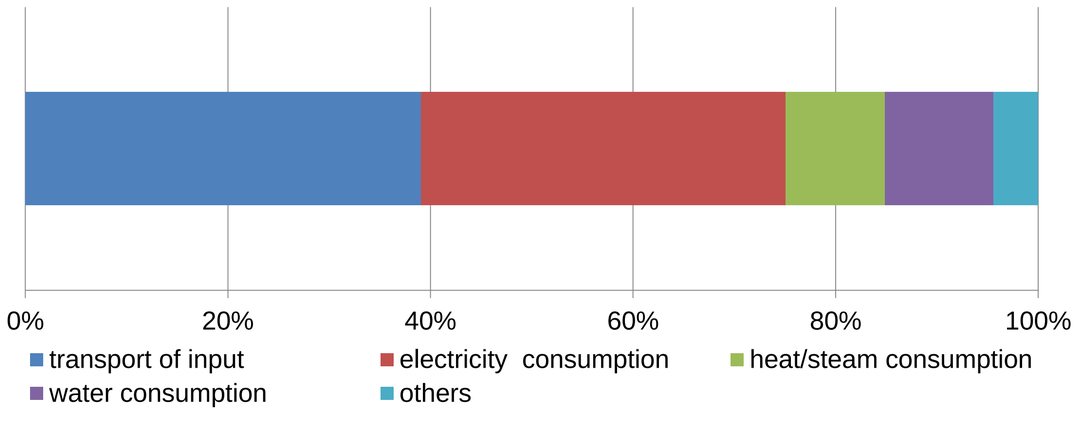

Figure 2. The distribution of environmental impact for main chosen factors (hotspots)

Methods:

The Life Cycle Inventory The analysis was conducted on literature and empirical data in regard to the level of advancement of the project. The study also included a comparison of the results with data found in literature for different types of biofuels production. The system boundaries include processes from waste sorting and transportation, pretreatment, enzymatic pretreatment, distillation and hydrothermal carbonization of biomass residues. The functional unit was defined as one litre of bioethanol produced from OFMSW.

Results and conclusions:

The results show that the highest environmental impact is caused by electricity consumption and waste transportation. However, the production of bioethanol from OFMSW can still be environmentally more favorable than fossil fuels and the lignocellulosic biomass utillisation can also contribute to the reduction of municipal waste of landfills and the cleaner production. Project BioRen is still in its early stage, however the results of the preliminary LCA analysis indicate that it is a promising technology for producing the bioethanol.

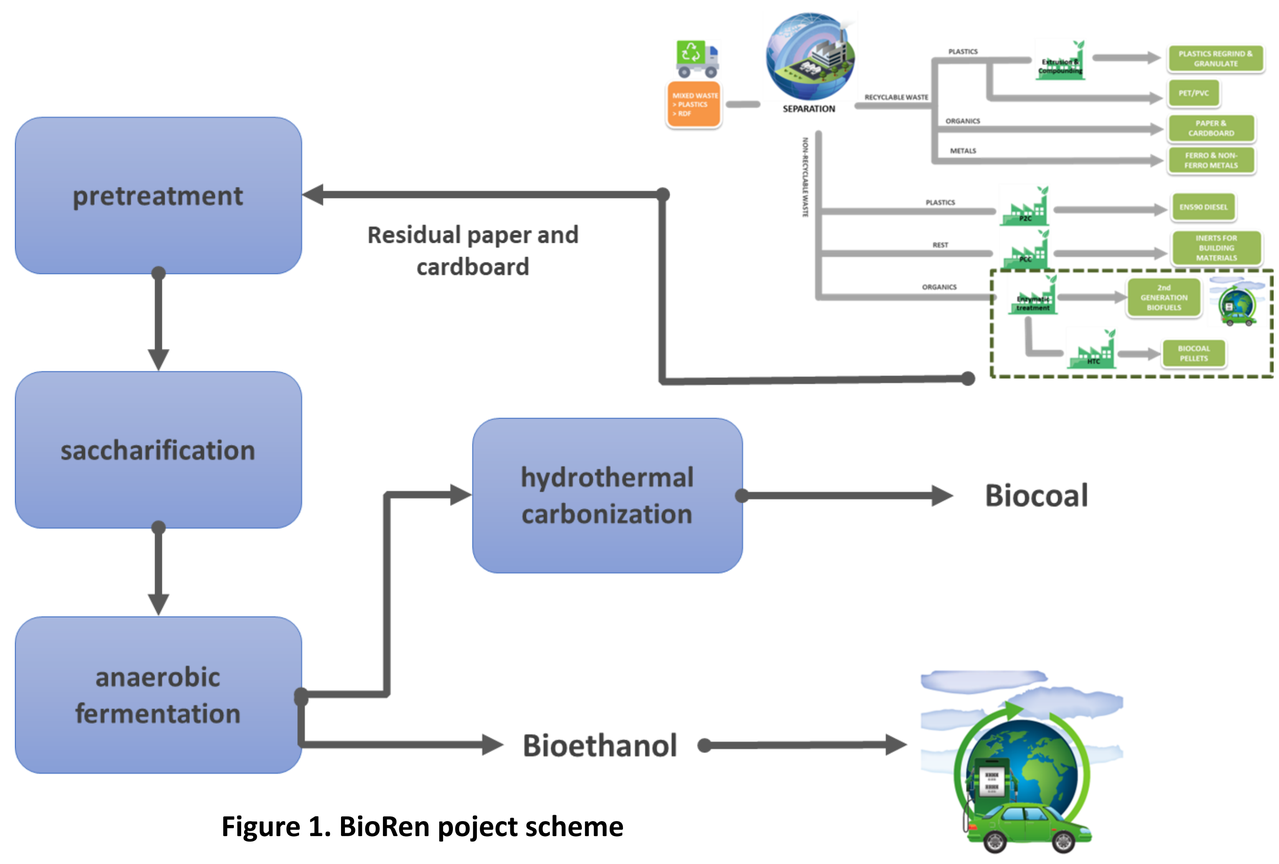

Figure 1. BioRen poject scheme

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