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PROCEEDING

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ASSESSING THE 5Ps OF SDGs
(PEOPLE, PLANET, PROSPERITY, PEACE AND PARTNERSHIP)"

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Welcome Message by the Conference Chair

Associate Professor Dr. Rasyikah Md. Khalid

Dear delegates of the 29th ISDRS Conference 2023,

The Faculty of Law, Universiti Kebangsaan Malaysia, UKM (or the National University of Malaysia), was proud to be the main organizer of ISDRS 2023. We were very grateful to be supported by our co-organizers: IDEA UKM, Institute of Fuel Cell UKM, Institute of Visual Informatic UKM, Institute of the Malay World and Civilization UKM, UKM-Graduate School of Business, Hadhari Institute UKM and UKM Strategy Center.

We were fortunate to receive 377 abstracts from researchers in 41 countries. This is, by far, the highest number of submissions in ISDRS conferences in the Asia continent, after Hong Kong and Nanjing. ISDSR conference in Europe generally attract around 400 abstracts, and we nearly hit that target.

ISDRS 2023 provided the platform for ISDRS members, mostly from Europe, to learn about the issues and progress in sustainable development in ASEAN. Likewise, ASEAN delegates benefited from the intellectual discourse and found new collaboration networks.

ISDRS2023 also introduced special themes on ASEAN, Religion, and IR4.0, led by UKM scholars.

The Malaysia conference took place in the middle of Agenda 2030, seven years and a half after SDGs were first launched in 2015 and seven years and a half more toward 2030. Papers presented at ISDRS 2023 have assessed the 5P of SDGs: people, planet, prosperity, peace, and partnership.

I hope that international delegates have enjoyed your stay in Malaysia. Beautiful moments of the sustainable field trips to Malacca, a UNESCO world heritage site, and to the Forest Research Institute of Malaysia or FRIM, a UNESCO tentative list as the oldest and largest man-made forest in the world, have been recorded in the conference album on the website.

My heartful gratitude goes to all delegates for making ISDRS 2023 a success, and I hope to see you all in Kathmandu, Nepal, for ISDRS 2024.

Rasyikah Khalid,

Chair, ISDRS 2023.

Keynote Address

Matthew Baird

Matthew Baird has over 32 years' experience in environmental and planning law in the Asia-Pacific Region. He was admitted to the Australian Bar in 1991 and practiced for 25 years in environmental and planning law. Matthew has consulted to the Asian Development Bank, UNEP, UNDP, IFC, WWF, PACT, and Vermont Law School, providing capacity building and training on programs on environmental law and advocacy in Asia and the Pacific since 2010. He has worked on environmental law and governance issues, including EIA, hydropower, water governance issues and public participation in ASEAN since 2010. He was a member of the Technical Working Group for the drafting of the Cambodian Environment and Natural Resources Code 2023. He is an Honorary Research Fellow at the Myanmar Centre for Responsible Business and a Fellow of the Environment Institute of Australia and New Zealand. His doctoral dissertation at the University of Southern Queensland is on EIA in ASEAN. He was appointed a Teaching Fellow of the College of Law (Australia) in 2021 and leads the ESG Law and Practice Group.

Plenary Speakers

Mazlin Bin Mokhtar

Emeritus Professor Dato' ChM. Dr Mazlin Bin Mokhtar is the Deputy Head (Research), & Director, Ecological Systems Program, United Nations Sustainable Development Solutions Network Asia Headquarters (UN SDSN ASIA) at Sunway University. He was the Director of the Institute of Environment and Sustainable Development and the Vice Chancellor (Research and Innovation) in Universiti Kebangsaan Malaysia (UKM).

Karlene Maywald

The Hon. Karlene Maywald is the Deputy Chair of ICEWaRM. Karlene was the representative for the seat of Chaffey in the South Australian House of Assembly from October 1997 until March 2010. During her tenure, from 2004 until 2010, she was South Australia's Minister for Water Security and the River Murray during one of the worst drought periods in living memory. She has a proven, long-standing track record in water management and is passionate about water reform in Australia.

Ahmad Parveez Ghulam Kadir

Datuk Dr. Ahmad Parveez Ghulam Kadir is the Director General of the Malaysian Palm Oil Board (MPOB) since 2019. He has more than 30 years of experience in the oil palm industry with expertise in the field of plant molecular biology, genetic engineering and biosafety. He has developed transgenic oil palm and has gained recognitions both locally and internationally and filed 15 patents. He is also an active member of the International Society for Oil Palm Breeders (ISOPB) president and American Oil Chemists' Society (AOCS) Asian Section chairman.

Weena Gera

Weena Gera is Associate Professor of Political Science and former Vice Chancellor for Administration (2019-2022) at the University of the Philippines Cebu. She has published and consulted on various governance analyses in the Philippines and Southeast Asia. In 2018, she was among the five recipients of the Gro Brundtland Award for Women in Sustainable Development. In 2019, she was conferred the Bernd Rode Award in the Senior Researchers category by the ASEA-UNINET for her research project on ecosystem services toward sustainable mineral development in the ASEAN.

Lance Manuel

Lance Manuel is the Texas Atomic Energy Research Foundation Professor of Engineering at the University of Texas at Austin. He is a Fellow of the American Association for the Advancement of Science (AAAS), the American Society of Civil Engineers (ASCE), and the American Society of Mechanical Engineers (ASME). He serves on the Marine Board of the National Academies of Sciences, Engineering, and Medicine (NASEM). He is the Editor-in-Chief of the ASME Journal of Offshore Mechanics and Arctic Engineering. For over 25 years, he has been active on projects related to renewables, primarily wind energy.

Olena Shevtsova

Olena Shevtsova is a guest researcher at Södertörn University in Stockholm, Sweden. She has been working upon a theory on stakeholder partnership in public administration. She has speaking at global level as EGRISS Steering Committee member (Expert Group on Refugee, IDP and Statelessness Statistics), participated in UN recommendations development BG-4e-EGRISS-IROSS-E.pdf (un.org), speaker at high-level events - UN World Data Forum, expert meetings of UNECE, UN ESCAP.

Stella Emery Santana

Professor Stella Emery Santana is a Professor of environmental law at FAESA Centro Universitario Brazil since 2006, and has been the director of the international program since 2009. She is a private consultant for international and environmental law issues. She has been the chairperson for the Espírito Santo state bar environmental commission for two terms, and was a volunteer in this commission until 2017. In 2016, she worked with the president of the Espírito Santo Environmental Agency as the environmental and administrative law consultant for the Samarco mining dam breakout that occurred in November 2015.

Olawale Olayide

Olawale Olayide is the Secretary of ISDRS. He is a sustainability expert with research experience in the areas of Agricultural Economics, Food Systems, Climate Change, and Circular Economy. He currently works at the Faculty of Multidisciplinary Studies, University of Ibadan, Nigeria. He is the Convener of the annual Circularity Africa Conference, Pioneer President of the Africa Circular Economy Research and Policy Network, and Founder of the Interconnections for Making Africa Great Empowered and Sustainable (IMAGES) Initiative. He has cognate experience in partnerships and policy engagements in continental and global affairs.

Siti Kartom Kamaruddin

Prof. Ir. Dr Siti Kartom Kamarudin is the Professor of Chemical Engineering at Department of Chemcial & Process Engineering, UKM. She is now the Director of Fuel Cell Institute of UKM. She is a world expert in low carbon energy related to Fuel Cell and Hydrogen Technology. Her is the recipient of the WIPO Award for the Best Women Invention and Best Innovation Award from TIPPA. In 2016, she was awarded by `The World Most Influential Minds' as top 100 world scientist in engineering. Since 2016 to 2021, she is recognized as the `Highly Cited Researcher' by Clarivate as top 1% Cited Researchers in the field of Engineering.

İlknur Öner

Professor. Dr. İlknur Öner is a Professor of Sociology, and the Head of Disaster Research Center, Fırat University, Elazig Turkiye. She is a member of the National Sociological Association since 2000, and have been involved with the International Sosiological Association since the 1994 Bielefeld Congress. Cuurently she is a a board member of ISA and a newsletter co-editor which is published in English, Spanish, and Turkish since 2018. She is an active member of ISA group on Sociology of Childhood, Sociology of Disaster, Sociocybernetics, and Women, Gender, and Society.

Tomás B. Ramos

Tomás B. Ramos is a professor of sustainability assessment and planning at NOVA University Lisbon and senior researcher at CENSE, Center for Environmental and Sustainability Research. He is listed in the World's Top 2% Scientists, and currently the Executive Editor of the Journal of Cleaner Production (Elsevier, IF: 11.072), the Editor-in-Chief of the journal Cleaner Production Letters (Elsevier), and member of the Editorial Board of several leading scientific journals. He was the ISDRS Board of Directors (2013-2019), member of the Accreditation Council of the Order of Engineers of Portugal (2004-2010) and President of the Portuguese Environmental Engineering Association (1997-1999).

Rose Liza Eisma-Osorio

Atty. Rose Liza Eisma-Osorio, an environmental lawyer and professor at the University of Cebu School Of Law. She was elected in 2019 as Chairperson of the International Union for Conservation of Nature – Academy of Environmental Law (IUCNAEL) – the first Asian to lead the academy. She is one of the founders of the Philippine Earth Justice Center, Inc. (PEJC), which has filed several environmental cases, including the landmark decision of the Supreme Court in Resident Marine Mammals and Dolphins vs. Reyes, where she acted as the stewards of the dolphins and whales, to stop illegal oil exploration in marine protected area in the Philippines.

Antonio A. Oposa

Antonio A. Oposa Jr., President of The Law of Nature Foundation, is one of Asia's leading voices in the global arena of environmental law. He pioneered the practice of Environmental Law in the Philippines, and his work is known locally and internationally for establishing, in the highest court of law, the principle of inter-generational responsibility – that this present generation has a responsibility to protect the environment for future generations. He is an expert in environmental policy and law, governance and litigation; an effective and respected activist for forest and marine protected areas in his native country; and a true warrior for the environment.

Nini Shazrina A. Shamli

Nini Shazrina is the Director of Corporate Services of Landasan Lumayan Sdn Bhd (LLSB), a wholly owned subsidiary of Menteri Besar Selangor (Pemerbadanan) (MBI). She was involved in various corporate restructuring exercises within MBI to improve efficiency through optimization of resources. In 2022, she was transferred to LLSB, a state-owned entity to spearhead the rejuvenation of Klang River under Selangor Maritime Gateway (SMG) project. The SMG aims at sustainable management of the Klang River Basin, once heavily polluted. Her project unlocks the tourism potentials along the river and ensures citizen to enjoy the best quality of life.

Peter Dobers

Peter Dobers is the President of ISDRS. He is professor of business administration at Södertörn University in Stockholm since 2015. During the years 2016-2022, he was the dean and chairperson of the Faculty Board. From 2022, he is the program director of the 2-year master's program Leadership for Sustainable Development. In the summer of 2022, he was elected to the Knowledge Foundation's board. His current research includes corporate social responsibility, guided tours in the broadest sense, sustainable development of regions, and cities' future investments as sustainable cities.

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From theory of a transboundary systems provision model to practice for sustainable climate risk-, disaster risk- and crisis management in the flood disaster-damaged Ahr Valley in Germany – Implementing Spree Forest and Lusatia Regions Land and Environmental Systems Model for Operationalizing SDGs and Resilience

Sandra Reinstädtler
Independent Scientist, Cottbus, Germany

Abstract

Successful implementation of the theoretically-applied, self-developed CA(LU)^{2}WA framework for sustainable climate risk- (CRM), disaster risk- (DRM) and crisis management (CM) is not easy for affected disaster-damaged regions. This case study on Ahr Valley Region acknowledges transboundary systems provisions and its operationalization for enhancing assessment with optimized information and data exchange: if regions, or even one single region, are not lying within same administrative coordination responsibility, the more complex planning is getting. The enhancements for well adjusted planning, data, communication channels within a Transboundary Systems Provision (TSP) must be critically evaluated in case of aiming to strengthen sustainability and resilience. Especially in case of a combined, region-overarching (benchmarking) perspective and planning for a sustainable CRM, DRM and CM, the to be implemented topics of sustainability, land- and environmental systems thinking, and transformative science for enhancing an optimized climate risk and land resilience are aggravating a fluent, transparent and on the ground processing way. Actuator of this research was the flood disaster in mid-July 2021 and simultaneously threatening COVID-19 pandemics in Ahr valley in the states of Rhineland-Palatinate and North Rhine-Westphalia, surrounding regions in Germany, and in Belgium. Topical entrance into this case study was a (short-termed) initiative field and action research about sustainable development, resilience and general planning combined land- and environmental systems processing, leading to constructive solution transferors against challenges in TSP.

A by the author for Lusatia, implied Spree Forest Region, possibly for worldwide regions developed, applied innovative theoretical approach, and verbal-argumentative model was approved for operationalizing TSP into the flood-destroyed Ahr Valley Region. Spatially determining different sustainable and resilient aspects through the landscape scale, regional planning level, and by the help of the operationally implanting „Climate Adaptive Land Use within Landscape Units and Drought and Water Management" (CA(LU)^{2}WA) proactive landscape meta-model should guide into a chance for TSP.

First results of the research being based on past, long-termed theoretical combined applied research pillars show that the framework with its applied instrumentations such as landscape units and transboundary river basin areas is not only specialized on ideal „prototype region" of Lusatia and inhabited Spree Forest. Instead, it is able to override risks and needs parallel in diverse regions.

Global SDGs are getting coupled with TSP and the CA(LU)^{2}WA framework, innovative and well known assessment methodologies. As a high-ranged, sustainable, resilient future-saving, capacity-building flagship initiative it gains regional (land) resilience in the flood disaster-, COVID-19-impacted Ahr valley together with further affected regions to rebuild simultaneously several destroyed regions, reconstructing them. 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 Ahr Valley Regions` effective applicability for gaining more regional resilience. This research supports processes around four pillars and possibly also five P`s (people, planet, prosperity, peace and partnership) in sustainable development and resilience transformations on regional level and landscape scale for buffering future climate change-, disaster-, crisis-related pressures, land resilience options while enhancing interdisciplinary sustainability science.

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Disruptive agency dynamics in urban sustainability transformations – A conceptual approach for studying insider-outsider relations in urban mobility systems

Daniel Peter
Technische Universität Dresden, Dresden, Germany. Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany

Abstract

Human agency plays an essential role for societal transformations since people are in some perspective fundamentally the initiators and carriers of societal change. Large scale societal change, as urgently moving towards reaching the SDGs requires, is posed with challenging or even disrupting what is currently normal, daily routine and structurally given. This process of disruptive change necessarily has to be started and continually enforced by a variety of agents. These have been diversely studied for example as niche agents, different types of entrepreneurs, activists, intermediaries or just generally as forerunners or change agents.

However, as has been noted regularly in the literature of sustainability transitions and transformations, discussions around conceptualizations of agency are ongoing, still dispersed and partially only vaguely developed. A general, overarching understanding of human agency in these sustainability transformation processes is still missing (as pointed out for example by Fischer & Newig (2016), de Haan & Rotmans (2018) and Koistinen & Terikangas (2021)). However, such an advancement is required for practical applicability of research insights such as for designing specific interventions and policies.

To get closer to such a conceptualization, in this research the insider-outsider dichotomy (first deployed in sustainability transformations by the project "DOUbT" (2022)) is applied to a novel conception of disruptive agency. Disruptive agency is understood as the ability of agents to act with the intention of disrupting a social system in order to transform it purposefully. It is taken the stance that this disruptive agency is performed by a variety of heterogeneous agents who necessarily are in epistemic, behavioural or institutional regard outsiders to the reference system they want to change. This co-constitutive interplay between disruptive agency and the relations on one side between different types of outsiders and on the other side between outsiders and insiders is conceptually explored. Additionally, a spatial perspective is taken to ground the analysis of these relations in the multitude of spatial contexts and the corresponding realities they do unfold in.

This novel theoretical approach is discussed in the context of an ongoing comparative case study examining the different relations between multiple types of outsiders and insiders in the mobility domain in three different German cities, with varying mobility cultures (Holz-Rau et al., 2022). Further, a specific focus is taken in this design to examine the influence of diverse spatial factors on outsider emergence, their relations and impacts.

This research contributes to gain a better understanding of how to reach all of the SDGs indirectly by providing a new perspective of how to analyse the disruptive agency of change agents pushing exactly the reaching of these goals forward. The discussed case study concerns more specifically insights regarding the SDGs "Sustainable Cities and Communities", "Climate Action" and "Peace, Justice and Strong Institutions" on a specific municipal level of three different German cities. In this context it is studied how the dynamic relations between varying outsiders and insiders shape transformative processes towards contributing to reaching these goals.

References were removed (above 500 word limits) or else the submission remain incomplete.

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Integrated Research on Earth and Societies − A new branch of sustainability science for the Anthropocene

Prof. Dr. Jochen Schanze[1,2], Prof. Dr. Dieter Gerten[3], Dr. Miriam Prys-Hansen[4]
[1]Leibniz Institute of Ecological Urban and Regional Development (IOER), Dresden, Germany. [2]TU Dresden, Dresden, Germany. [3]Potsdam Institute for Climate Impact Research, Potsdam, Germany. [4]GIGA German Institute for Global and Area Studies, Hamburg, Germany

PROF. DR. JOCHEN SCHANZE

Abstract

There are visible signs that adverse changes in the Earth system are accelerating despite international efforts to increase sustainability. Ongoing global warming with its impacts, the accumulation of nutrients and pollutants in the air, soils, inland waters and oceans, water stress, the global biodiversity loss and other environmental changes, regardless of their geological traces, are obvious indications of an Anthropocene and have significant societal consequences. While lack of compliance with the SDGs is supposed to be one major reason for these trends, the common operationalisation of sustainability as an optimisation of equally important economic, social and ecological pillars increasingly appears to be another. The authors provide a review of international scientific discourses relevant to Earth system changes, their impacts and governance. In particular, they refer to the Earth system sciences, the global sustainability sciences, the Earth system governance science, and selected others fields of research. Comparing this review with the observed evolution of the Anthropocene reveals research gaps, especially in understanding the Earth system, Earth-societies interrelations, scientific reasoning of societal goals on Earth and societies, as well as their social negotiation, possible effective innovations, transformative capacities and others. Therefore, an 'Integrated Research on Earth and Society' (intRES) is proposed to explicitly and more comprehensively address the interfaces between the natural and societal systems that determine the Anthropocene. We suggest the following dimensions of integration to be examined with an intRES: (i) integration at the interface between the Earth system's geo- and biosphere and societies with their political, social, economic, technological and ecological facets; (ii) integration across world regions (especially the global South and North), political systems and actors (e.g., individuals, social groups, levels); (iii) integration across spatial and temporal scales, including past and projected future dynamics; (iv) integration of descriptive and explanatory empirical findings with normative reasoning contexts; (v) integration of autonomous or self-organised dynamics and control-oriented governance arrangements; and (vi) integration across disciplinary theories, methods and models that also link scientific and societal knowledge. To tackle these dimensions of integrated research, the following main tasks are proposed, taking the literature on sustainability transformations with systems knowledge, target knowledge and transformation knowledge into account: (1) natural and social science holistic approaches that span spatial and temporal scales and societal levels and represent the Earth system and societies with their dynamic interrelations; (2) Science-based reasoning contexts for normative references as well as the analysis of institutional arrangements for negotiating planetary or global goals and for implementing and monitoring them; (3) Transformative approaches for the Anthropocene that promote coherent knowledge about both the Earth system and societies on the one hand and science-based and societally agreed target knowledge on the other, and from this develop action-oriented knowledge for cross-scale sustainability transformations involving societal actors. The respective research demands are illustrated by examples from current research activities.

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What is Ecology? A core discipline in the interdisciplinary arena of environmental and sustainability research

Leon Maximiliano Rodrigues

Universidade Aberta, Lisboa, Portugal. Universidade Estadual do Rio Grande do Sul, Soledade, Brazil

LEON MAXIMILIANO RODRIGUES

Abstract

This essay frames Ecology as a core discipline in Environmental and Sustainability Sciences, interdisciplinary fields of applied sciences. However, while interdisciplinarity has emerged recently as an academic practice, there is a lack of efforts to systematize the emerging interdisciplinary sciences.

It is advocated, then, that Ecology plays a central role in environment and sustainability research and applications. The concept and scope of Ecology is initially discussed, From Haeckel (1866) to Krebs (1972), to frame it as a science and discipline. Next, some of the main theories invoked to explain environmental and sustainability issues are explored from the perspective of Ecology.

It is argued that Ecology, as a science that investigates how nature is structured and functions, integrates practically all fields of Natural Sciences, and is complementary to Social Sciences to interpret the relationship between social and natural systems. This topic is at the heart of the main issues on sustainability.

It is also argued that the importance of this relationship, based on a strong sustainability perspective (Ayres et al., 2001), is linked to the directly dependence of human sustainability on ecological systems (e.g., Motesharrei et al., 2014), and their essential services that emerge from the organization and functioning of these systems (pollination, water self-purification, soil fertility, climate regulation, etc.).

Finally, it is argued that Ecology, since its emergence as an autonomous science early 20th century, studied ecological systems from the lens of the positivist, Cartesian-mechanistic paradigm. Until the emergence of "general systems theory" (von Bertalanffy, 1968) and the "theory of complex systems" (Buckley, 1967), a theory to unifying ecological systems was lacking. Such theories, however, require a perspective different from that of the positivist paradigm. They require holistic, systemic and complex thinking (e.g., González-Márquez & Toledo, 2020; Kjellman, 2006; Santi, 2019). But, complex adaptive systems are highly dynamic and unpredictable and rely on diversity to be creative, adaptive and resilient (Ahmed et al., 2005). This information is the basis of Ecology.

Thus, Ecology as a discipline is central for environmental and sustainability sciences. The application of knowledge is not only to address the intricate relationships between the structural components of ecological systems, but also to examine human-mediated ecological threats to the environment and develop solutions (Chakraborty, 2021; Usmandjanovna, 2020). Therefore, it has the potential to support decisions towards the SDGs, especially objectives 2.3, 2.4, 2.5, 6.4, 6.5, 6.6, 13.1, 13.2, 13.3, 14.1, 14.2, 14.3, 14.4, 14.7, 15.1, 15.2, 15.3 , 15.4, 15.5, 15.8, 15.9 (UN, [s.d.]).

The step towards sustainability is intrinsically an ecological path, because to offer the 5Ps of the SDGs it will be necessary to have a planet with its life support systems minimally preserved all around the world. Therefore, to operationalize the SDGs it is important to promote ecological literacy and recognize it as a

universal demand in society, demanding: (i) the inclusion of the subject Ecology in curricula at different levels; and (ii) including ecologists in the team of research groups, governments and companies.

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Does Circular Economy care for us? Lets talk about the ethics and aesthetics of care of the Circular Economy

Santiago PEREZ
European Culture and Technology Lab - European University of Technology, Dublin, Ireland. InSyTE - University of Technology of Troyes, Troyes, France

S A N T I A G O P E R E Z

Abstract

The limitations of our current production and consumption patterns prompted the development of the Circular Economy (CE), concept that is presented as an economic model capable of balancing economic growth with environmental protection. This new economic model, an alternative to the linear economy, is now incorporated into public policies, socio-ecological, and energy transition strategies in several nations around the globe. However, the scientific community debates extensively not only the clarity of the concept (Corvellec et al, 2022; Kirchherret al, 2017) but also its territorial dimension (Niang et al, 2020; Tapia et al, 2021; Veyssière et al, 2022). What are the boundaries of CE in theory and in practice? Where to set the boundaries of the impact of CE? Are those impacts merely technological?

Following the third and fourth industrial revolutions, technology mediates ever-more aspects of everyday life to an unprecedented respect. The shaping of those technologies will significantly impact how we both mediate and act upon our environment and one another. CE is at the centre of technological developments; therefore, it is an inherently cultural development, bounded by human ethical and aesthetic considerations (Pla-Julián & Guevara, 2019). Such considerations are spatially and politically (Millstein, 2017; Rancière, 2010) encoded in how we design, build, interact with, employ, or aestheticize technology. Based on model of the Doughnut proposed by Raworth (2018), this article will discuss the role of the aesthetics of care of the CE: understanding the fulfilling the social foundations and respecting the planetary boundaries as acts of care.

We believe that CE is informed by an understanding of Aesthetics as the “distribution of the sensible” (Rancière, 2013) that is inherently ethical and political in conjunction with our sense experience of everyday life (Saito, 2017). We consider the CE as a practice of care: as restorative, reparative and creative. Interpretation of the CE as an aesthetic act of care opens the potential for new forms of reasoning in relation to justice and democracy in society.

This article aims to discuss the ontological and epistemological boundaries of the CE to understand its practices as acts of care within an Aesthetics of Care (Saito, 2022). Then it will set some spatial boundaries to reflect on CE as a technology inherently bounded in space and time. Lastly, we will discuss how the aesthetics of care of the CE can open new forms of reasoning in relation to more sustainable geographies of circularity.

This article presents preliminary results of an Erasmus+ Action-KA220-HED for the education of Aesthetics and Ecology in TechEd. Discussing the ontological and epistemological boundaries of the CE could broaden its contribution to the SDGs (Schröder et al., 2019; Schroeder et al, 2019-B). Such reflection helps to conceive pedagogical methods focused on understanding the relationship of technology (CE) in society and promote pro-environmental behaviors (SDG4 and 12). Considering CE actions and acts of care (Black, 2018; Thompson, 2015) can help to close its contribution gap to the social sphere (Schroeder et al., 2019) and lay a foundation for a sustainable social transition (SDG 5,9,10,11,16,17).

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Exploring the role of plural values and intersectional diversity in tackling global biodiversity loss: a targeted review of the use of creative, deliberative and behavioural intervention methods in triggering transformative change

Prof. (Dr) Alex Franklin[1], Ms Agnes Zolyomi[1], Prof. (Dr) Ilkhom Soliev[2]
[1]Coventry University, Coventry, United Kingdom. [2]Martin Luther University of Halle-Wittenberg, Halle, Germany

Abstract

Continued loss of biodiversity now threatens both the biosphere and human life. System-wide transformative changes are needed, including altering practices, behaviour and values across a full spectrum of intrapersonal, interpersonal and institutional levels. But, what interventions have the highest transformative potential for societal change? And, what factors serve to shape the extent to which an intervention can trigger transformative change? In addressing these two questions, our particular interest in this paper is in better understanding the role of plural values and intersectionality in shaping our relations with biodiversity, nature, green space and the outdoors (as it is variously referred to) across both urban and rural settings; and in follow on, the contribution of behavioural, creative and deliberative methods for promoting transformative change. Interim findings are presented, drawn from a combination of a targeted literature review and a series of online workshops, which were undertaken towards the beginning of a three-year international project ('PLANET4B'). Both elements involved the participation of a multidisciplinary consortium of academic and practitioner partners with existing knowledge and experience of facilitating co-creative interventions in a range of key sectors as well as socio-cultural and environmental settings. This paper has cross-cutting relevance for a number of SDGs, including 3, 5, 10, 11, 14, 15 and 17.

Poster

THE 29TH INTERNATIONAL SUSTAINABLE DEVELOPMENT RESEARCH SOCIETY ISDRS Conference

What is Ecology? A core discipline in the interdisciplinary arena of environmental and sustainability research

Leon Maximiliano Rodrigues[1]

Introduction

From the most popular definition of "ecology" by Ernst Haeckel (1866), which says that Ecology is the study of "the organism's relationship with the environment", to the more objective and precise one by Charles Krebs (1972), Ecology has consolidated itself as a science and discipline. Krebs was able to express the specificity of ecology as a discipline, defining it as "the science that studies the interactions that determine the distribution and abundance of species".

However, Ecology, as well as other branches of Natural Sciences, initially focused on pristine natural environments, avoiding environments altered by humans. This made sense since a worldview prevailed where society and nature were perceived as separate things (Souza, 2020). Today we can no longer ignore the human influence in all ecological systems on the planet, even where humans are not there.

Therefore, Ecology should help to formulate positive and plausible visions for the relationships of society and ecosystems that can potentially sustain ecosystem services for long periods of time (Carpenter & Folke, 2006).

However, the great profusion in the use of Ecology theories, concepts and terms due to the emergence of environmental and sustainability issues, especially in recent decades, may have led to a superficial and mistaken understanding of Ecology theory by other fields of science. It is therefore important to understand how ecology integrates with other disciplines in the interdisciplinary arena.

Among the different visions/definitions of sustainability, the one that is most in line with an ecological vision is strong sustainability (e.g., Ayres, 2001), which fits into a systemic approach when considering nested economic, social and ecological systems, with the smaller system supporting by and dependent on the larger one, within which it is represented and with which it promotes exchanges (bidirectional feedbacks) (Fig. 1).

The application of ecological theory in Environmental and Sustainability Sciences — and in other fields — must take these aspects into account. In this sense, the present study sought to verify the use of ecological theory in different areas of knowledge.

Methodological and Philosophical Principles

(**1**) An initial survey was carried out in search engines to verify the Ecology terms most used in the literature. Then (**2**) a selection of a term was made according to the relevance in the search (step **1**) and based on the relationship with the ecological theory (preference for more comprehensive theories). Subsequently, a search was carried out (**3**) for applications of the term in the titles of references in Google Scholar, including only articles, book chapters and reports, sorted by relevance, until no new information was found in 50 consecutive titles. (**4**) The term was then analyzed under the optics of two mental structures: (**a**) mycelial thinking, an adaptation of the rhizomatic thinking of Deleuze & Guattari, 1980); and (**b**) the zone of consilience, an adaptation of the principles of consilience, by Whewell (1840), and consonance, by McMullin (2001) (Fig. 2).

Results and discussion

One of the most used ecology terms in the literature is "ecosystem". This was selected for its importance to ecological theory, being at the same time meaning, model and metaphor, and a complex, fundamental and widely useful ecological concept (Pickett & Cadenasso, 2002). The ecosystem is recognized as the functional and structural unit of Ecology. And its structure brings together two major components: the biota (or biocenosis or biological community) and the biotope (or ecotope or physical environment) (Fig. 3). And ecosystem has an organization, expressed in its "trophic levels and relationships", in the structure of communities, and in the metabolism, which controls the flows of energy and matter in the trophic network and between it and the environment. Like ecological theory, ecosystem theory must be considered in the application of related terms; and the same holds true for other theories of ecology.

Several areas of knowledge have applied the term ecosystem, such as: Environmental and Sustainability Sciences, Management and Business, Computer Science, Economics, Medical and Health Sciences and Education, among others. The most widely used term is "ecosystem service", followed by ecosystem health, ecosystem-based management, ecosystem management, ecosystem engineers, cultural ecosystem, business ecosystem, entrepreneurial ecosystem and others.

Some applications proved to be correct, such as 'ecosystem services' and 'ecosystem management', while others proved to be wrong, such as 'cultural ecosystem' and 'business ecosystem.

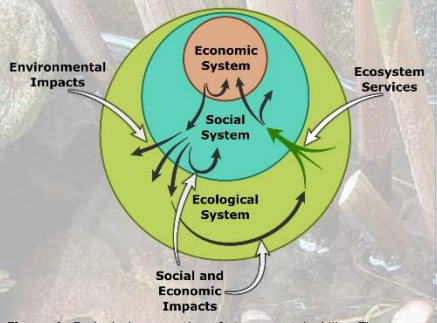

Figure 1. Ecological perspective of strong sustainability. The arrows represent fluxes of matter, energy and information.

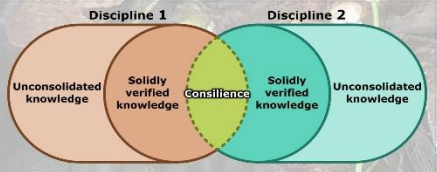

Figure 2. Consilience (or interdisciplinary) zone of knowledge, the zone of overlapping and consonance of knowledge from two (or more) disciplines.

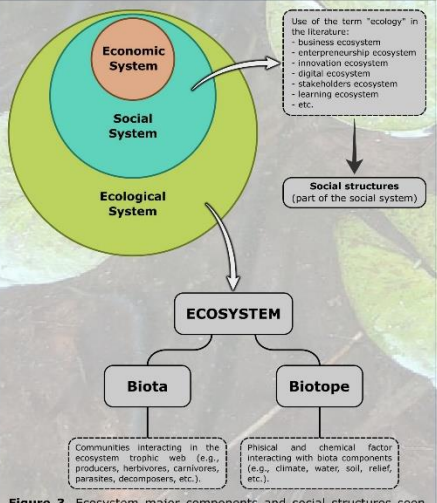

Figure 3. Ecosystem major components and social structures seen as ecosystems in the literature.

Discussion

The"[E]*cology can provide an answer to the question that worries the minds of many: why today nature is in such a disastrous state and how can we change anything?*" (Usmandjanovna, 2020, p. 53). Therefore, the theories of Ecology, as well as the concepts and terms of the framework of Ecology must be well understood and properly incorporated by other fields of knowledge. However, there seems to be a tendency for the meaning of terms to move away from the original as the field of application moves away from the original discipline. A "cordless phone" seems to occur, because in addition to the distorted 'importation' of terms from Ecology, the term is not always absorbed directly from Ecology, often being extracted from references outside the area of Ecology or even Biological Sciences, which often results in a misapplication of the term.

The structures studied in the references found are not ecological structures, but social structures (e.g., business ecosystem) or technological ones (e.g., internet of things ecosystem). The definition adopted and allegedly inherited from ecological theories is, in most cases, inherited from the general systems theory of Bertalanffy (1968), which contributed to the theory of ecosystems, but proposes to explain a broader range of types of living structures. On the other hand, the theoretical components that differentiate ecosystems as a specific type of system are ignored in the application of the term. Thus, it would be appropriate to refer to these structures as "systems" rather than "ecosystems".

The lack of dialogue between the Natural Sciences and the Social Sciences may be one of the factors explaining the problem. There is an embarrassing gulf between these two great fields, which seems to demand a radical new "world view", but with potentially monumental impact on human culture (Kjellman, 2006). On the other hand, part of the blame may lie with Ecology itself, since the way in which Ecology is understood and practiced as a science is also not unanimous. Much of the production in the field of Ecology follows the classical view based on the Cartesian-Newtonian paradigm, with a reductionist character, while some more recent currents seek a more systemic (e.g., Kjellman, 2006) or holistic (e.g., Santi, 2019) view, as it is referred to by some, or even as an ecological paradigm in certain fields of knowledge, (e.g., González-Márquez & Toledo, 2020; Joh, 2006). A systemic and integrative vision is important for Ecology to fulfill its role in the interdisciplinary arena and contribute to fields such as Sustainability Science.

Conclusions

If we consider that Ecology is a young science, but one that has acquired subtle relevance, it is necessary to consider strategies to improve and accelerate the inclusion of Ecology in the educational and governance agenda. Ecology was included in curricula only in the early 1970s (e.g., Chamberlin, 1973). It is not surprising that there is a gap in the ecological literacy of social actors and even the scientific community.

Considering the above, there is clearly a misunderstanding of ecological theories by other fields, especially outside the Biological Sciences. To remedy the identified problems and gaps and accelerate society's ecological (and environmental) literacy, Ecology disciplines should be incorporated into the curricula of courses that work in the fields of Environmental Sciences and Sustainability. For the same reasons, ecologists should be incorporated as active team members in research groups, government agencies, companies, and governance structures.

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[1] Leon Maximiliano Rodrigues, Track: 1.1a
Universidade Aberta (UAb), Universidade Estadual do Rio Grande do Sul (UERGS)

Video link: https://vimeo.com/841552526?share=copy

TRACK 1
Sustainability and Science

1c. Assessing sustainability

Abstracts

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A threefold approach to rescue the 2030 Agenda from failing

Prajal Pradhan
Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany. Bauhaus Earth, Berlin, Germany

Abstract

Countries are not on track to meet the 2030 Agenda for Sustainable Development which calls for transformative changes to shift the world onto a sustainable and resilient path. The 2030 Agenda comprises 17 Sustainable Development Goals (SDGs) and 169 targets to be achieved by 2030, balancing the three sustainability dimensions – social, economic, and environmental. So far, SDGs have had a limited transformative impact because of their selective implementation without considering their complex interactions. SDGs interact positively (i.e., synergies) or negatively (i.e., trade-offs) depending on context- and location-specific mechanisms. Failing to meet SDGs will negatively affect the lives of billions of people and worsen socioeconomic and environmental crises. Therefore, the next few years are crucial to accelerate SDG progress and adopt a post-2030 Agenda or a follow-up of SDGs. I propose three research avenues with a threefold scientific approach to address these urgent needs. The research avenues are systemic prioritization of SDGs, understanding the impacts of underachieving SDGs, and building a post-2030 Agenda based on scientific evidence. The threefold approach comprises quantitative analysis, qualitative analysis, and knowledge co-creation. Addressing the three research avenues can rescue the 2030 Agenda from failing by generating three novel understandings. The first is understanding mechanisms underlying SDG interactions and transformative actions to resolve the current trade-offs among SDGs, resulting in win-win solutions. The second is understanding the potential and limitations of SDGs in shifting the world towards a sustainable and resilient path. The third is to initiate a process to co-create a science-based post-2030 Agenda for sustainable transformation for building social prosperity and foundations within planetary boundaries. Generating these understandings requires combining quantitative and qualitative analyses with knowledge co-creation, i.e., a broad range of scientific and non-scientific knowledge and understanding.

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Full cost accounting methods for product sustainability assessment: proposing ground rules for an emerging field

dr. Walter Vermeulen[1], dr. Erik Roos Lindgreen[2]
[1]Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, Netherlands. [2]Department of Economics, University of Messina, Messina, Italy

Abstract

Many environmental and social impacts in product's value chains are currently unaccounted for in the price of products. Several methods exist to calculate both the pressures of such impacts, as well as their monetization. In the context of live cycle assessment (LCA), expressing environmental and social impacts in monetary terms allows for aggregation and easier communication. Many methods for monetization exist, with fundamental differences in their underlying monetization approach, accuracy, availability and application. Several scientific and consultancy initiatives have contributed to this development by introducing monetization methods that also use different methodologies. We reflect on the differences between such existing methods. First, we review the foundations of monetization and introduce a new categorization to align terminologies. We briefly put forward a summary of the connections between monetization and life-cycle assessment methods, since both categories of methods can be seen as the building blocks of existing full cost accounting methods. We then sketch the landscape and its challenges, after which we inventory current full cost accounting methods and, through interviews with their developers, provide insights into their underlying monetization philosophy, data sources and quality (monetary valuation methods), scoping, aggregation, and transparency. We find that methods are applying different and at various points conflicting approaches. The scope of the analyses is very diverse, while underlying theoretical and methodological choices are not always transparent. From this review, we will propose four exploratory ground rules for full cost accounting methods in the discussion section.

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Representative Life Cycle Inventory data for agricultural systems: the case of olive production

Dr Giovanni Mondello[1], Prof Giuseppe Saija[1], Dr Teresa Maria Gulotta[2], Prof Roberta Salomone[1], Prof Patrizia Primerano[2]
[1]Department of Economics, University of Messina, Messina, Italy. [2]Department of Engineering, University of Messina, Messina, Italy

Abstract

Despite the fundamental role of the LCA in assessing environmental sustainability, some issues related to its application still exist. Specifically, there is a common consensus among the international scientific community on the need for representative site-specific data to build proper Life Cycle Inventories (LCIs). This is particularly true for agri-food and agricultural products, for which the production processes commonly vary, depending on geographical, technological, biological, and environmental conditions. In this context, the aim of this study is to assess the potential environmental impacts related to the production of olives, through LCA, comparing two systems modelled using, on the one hand, data from Ecoinvent database, on the other, regional data collected through secondary sources. The aim is to understand if differences in terms of results may exist when data obtained from more representative secondary sources are used instead of data from commercial databases. The main findings underscore that using more representative regional data, instead of data from Ecoinvent, results in higher environmental impacts in all the investigated impact categories, except for acidification and photochemical oxidation. The results here presented permit highlighting the importance of using representative data, particularly when LCA is applied in the context of comparative analyses or environmental labels.

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THE CONTRIBUTION OF THE 2030 AGENDA AND THE SGD TO SUSTAINABILITY AND RESILIENCE IN ORGANIZATIONS

PhD Candidate Fabio Silva

University of Sao Paulo, Sao Paulo, Brazil

PHD CANDIDATE FABIO SILVA

Abstract

Systemic changes, unexpected and abrupt events with interconnected global risks, have been affecting people's lives, businesses, and the environment, demanding sustainable responses from organizations to face global challenges. Themes of resilience and sustainability, essential for organizations, have taken hold of recent business discussions. Given this context, organizations seek business strategies that develop their organizational resilience and corporate sustainability capabilities to deal with global risks. There is evidence that sustainability guidelines and practices in business can increase organizational resilience while enhancing corporate sustainability.

One of the largest initiatives in corporate sustainability in the world, the UN Global Compact, has the mission of engaging the business sector in sustainable and socially responsible actions and policies. Many organizations have adhered to the 2030 Agenda and the 17 Sustainable Development Goals (SDGs). Thus, this study aims to analyze whether the SDGs contributed to the organizational resilience and corporate sustainability of a business organization in the electricity sector - Eletrobras. Eletrobras is the largest company in the electricity sector in Latin America, a publicly traded private company. It has been a signatory to the UN Global Compact since 2006 and, in 2017, it made a commitment to the 2030 Agenda, developing a series of actions to incorporate the SDGs into its business strategy.

We conducted a case study with desk research of data and information between 2011 and 2020. We explored the dimensions of corporate sustainability and organizational resilience using theory, developing measurement scales, and conducting statistical tests. The process of adopting the 2030 Agenda and its SDGs for business management was analyzed and how this impacted corporate sustainability and, consequently, organizational resilience. Indicators were selected for corporate sustainability with 64 indicators distributed in four dimensions. Organizational resilience was composed of 39 indicators distributed in 5 dimensions. The large number of variables is a strategy to reflect the complexity and bring us as close as possible to the reality of the case study organization. The variables have equal weights for the composition of the dimensions. Statistical tests of linear regression, analysis of variance - ANOVA, and test of coefficients, T student test of Independent Samples were carried out, with the objective of showing the performance after the incorporation of the SDGs by Eletrobras of the variables of corporate sustainability and organizational resilience and the interrelationships between them. Corporate sustainability was considered as an independent variable, that is, the variable that will affect the organizational resilience variable.

Statistical evaluations show that the performance of corporate sustainability and organizational resilience of the company had an improvement in its performance after the incorporation of the SDGs. The results revealed that organizational resilience has a strong, positive, and significant correlation with corporate sustainability. It is estimated that the more current the year, the better the performance of corporate sustainability and, therefore, of organizational resilience. The incorporation of the SDGs proves, in this case, to be a fundamental element in organizations.

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Evaluation of mineral and water resources availability for Life Cycle Assessment

Miguel Roque dos Santos[1], Dr. João Joanaz de Melo[2], António Galvão[2]
[1]NOVA University of Lisbon, School of Science and Technology, Costa da Caparica, Portugal. [2]CENSE, NOVA University Lisbon, School of Science and Technology, Caparica, Portugal

MIGUEL ROQUE DOS SANTOS

DR. JOÃO JOANAZ DE MELO

Abstract

One of the greatest challenges associated with non-renewable natural resources is their finite nature. This characteristic means that eventually the resources may be exhausted if not well managed or conserved. The scarcity of a mineral resource is an important aspect to provide an orientation when procuring alternative resources. In particular, the current climate crisis has put enormous pressure on scarce mineral resources stocks in our attempt to achieve a swift energy transition. To carry out this management it is necessary to evaluate the current and future scarcity of the main raw materials and the environmental impacts of their extraction and transformations, in a circular economy perspective – using life cycle assessment (LCA) as a tool.

Resource use is an important indicator in LCA. Most methods only consider a dichotomy – renewable vs non-renewable. The reality is much more complex, and few methods try to address this problem. One such is method is EcoBlok, developed in NOVA University Lisbon. The goal of this research is to update the EcoBlok indicators "Resource" and "Water" – where resource scarcity is evaluated based on stock duration of mineral and biological resources, and water abstraction is assessed considering water stress. In order to assess global resource scarcity and water stress, it was necessary to compile and systematise a large set of global data drawn from various sources.

The analysis had two parts. The first part studied stock duration of mineral resources with a special focus on those which play or may play a key role in the energy transition, particularly fossil fuels and rare earths and metals. The second part studied water resources, considering water availability, abstraction, ecological and management constraints. The analysis was conducted at global and national levels. This research demonstrated it is possible to compile the global data required by EcoBlok indicators, at least at national level, and, if local information is available, also at subnational level. This approach could provide a potential improvement in global LCA indicators for resource extraction and water abstraction.

Key-words: Resource scarcity; Water stress; Energy transition; Life cycle analysis; Stock duration

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Sustainability Indicator Systems: from families to the regional level

Oscarina Martins[1], Sandra Caeiro[2]
[1]Universidade Aberta, Porto, Portugal. [2]Universidade Aberta, Lisboa, Portugal

Abstract

Sustainability indicator systems (SIS) are frameworks that combine multiple indicators to evaluate sustainability achievement in its manifold dimensions. They can be used to assess and report the progress toward Sustainable Development Goals, to monitor and improve sustainability performance and allow decision-makers to make informed decisions. These systems can be applied from an individual or family level to a broader spectrum such as regions or countries. Although they are constructed in these separate levels, they are interrelated and influence each other. Thus, it is needed to find means of integration between them. The aim of this work was to study how sustainability indicator systems are being integrated from families to a regional level. For that purpose, it was conducted a literature review, through a search in the databases of Web of Science, SCOPUS and EBSCO. The search was done in March of 2023 using the following equation of terms: ("sustainable indicator*" or "sustainability indicator*" or "indicator system*" or "sustainability assessment" or "sustainability system*" or "environmental assessment" or "environmental system*" or "environmental indicator*" or "integrated approach") and ("household*" or "housing" or "resident*") and ("scale*") and ("local" or "regional"). The inclusive criterion was the presence of the words in the title or the abstract, full text available and published in academic journals and peer-reviewed. The search found 240 papers. The preliminary results show that sustainability indicator systems rarely integrate different levels but are more often related to specific spaces or delimited groups of people, preferential using aggregation methods. Related to the family level, it can be identified that energy and water consumption as well as waste management are the most prevalent areas. When looking for sustainability integration at the community level, the items are related to access to public services, land use, transportation and community engagement. At the regional level, the methods used are the quantification of the natural resources use, economic development and governance. Further research is needed to develop an integrative framework for sustainability, from families to the regional level.

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Evaluation of Progress for Achieving Sustainable Development Goal 6 Targets in Malaysia

Dr Mohd Yusoff Ishak, M L A. BASEK
Department of Environment, Faculty of Forestry and Environment, Universiti Putra Malaysia, Serdang, Malaysia

Abstract

Water resource management has become more complicated and contentious in recent years as a result of water scarcity and pollution. Severe water scarcity has affected over two billion people and lowered quality of life. Thus, Sustainable Development Goal 6 on water and sanitation is fundamentally important and conditional to the achievement of sustainable water resources management. The purpose of this study is to analyze articles published in the subject categories of water research and water resources over a period from 2015 to 2022 in support of SDG6 and each of its targets midway of Agenda 2030 in Malaysia. The water research and water resources are especially related to SDG 6 with its eight global priorities that span the entire water cycle.

We use bibliometric analysis to assess and evaluate the field's scientific performance and report sustainability. The trend of journal from author's keyword, growth trend of the journal, and trend of different affiliations were also investigated to unravel the influence on SDG6 in Malaysia. This includes indicators most used to support management systems and communicate sustainability performance to stakeholders. After seven and half years running of SDG6, current knowledge on water and the trends in water research and water resources based on the Scopus database output using a list of 1057 terms suggested by the United Nations University for the field's scientific performance.in relation to Malaysia is investigated. We also focus on the immediate response required to redefine water scarcity and further improve evaluation methods and tools in order to provide insights and actionable recommendations for regional water scarcity reduction.

The findings indicated that additional research should be conducted to address water scarcity and shortages caused by water quality, as this is a critical component of increasing water usage efficiency by optimizing the water quality match between supplies and demands, in addition to saving physical volumes of water.

These findings suggest that more advocacy campaigns and trainings are needed to increase public awareness and capacity building especially for increasing people's engagement in an efficient water resources management. This would in turn support policy development and organizational learning through integration of solution and strategies to balance the 5P of SDG and on how to achieve SDG by the end of 2030.

Full Papers

Representative Life Cycle Inventory data for agricultural systems: the case of olive production

Giovanni Mondello[1], Giuseppe Saija[2], Teresa Maria Gulotta3, Roberta Salomone[4], Patrizia Primerano[5]

[1] Department of Economics, Sustainability Lab, University of Messina, via dei Verdi, 75, Messina, Italy
[2] Department of Economics, Sustainability Lab, University of Messina, via dei Verdi, 75, Messina, Italy
[3] Department of Engineering, University of Messina, Contrada Di Dio, Messina, Italy
[4] Department of Economics, Sustainability Lab, University of Messina, via dei Verdi, 75, Messina, Italy
[5] Department of Engineering, University of Messina, Contrada Di Dio, Messina, Italy

[1] giovanni.mondello@unime.it

Abstract. Despite the fundamental role of the LCA in assessing environmental sustainability, some issues related to its application still exist. Specifically, there is a common consensus among the international scientific community on the need for representative site-specific data to build proper Life Cycle Inventories (LCIs). This is particularly true for agri-food and agricultural products, for which the production processes commonly vary, depending on geographical, technological, biological, and environmental conditions. In this context, the aim of this study is to assess the potential environmental impacts related to the production of olives, through LCA, comparing two systems modelled using, on the one hand, data from Ecoinvent database, on the other, regional data collected through secondary sources. The aim is to understand if differences in terms of results may exist when data obtained from more representative secondary sources are used instead of data from commercial databases. The main findings underscore that using more representative regional data, instead of data from Ecoinvent, results in higher environmental impacts in all the investigated impact categories, except for acidification and photochemical oxidation. The results here presented permit highlighting the importance of using representative data, particularly when LCA is applied in the context of comparative analyses or environmental labels.

1. Introduction

The agrifood sector is one of the most environmentally impactful production systems, contributing, for example, to one-third of the global greenhouse gas emissions produced by anthropogenic sources. Indeed, focusing on a life cycle perspective, the emissions caused by agrifood systems, in terms of climate change impacts, were equal to 16 billion tonnes of carbon dioxide equivalent (CO_2eq), in 2020. These emissions decreased for 3% in 2019, due to the COVID-19 related issues, but grown of 9% since 2000 (FAO, 2022). Among the various methods used for evaluating the environmental impacts connected to production processes or systems, the Life Cycle Assessment (LCA) is considered one of the most adopted for assessing agricultural productions, and its use is constantly increasing (Notarnicola et al., 2017). According to the ISO 14040 (ISO, 2006a), the LCA method allows the assessment of the potential environmental impacts of a product, process, or service among its whole life cycle, thus from raw material extraction, throughout transformation and manufacturing, transport, use, and end of life. Among the four main phases which characterise the LCA method (i.e., goal and scope definition, inventory analysis, impact assessment, and interpretation), the Life Cycle Inventory (LCI) refers to the collection and quantification of the data, in terms of inputs and outputs, related to the life cycle of the product, process, or service under investigation (ISO, 2006a); it is considered as the most intensive work and time-spending phase of a LCA study (Laca, Herrero, and Díaz, 2011). Furthermore, despite the LCA is considered a not-site specific method, there is common

consensus among scholars for the need of site-specific data to build a representative LCI (Frischknecht et al., 2019), particularly when the LCA study is applied for assessing agrifood products (Notarnicola et al., 2022). Indeed, production process in agrifood sector and, specifically, agricultural activities are highly diversified due to technological, biological, and environmental factors related to the geographical context, thus varying among countries and regions (Liliane and Charles, 2020). This is particularly true for olive and olive oil production (Fernández-Lobato et al., 2021), which represents one of the most important cultivation practices in the Mediterranean regions (Grillakis, Kapetanakis, and Goumenaki, 2022).

Considering that the LCI should contain site-specific inputs and outputs, primary sources, directly collected through companies, shall be used in order to maximise the representativeness for the investigated system. Despite this, when foreground data are not available, the LCA practitioner shall adopt secondary data, that are commonly obtained through dedicated databases. In this regard, Mondello et al. (2022) carried out a literature review to analyse the use of secondary data from databases in LCA studies of olive oil, also focusing on the declared geographical boundaries among the investigated articles. The authors highlighted that most of the studies, which where commonly focused the Italian context, adopted Ecoinvent database (Ecoinvent, 2023) as source for secondary data. Despite this, Notarnicola et al. (2022) pointed out that the only dataset available in Ecoinvent and related to the olive production in Italy (i.e., "olive production at farm") contains 70 inputs and outputs, of which only 4 are related to the Italian context, while the others are referred to global or "Rest of the World" context. This may result in missing the representativeness of the LCI adopted for assessing olive or olive oil productions as well as in creating potential biases in the outcomes from the LCA study. Thus, there is the need of national and regional datasets that would permit to obtain a representative LCI in order to account the intrinsic and extrinsic factors, related to specific geographical boundaries, that characterise the agricultural production processes and related products. In this context, the project "Promoting Agrifood Sustainability: Development of an Italian Life Cycle Inventory Database of Agri-Food Products (ILCIDAF)" (PRIN – Progetti di Ricerca di Interesse Nazionale 2017- Prot. 2017EC9WF2, sector ERC SH2, Linea C – financed by the Ministry of University and Research) aims to develop a database for four Italian agri-food products (olive oil, citrus, wine, and pasta), to be used as secondary source in LCA study. Starting from the scope of the ILCIDAF project, the goal of the study here presented is to compare, through LCA, the potential environmental impacts related to the production of olives, using regional data from secondary sources referred to the Italian context and data from Ecoinvent database. The aim is to understand if differences in terms of results may exist when data gathered from more representative regional LCI are used instead of data from commercial databases. In addition, the approach adopted to model the regional Italian dataset is proposed. The geographical reference of the study is related to the Apulia region (Italy), which represents the main Italian region in terms of olive production; this region is also considered as the reference for the dataset related to olive production in Italy available in Ecoinvent database.

2. Methodology

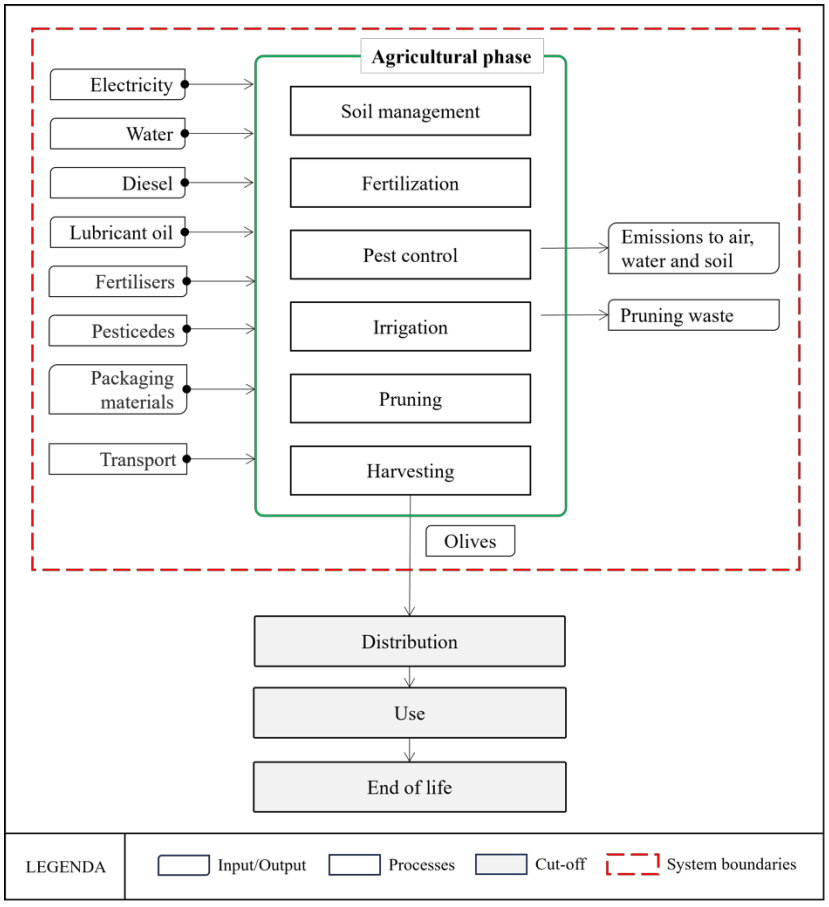
This section reports and describes the different LCA phase, according to the ISO 14040 (ISO, 2006a) and ISO 14044 (ISO, 2006b) standards, applied for carrying out the comparative analysis between the two investigated olive production systems.

2.1 Goal and scope definition

The goal of this study is to assess the environmental impacts related to olive production in Italy, by comparing two different system, specifically one modelled using regional LCI data collected through secondary sources, that are representative for Apulia region (System 1 - ILCIDAF), and one system in which data for the same region are accounted through the Ecoinvent database (System 2 - Ecoinvent). The scope is to investigate the variability, and its extent, in terms of the results, between the two investigated systems and the related inventory data. The functional unit selected to carry out the analysis is represented by 1 kg of olives. This functional unit has been selected according to the reference unit used in the dataset reported in Ecoinvent. System boundaries (figure 1) follow a cradle-to-gate approach, thus including all the agricultural processes that are involved in olive production, such as soil management, fertilisers and pesticides use, electricity and water consumption, as well as pruning waste treatment. Cut-off criteria include the distribution, use, and end-of-life phases. Due to the lack of regional LCI data specifically related to the packaging of fertilisers and pesticides, and to the amount of pruning waste produced, some assumptions have been made. In particular,

starting from the data included in Ecoinvent and considering the reference flow in terms of olive yield reported in the database, these missing data were accounted through proportionally relating their amounts to the olive yield for the Apulia region obtained by means of statistical sources.

Figure 1. System boundaries related to the investigated systems.



2.2 Inventory analysis

The LCI related to the System 1 has been modelled considering different secondary sources that are representative for the Apulia region. Table 1 shows the inventory related to System 1 as well as the sources used for data collection and calculation. In particular, four main types of secondary data have been used to build the LCI of System 1: i) the Italian National Institute of Statistics (ISTAT, 2022) for accounting the olive yield and the cultivated land in Apulia region, ii) the Integrated Production Regulations (IPR) for Apulia region (Regione Puglia, 2021) as source for data related to fertilisers and pesticides use, iii) the technical handbook of agriculture provided by Ribaudo (2017) to collect the data related to irrigation and soil management, and iv) the international scientific literature to calculate the emissions caused by fertilisers, pesticides and diesel use, as well as the emissions linked to natural phenomena (i.e., heavy metals), and the distances for the transportation of fertilisers and pesticides.

Regarding the System 2, the dataset “Olive {IT}| olive production | Cut-off, U” from Ecoinvent 3.6 (Moreno Ruiz et al., 2019) has been used for accounting the data related to commercial database. It is important to highlight that some inputs and outputs reported in the Ecoinvent dataset are not included in the regional dataset. For example, despite the glyphosate is accounted for pest control in olive production, in Ecoinvent, the IPR for Apulia region reports that this pesticide is not allowed to be adopted in agricultural practices in Italy, thus it has been omitted in the regional LCI, as well as its related emissions to air, water, and soil.

Table 1. Life Cycle Inventory and data sources related to 1 kg of olive produced in Apulia region (System 1).

Input/Output		Unit	Amount	Data source
Input	N fertiliser	kg	1.50E-02	Regione Puglia, 2021
	P fertiliser	kg	6.25E-03	Regione Puglia, 2021
	K fertiliser	kg	1.50E-02	Regione Puglia, 2021
	Copper (pesticide)	kg	8.89E-04	Regione Puglia, 2021
	Mancozeb (pesticide)	kg	5.56E-04	Regione Puglia, 2021
	Packaging (fertiliser)	kg	1,32E-01	Moreno Ruiz et al., 2019
	Packaging (pesticide)	kg	1,70E-02	Moreno Ruiz et al., 2019
Input	Water (irrigation)	m3	2.06E-01	Ribaudo, 2017
	Electricity (irrigation)	kWh	1.09E-01	Ribaudo, 2017
	Diesel (soil management)	kg	1.66E-02	Ribaudo, 2017
	Lubricating oil (soil management)	kg	3.13E-04	Ribaudo, 2017
	Transport (fertiliser and pesticide)	tkm	5.32E-02	Eurostat, 2022
Output (emissions to air)	Ammonia (fertiliser)	kg	1.80E-03	Zampori and Pant, 2019
	Dinitrogen monoxide (fertiliser)	kg	3.30E-04	Zampori and Pant, 2019
	Nitrogen oxides (fertiliser)	kg	6.93E-05	Zampori and Pant, 2019
	Copper (pesticide)	kg	8.00E-05	Zampori and Pant, 2019
	Mancozeb (pesticide)	kg	5.00E-05	Zampori and Pant, 2019
	Ammonia (diesel)	kg	3.33E-07	Nemecek and Kägi, 2007
	Benzene (diesel)	kg	1.21E-07	Nemecek and Kägi, 2007
	Benzo(a)pyrene (diesel)	kg	4.99E-13	Nemecek and Kägi, 2007
	Cadmium (diesel)	kg	1.66E-13	Nemecek and Kägi, 2007
	Carbon dioxide, fossil (diesel)	kg	5.19E-02	Nemecek and Kägi, 2007
	Carbon monoxide, fossil (diesel)	kg	9.03E-05	Nemecek and Kägi, 2007
	Chromium (diesel)	kg	8.31E-10	Nemecek and Kägi, 2007
	Copper (diesel)	kg	2.83E-08	Nemecek and Kägi, 2007

	Dinitrogen monoxide (diesel)	kg	2.00E-06	Nemecek and Kägi, 2007
	Heat, waste (diesel)	MJ	7.55E-04	Nemecek and Kägi, 2007
	Methane (diesel)	kg	2.14E-06	Nemecek and Kägi, 2007
	Nickel (diesel)	kg	1.16E-09	Nemecek and Kägi, 2007
	Nitrogen monoxide (diesel)	kg	6.95E-04	Nemecek and Kägi, 2007
	NMVOC (diesel)	kg	4.41E-05	Nemecek and Kägi, 2007
	Particulates (diesel)	kg	7.18E-05	Nemecek and Kägi, 2007
	Sulphur dioxide (diesel)	kg	1.68E-05	Nemecek and Kägi, 2007
	Zinc (diesel)	kg	1.66E-08	Nemecek and Kägi, 2007

Table 1. Continue.

Input/Output		**Unit**	**Amount**	**Data source**
Output (emissions to groundwater)	Nitrate (fertiliser)	kg	8.10E-02	Zampori and Pant, 2019
	Cadmium (heavy metals)	kg	1.65E-07	Notarnicola et al. 2023
	Chromium (heavy metals)	kg	1.02E-05	Notarnicola et al. 2023
	Copper (heavy metals)	kg	1.52E-06	Notarnicola et al. 2023
	Lead (heavy metals)	kg	2.67E-07	Notarnicola et al. 2023
	Mercury (heavy metals)	kg	4.28E-11	Notarnicola et al. 2023
	Nickel (heavy metals)	kg	0.00E+00	Notarnicola et al. 2023
	Zinc (heavy metals)	kg	1.22E-06	Notarnicola et al. 2023
Output (emissions to river)	Phosphate (fertiliser)	kg	5.58E-04	Zampori and Pant, 2019
	Cadmium (heavy metals)	kg	1.95E-08	Notarnicola et al. 2023
	Chromium (heavy metals)	kg	1.06E-05	Notarnicola et al. 2023
	Copper (heavy metals)	kg	4.96E-06	Notarnicola et al. 2023
	Lead (heavy metals)	kg	1.32E-06	Notarnicola et al. 2023
	Mercury (heavy metals)	kg	2.92E-10	Notarnicola et al. 2023
	Nickel (heavy metals)	kg	6.81E-06	Notarnicola et al. 2023
	Zinc (heavy metals)	kg	7.43E-06	Notarnicola et al. 2023

	Copper (pesticide)	kg	8.89E-06	Zampori and Pant, 2019
	Mancozeb (pesticide)	kg	5.56E-06	Zampori and Pant, 2019
Output (emissions to soil)	Cadmium (heavy metals)	kg	1.13E-06	Notarnicola et al. 2023
	Chromium (heavy metals)	kg	-6.05E-08	Notarnicola et al. 2023
	Copper (heavy metals)	kg	-1.89E-06	Notarnicola et al. 2023
	Lead (heavy metals)	kg	4.11E-07	Notarnicola et al. 2023
	Mercury (heavy metals)	kg	7.20E-09	Notarnicola et al. 2023
	Nickel (heavy metals)	kg	-2.83E-06	Notarnicola et al. 2023
	Zinc (heavy metals)	kg	1.89E-05	Notarnicola et al. 2023
	Copper (pesticide)	kg	8.00E-04	Zampori and Pant, 2019
	Mancozeb (pesticide)	kg	5.00E-04	Zampori and Pant, 2019
Output (waste)	Waste wood, untreated	kg	6,86E-01	Moreno Ruiz et al., 2019

2.3 Impact assessment and interpretation

The impact assessment has been performed using the CML-IA baseline method, which includes 11 impact categories (i.e., abiotic depletion, abiotic depletion (fossil fuel) global warming – GWP100a, ozone layer depletion, human toxicity, fresh water aquatic ecotoxicity, marina aquatic ecotoxicity, terrestrial ecotoxicity, photochemical oxidation, acidification, and eutrophication). This method has been selected in order to obtain a detailed picture of the environmental performance of the investigated systems, and to point out how the contribution to the environmental impacts of System 1 and System 2 may vary among different impact categories. Furthermore, the results have been interpretated by analysing the percentage variance, in terms of environmental impacts, between the two systems.

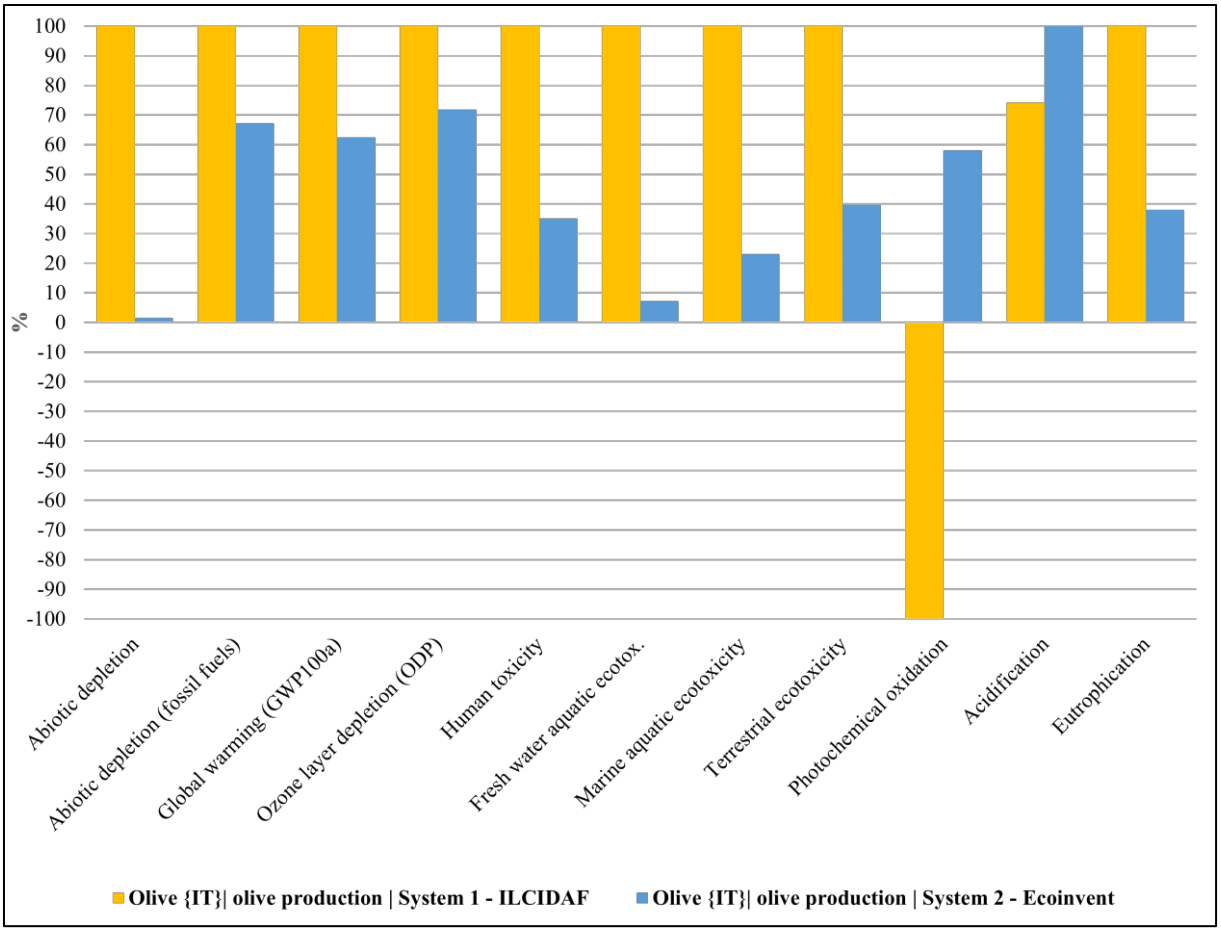
3. Results and Discussion

The results obtained from the comparative analysis are reported in figure 2. The main findings underscore that System 1, in which the LCI has been built using representative secondary data for olive production in Apulia region, causes the highest contribution in all the investigated impact categories, except for photochemical oxidation and acidification, in which the main environmental impacts are related to the Ecoinvent dataset (System 2). The higher difference in terms of contribution to environmental impacts between System 1 and System 2 emerges in the impact category related to abiotic depletion, in which the contribution of System 1 (9.95E-06 kg Sb eq per 1 kg of olive) is about 98% higher than System 2 (1.55E-07 kg Sb eq per 1 kg of olive). An analysis in depth underscores that the highest impacts in terms of abiotic depletion caused by the System 1 are due to use of copper for pest control. Indeed, despite this pesticide is included in both the system, the amount of copper calculated for System 1, using the IPR for Apulia region, is much higher than the amount accounted in Ecoinvent through scientific literature. On the contrary the lowest difference, in terms of contribution to the environmental impacts of the two investigated systems, emerges in the ozone layer depletion impact category, for which System 1 causes 3.92E-08 kg CFC-11 eq per 1 kg of olive, while System 2 contributes for 2.81E-08 kg CFC-11 eq per 1 kg of olive. In this regard, the higher contribution of System 1 is due to the diesel consumption in the machineries adopted in soil management practices. Focusing on the global warming, which represent one the most important impact categories to be evaluated in agricultural productions, the results shows that the contribution of System 1 (0.395 kg CO_2 eq per 1 kg of olive) is about 40% higher than System 2 (0.247 kg CO_2 eq per 1 kg of olive).

This is because of the higher amount of inorganic nitrogen and potassium fertilisers, that contribute to the impacts respectively for 13.8% and 11.6%. As for the copper used as pesticide, the data related to inorganic fertilisers were also collected through IPR for Apulia region.

In addition, the results show that System 1 causes an environmental benefit in terms of photochemical oxidation impact, when compared to System 2. Those benefits are mainly due the treatment of pruning waste, for which an open burning process is considered. Despite this, it is important to point out that some assumptions were defined in order to account the amount of pruning waste produced in System 1, because of the lack of related site-specific regionalised data. In particular, this data has been assumed by proportionally relating the amount of pruning waste reported in Ecoinvent database to the olive yield related the Apulia region, for which data were collected through regional statistic sources. Instead, regarding the acidification impact, the results underscore that the highest contribution is related to System 2, specifically due to the use of glyphosate and the tillage activities. As previously stated, although Ecoinvent dataset reports the glyphosate as input for pest control in olive production in Apulia region, this pesticide is not currently allowed in Italy. This highlights the importance of using a LCI that includes representative data for the geographical context related to the analysed system.

Figure 2. Contribution analysis to the environmental impacts of System 1 and System 2 (characterised results - CML-IA baseline method).



The outcomes obtained from the study has been further interpreted by calculating the percentage variance between the environmental impacts resulted for System 1 and System 2. As shown in table 2, a remarkable variance occurs between the two systems. In particular, the highest percentage variance is related to the results in term of abiotic depletion (98.44%), followed by freshwater aquatic ecotoxicity (92.77%), and marine aquatic ecotoxicity (76.99%). On the contrary, the lower variance was identified in ozone layer depletion impact category (28.24%), followed by abiotic depletion (fossil fuels) (32.84%). Regarding the impacts in terms of photochemical oxidation, the percentage variance resulted from the analysis is equal to -158.11%. This value is because the treatment of wood waste in System 1 causes negative environmental impacts.

Table 2. Potential environmental impacts of System 1 and System 2 and related percentage variance (characterised results - CML-IA baseline method).

Impact category	Unit	Olive {IT}| olive production | System 1 - ILCIDAF	Olive {IT}| olive production | System 2 - Ecoinvent	Percentage variance
Abiotic depletion	kg Sb eq	9.95E-06	1.55E-07	98.44%
Abiotic depletion (fossil fuels)	MJ	4.19	2.81	32.84%
Global warming (GWP100a)	kg CO_2 eq	0.39	0.25	37.56%
Ozone layer depletion	kg CFC-11 eq	3.92E-08	2,81E-08	28.24%
Human toxicity	kg 1,4-DB eq	0.85	0.29	64.95%
Fresh water aquatic ecotoxicity	kg 1,4-DB eq	0.77	0.06	92.77%
Marine aquatic ecotoxicity	kg 1,4-DB eq	542.52	124.83	76.99%
Terrestrial ecotoxicity	kg 1,4-DB eq	0.01	0.05	60.29%
Photochemical oxidation	kg C_2H_4 eq	-2.21E-04	1.28E-04	-158.11%
Acidification	kg SO_2 eq	0.005	0.007	-34.71%
Eutrophication	kg PO_4^{---} eq	0.01	0.004	62.02%

4. Conclusion

The aim of this study was to analysis if potential differences in terms of results may exist when data gathered from more representative regional LCI are used instead of data from commercial databases, in LCA study applied to agricultural and agrifood productions. In this regard, the potential environmental impacts of olive production at Italian regional level were evaluated. In particular, a comparative analysis was preformed between a system, in which the LCI has been modelled adopting representative secondary data for Apulia region (System 1 - ILCIDAF), and one in which data were collected using the Ecoinvent database (System 2 - Ecoinvent). The main findings underscored that System 1 causes a higher contribution to the environmental impacts in all the investigated impact categories, when compared to System 2. This is except for photochemical oxidation and acidification in which the highest contribution was connected to the LCI related to the Ecoinvent database. Furthermore, a high variability in terms of percentage variance between the two systems has been pointed out.

The results obtained from this analysis permits to provide some valuable consideration related to the need and the use of representative regionalised LCI, in LCA studied applied to the agrifood sector. First, considering that the datasets in Ecoinvent commonly include data gathered from scientific literature, this may result in accounting data that are not directly referred to the geographical context. Indeed, as pointed out in the present analysis, the inventory in Ecoinvent includes some inputs that should not be included in a site-specific inventory related to regional context, because they may be outdate, obsolete or not allowed. For example, despite the glyphosate is classified, by the Italian regulation, as a not allowed chemical product to be used for pest control in agricultural practices for olive production, it is included in the inventory related to the olive production in Ecoinvent, causing a high contribution to the environmental impacts in term of acidification. The importance of using representative data has been also highlighted by the high variability, in terms of results, among the investigated systems. This is particularly true when the LCA method and

related inventories are used in the context of comparative analysis or environmental labels. Indeed, the use of not site-specific data may result in missing the intrinsic and extrinsic characteristics of the agricultural products under investigation. This may cause biases, specifically when comparative analyses are performed for identifying potential strategies for improvement. Similar issues may occur when companies need to certify through environmental labels their agrifood products. Considering for example the Environmental Product Declaration (EPD) (EPD International, 2023), which aims at providing information, through a declaration that is verified by an independent verifier, about the environmental performance of a product, the utilisation of not representative data may result in accounting environmental impacts related to the products, that may be not fully reliable for the purpose of the label.

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Evaluation of resource scarcity for life cycle analysis

Miguel Roque dos Santos[1], João Joanaz de Melo[2] and António Galvão[3]

[1] NOVA Univesity Lisbon
[2] CENSE, NOVA University Lisbon
[3] CENSE, NOVA University Lisbon

[1] mard.santos@campus.fct.unl.pt; [2]jjm@fct.unl.pt; [3]amg13172@campus.fct.unl.pt

Abstract. One of the greatest challenges associated with non-renewable natural resources is their finite nature. The current climate crisis has put added pressure on scarce resources stocks in our attempt to achieve a swift energy transition. An important tool to design products and processes is life cycle assessment (LCA). Resource use is an important indicator in LCA. The goal of this line of research is to explore available information in global open-access data bases, to compute practical indicators on resource scarcity. This paper focuses on water and mineral resources. The main indicators selected to describe sacarcity are, respectively, water stress for water abstraction, and stock duration for mineral resources. Available information and our analysis suggest that current patterns of exploitation, both of water and of minerals, are often unsustainable, with negative social, economic and ecological consequences. 30% of the countries studied are affected by water stress; 60% of minerals reviewed have a low stock duration, including most of those critical for the energy transition. Those risks can be reduced by considering the impacts of decisions that lead to resource depletion. Good information on resource scarcity plays a key role in more robust life cycle assessment.

1. Introduction

The Industrial Revolution marked an important turning point through the widespread use of non-renewable resources such as coal and oil, which were key to economic development and population growth around the world. These factors led to increased pressures on resources due to rising demand and usage, resulting in reduced availability. This scarcity has caused shortages of various resources such as minerals or water, thereby exacerbating economic and social inequalities among countries and regions. To comprehend the complexity of interactions among resources, society, and the environment, an in-depth study of resource scarcity becomes essential.

The primary objective of this paper is to assess resource scarcity on a global scale, focusing on critical water and mineral resources. It utilizes information from open sources and calculates scarcity indicators relevant for decision-making and particularly to Life Cycle Assessment (LCA).

The study seeks to systematize as much data as possible on a global scale, discretized at least at national level, regarding water abstraction and mineral resource extraction.

2. Literature review

The term "natural resources" refers to materials found in nature that can be used for human benefit. They are crucial for human survival and development, supporting economic and social growth. These resources can be utilized in various sectors such as energy production, agriculture, construction, manufacturing, and healthcare. However, their use can have negative environmental and social impacts, including depletion and environmental degradation (Tietenberg, 2017)[1]. Natural resources can be divided into renewable (e.g., wind, solar) and non-renewable (e.g., fossil fuels, minerals) (Harris, 2018)[2]. Sustainable management of natural resources requires policies that balance economic growth with environmental protection, promoting renewable energy and sustainable consumption. It is also important to respect the rights and livelihoods of local communities (EEA, 2022)[3].

The terms "resource" and "reserve" have distinct meanings in natural resource management. A resource refers to a potentially economically extractable natural material, while reserves are the portion of the resource

that can be extracted using existing technology for economic gain (USGS, 2021)[4]. The difference between the two terms is crucial for accurately estimating resource availability and planning for sustainable management. Estimating reserves involves assessing the technical and economic feasibility of extraction, considering factors such as resource quality, quantity, extraction costs, and market demand. Estimating reserves can be challenging due to changing economic and technological conditions. Additionally, reserves can be influenced by environmental factors such as natural disasters and climate change, which can impact the ability to extract and utilize a particular resource (Demirmen, 2007)[5]. Accurate reserve estimation is important for industry stakeholders and public authorities to plan for sustainable resource management.

Resource scarcity can be defined as a situation in which the demand for a particular resource exceeds its supply, leading to depletion or exhaustion (UNEP, 2005)[6]. Resource scarcity can be caused by various factors, including population growth, excessive consumption, or climate change. It is projected that the global population will reach 9.7 billion by 2050, increasing the demand for food, water, and energy (United Nations, 2019)[7]. Excessive consumption is another cause of resource scarcity, where individuals or nations consume resources at a rate that exceeds their regenerative capacity (UNEP, 2011)[8]. Climate change, driven by human activities such as burning fossil fuels, deforestation, and industrialization, is also a significant contributor to resource scarcity (IPCC, 2018)[9].

Resource scarcity poses a significant challenge for humanity, and its causes are complex and multifaceted. Assessing resource scarcity requires a comprehensive approach that considers the interaction between environmental, social, and economic factors.

The assessment of resource scarcity is crucial for evaluating resource availability and promoting sustainable utilization. It helps identify areas experiencing increasing scarcity and informs the development of management and conservation strategies. For example, assessing water scarcity aids in identifying areas with shortages and exploring alternative sources like desalination (EC, 2018)[10]. Policymakers benefit from resource scarcity assessment by understanding the need for regulations to ensure sustainable resource use. Additionally, it drives innovation and technological advancements to meet growing resource demands (Tsuboi, 2019)[11].

The transition to a carbon-neutral economy has become a global priority, driven by the need to reduce greenhouse gas emissions and mitigate climate change (IPCC, 2018)[9]. This transition involves shifting to renewable energy sources, improving energy efficiency, and decarbonizing existing energy systems (IEA, 2022)[12]. The adoption of renewable energy has been increasing, with solar and wind power leading the way (IEA, 2021)[13]. Energy efficiency plays a crucial role in reducing environmental impact and achieving sustainable development (IEA, 2022)[14]. Additionally, the demand for mineral resources, such as lithium and cobalt, crucial to produce carbon neutral technologies, is expected to grow as the transition to a low-carbon economy intensifies (UNEP, 2011)[8]. The successful energy transition requires collaboration across sectors and the deployment of innovative technologies.

The Life Cycle Assessment (LCA) methodology is used to evaluate the environmental impacts of a product or process throughout its entire life cycle, providing a comprehensive understanding of its environmental effects (UNEP, 2011)[8]. LCA helps identify areas for improvement and supports informed decision-making towards more sustainable options (ISO, 2006)[15]. It has been widely applied in various sectors, such as agriculture and transportation, to assess the environmental performance of products and processes. International organizations like the ISO and UNEP have developed guidelines and standards to ensure consistent and reliable LCA studies.

One of the key aspects of LCA is considering resource use and associated environmental impacts (Finnveden et al., 2009)[16]. It helps identify critical resources in product life cycles and facilitates strategies for resource efficiency and environmental impact reduction. Integrating resource scarcity assessment into LCA enables comprehensive environmental evaluations and supports the development of sustainable product design and production practices (Guinée et al., 2011)[17]. Overall, resource scarcity assessment is essential for promoting sustainable resource management and reducing environmental impacts in product life cycle.

3. Methodology

3.1. Data collection

Data sources were reviewed for the largest possible scope at global level, robustness and comparability. Ultimately the data analysed in the paper were collected from three main sources: the Food and Agriculture Organisation (FAO) of the UN, the United States Geological Survey (USGS) and Beyond Petroleum (BP)

Energy Outlook. The hydrological data collected from FAO ranges from 2016 to 2020 and covers 152 countries. Data on mineral reserves and production collected from the USGS ranges from 2017 to 2021 and considers 64 minerals. Fossil fuels information was collected from BP and ranges from 2017 to 2021.

3.2. Resource scarcity indicators

The main indicator used to describe water scarcity was water stress, which has been widely used by many. In this paper we followed the formulation of FAO[19] :

$$\text{WS} = \frac{\text{TFW } (\text{km}^3/\text{year})}{\text{TRR } (\text{km}^3/\text{year}) - \text{EF } (\text{km}^3/\text{year})}$$

WS = water stress
TFW = total freshwater withdrawn
EF = quantity of freshwater flows needed to sustain ecosystems and human livelihoods
TRR = total renewable resources

In this paper the analysis was conducted by country, but the same principles and formula hold at the scale of the hydrographic basin or sub-basin, if the necessary information is available.

Note that water quality and the resulting ecosystem services are excluded from this formulation. Methods for calculating ecological flows are highly variable and range from global estimates to comprehensive river basin assessments. To better understand the influence of the EF definition, the ratio TFW/TRR and the ratio EF/TRR were also calculated.

The main indicator used to describe mineral resource scarcity was stock duration, using the following formula:

$$\text{Stock duration (years)} = \frac{\text{Average proved reserves (kt)}}{\text{Average annual production (kt/year)}}$$

In this paper the analysis privileged the global level (with some disagregation by continent or country) because most of the mineral resources reviewed are global commodities. Nevertheless, the same principles and formula hold at any geographical scale appropriate to the market of the resource, if the necessary information is available.

3.3. Application of resource scarcity indicators in LCA

There are several LCA methods that have been developed and used over the years to facilitate the analysis of environmental impacts associated with products, processes, or systems throughout their life cycle, e.g. CML, ReCiPe, Eco-Indicator 99, EPS and EcoBlok.

The EcoBlok method was developed at NOVA University Lisbon, with the main objective of standardizing the implementation of a quantitative environmental label for any product, whether goods or services, calculated using a life cycle approach (Melo et al, 2010)[18]. This method considers six key performance indicators (KPI): (i) water abstraction, (ii) resource extraction, (iii) land use, (iv) greenhouse gas emissions, (v) air pollutant emissions, and (vi) pollutant emissions to water and soil. In this paper we explore the use of resource scarcity information to compute two of those indicators, water abstraction and the mineral component of resource extraction (the method also contemplates biomass extraction, but this component will not be discusssed in this paper).

All KPI in the EcoBlok method use the following general equation:

$$KPIi = \sum Qij \,.\, feqij$$

KPIi - key indicator i expressed in equivalent units
Qij - physical quantity of variable j for key indicator i
feqij - equivalence factor for variable j, key indicator i, representing its significance

The basic principle is to penalise, with an adimensional equivalence factor (feq), variables that are proportionally more significant for the performance of each KPI. This approach has been widely used to create aggregate indexes e.g. for global warming, acidification or toxicity, in LCA studies and other applications. In the EcoBlok method the same logic is used to aggregate the "resources" KPI. In the case of water abstraction and resource extraction, a "sustainable" threshold is defined above which feq > 1, while below that threshold feq = 1.

Two different approaches can be adopted for the calculation of the equivalence factor for water abstraction feqWA. The first is based on water stress, considering the environmental flow (feqWA1); the second uses the simpler ratio TFW/TRR (feqWA2). The two formulas are the following:

$\text{feqWA1} = \frac{\text{Water stress (\%)}}{\text{Desirable threshold 25\%}}$	$\text{feqWA2} = \frac{\text{TFW/TRR}}{\text{Desirable threshold 20\%}}$

The feqWA1 considers a desirable water stress threshold of 25%, indicated by FAO for water management class A (FAO, 2019) [19]. For feq2, a desirable threshold of 20% is adopted for the ratio TFW/TRR, as suggested by OECD in water scarcity studies (OECD, 2003) [20]. The first approach provides richer ecological and social information, but is less robust because the ecological flow for different countries may be defined with a variety of scientific methods (or lack thereof) and political options, not necessarily well founded. Ultimately the choice of approach will be a function of data availability and comparability.

The equivalence factor for resource extraction feqRE is calculated according to the following formula:

$$\text{feqRE} = \frac{\text{100 years}}{\text{Stock duration (years)}}$$

The horizon of 100 years was adopted because it is the optimistic upper limit of human life-span, economic significance, and prediction capability of our models.

3.4. Ranking of mining countries

To highlight the countries with the greatest weight in the exploitation of mineral resources, two rankings were developed:

- *Nations' weight in the global extractive industry* — This ranking is divided in two parts, production and reserves. It counts the number of times each country appears in the biggest productions or reserves of the 64 minerals. The fifteen countries with the highest scores have been compiled in a table representing the current and potential relevance of each country in the global exploitation of the resources.
- *Nations' weight in the energy transition* — This ranking is also divided in two parts, production and reserves. It portrays the current and potential weight of nations in the energy transition by considering tem key minerals: lithium, cobalt, copper, nickel, manganese, zinc, graphite, silicon, rare earths, and bauxite. The countries with the highest values for each resource were assigned scores from 1 to 10; the country with the highest production/reserves receives 10 points, the second highest receives 9 and so on. The points for each country were summed and resulted in a final score.

4. Results and Discussion

4.1. Water scarcity

Evaluating the fifteen countries with higher water stress values, it is conspicuous that nine countries have values above 100%. This means that these countries are abstracting more water than the sustainable flow. Water stress values greater than 100% can be an indication of serious poor resource management, and can result in water scarcity, droughts, and other related problems, such as increased competition for water resources between different uses, domestic, agricultural, and industrial. Most of these countries share similar causes, such as arid climate, high human population density, excess use, and poor water management. These factors can trigger conflicts between populations, either at the intranational or international level.

Countries such as Sri Lanka, Eswatini or the Republic of Korea are on the list of countries with the highest water stress values due to the environmental flow criteria considered. As table 2 shows, these countries have a low TFW/TRWR ratio, which means that the water extractions represent a small share of the available resources. However, because they consider a high environmental flow (as a percentage of total available resources), they end up with high water stress values. Of course, water stress depends not only on water abstraction, but also on the country's needs to maintain environmental quality and social well-being. While some countries may consider higher environmental flow values in order to ensure their sustainability, others define low ecological flow values because they have few resources, or in order to mask excessive water abstraction. This means that the environmental flow determination by each country can take into consideration an environmental or a political approach.

In total there are 47 countries with water stress level above the 25% limit defined by FAO's water management class A, and 9 of them register water stress above 100%. It is also important to emphasize that 78 countries registered water stress level under 10%.

Table 1. Countries with highest water stress values

Country	Population (millions)	Gross per capita uses (m^3/cap/day)	TFW (km^3/year)	TRR (km^3/year)	EF (km^3/year)	Water stress (%)
Uzbekistan	32.0	4.9	57.3	48.9	14.0	164
Turkemenistan	5.8	13.2	27.9	24.8	5.4	143
Argelia	41.4	0.6	9.5	11.7	4.6	134
Egypt	96.4	2.0	70.8	57.5	2.6	129
Syria	17.3	2.2	14.0	16.8	5.6	124
Sudan	40.8	1.8	26.9	37.8	15.1	119
Pakistan	208.0	2.5	193.3	246.8	83.8	119
Jordan	9.7	0.3	0,9	0.9	0.0	101
Israel	8.2	0.4	1.2	1.8	0.6	100
Tunisia	11.4	0.9	3.7	4.6	0.7	94
Sri Lanka	21.1	1.7	12.9	52.8	38.5	91
Republic of Corea	51.1	1.6	29.2	69.7	35.4	85
Iran	80.7	3.2	93.0	137.0	22.7	81
Eswatini	1.1	2.6	1.1	4.5	3.1	78
India	1 338.5	1.3	647.5	1 910.9	937.1	66

TFW – Total freshwater withdrawn; TRR – Total renewable resources; EF – Environmental flow

Table 2. Influence of EF criteria on feqWA

Country	Water Stress (%)	TFW/TRR (%)	EF (% of TRR)	$feqWA_1$ (WS/0.25)	$feqWA_2$ (TFW/TRR/0.2)
Uzbekistan	164	117	29	5.5	5.9
Turkemenistan	143	113	22	4.8	5.6
Argelia	134	82	39	4.5	4.1
Egypt	129	123	5	4.3	6.2
Syria	124	83	33	4.1	4.2
Sudan	119	71	40	4.0	3.6
Pakistan	119	78	34	4.0	3.9
Jordan	101	97	4	3.4	4.8
Israel	100	65	35	3.3	3.3
Tunisia	94	80	15	3.1	4.0
Sri Lanka	91	25	73	3.0	1.2
Republic of Korea	85	42	51	2.8	2.1
Iran	81	68	17	2.7	3.4
Eswatini	78	24	69	2.6	1.2
India	66	34	49	2.2	1.7

TFW – Total freshwater withdrawn; TRR – Total renewable resources; EF – Environmental flow; $feqWA_1$ - Equivalence factor 1 for water abstraction; $feqWA_2$ - Equivalence factor 2 for water abstraction

Table 3. Number of countries per water stress level

Water Stress	Number of countries
> 100 %	9
> 75 to 100%	5
> 50 to 75%	11
> 25 to 50%	22
> 10 to 25%	27
≤ 10 %	78
Total	**152**

4.2. Mineral resources scarcity

Of the 10 key minerals for energy transition considered, only 4 are not in a state of scarcity (stock duration over 100 years). The remaining minerals, namely cobalt, copper, nickel, manganese, zinc, and bauxite, have limited stock durations, considering their importance for the present and future of the energy transition. They have high strategic value irrespective of current production.

Among the minerals with stock durations exceeding 100 years, their production is very low compared to their high availability. This can be due to their limited economic importance, such as the case of graphite, the difficulty of extraction, as with rare earths, or even due to the absence of a well-established international market, as with lithium. Minerals that are intensively exploited and have limited stock durations already have significant economic importance.

Table 4. Stock duration of the 10 key minerals for the energy transition

	World Total Average 2017-2021			
Mineral resource	**Production (Mt/year)**	**Reserves (Mt)**	**Stock duration (years)**	**feqRE**
Lithium	0.1	18.5	212	1.0
Cobalt	0.1	7.1	50	2.0
Rare Earths	0.2	117.2	561	1.0
Copper	20.4	861.0	42	2.4
Nickel	2.5	101.5	41	2.7
Manganese	19.1	1 096.5	57	1.8
Zinc	12.5	245.5	20	5.3
Grafite	1.0	310.0	305	1.0
Silicon	7.8	ND	>>100	ND
Bauxite	354.7	24 570.9	69	1.5

Silicon is one ou the most abundant elements on Earth crus, only limited by production. Rare earths are limited by very low density and difficulty of extraction

ND – No Data; feqRE - Equivalence factor for resource extraction

39 out of 64 minerals reviewed are in a state of scarcity, meaning they have a stock duration of less than 100 years; 15 of them have a stock duration of less than 25 years; for 7 there are not enough data. Out of the 64 minerals, only 18 are not in a state of scarcity.

Table 5. Stock duration of the 64 minerals

Stock duration (years)	**Number of minerals**
> 100	18
> 50 to 100	12
> 25 to 50	12
≤ 25	15
NA	7
Total	64

Oil and natural gas stock durations are below one hundred years for almost all regions (cf. Table 6). The world average stock duration is 51 years for both oil and gas.

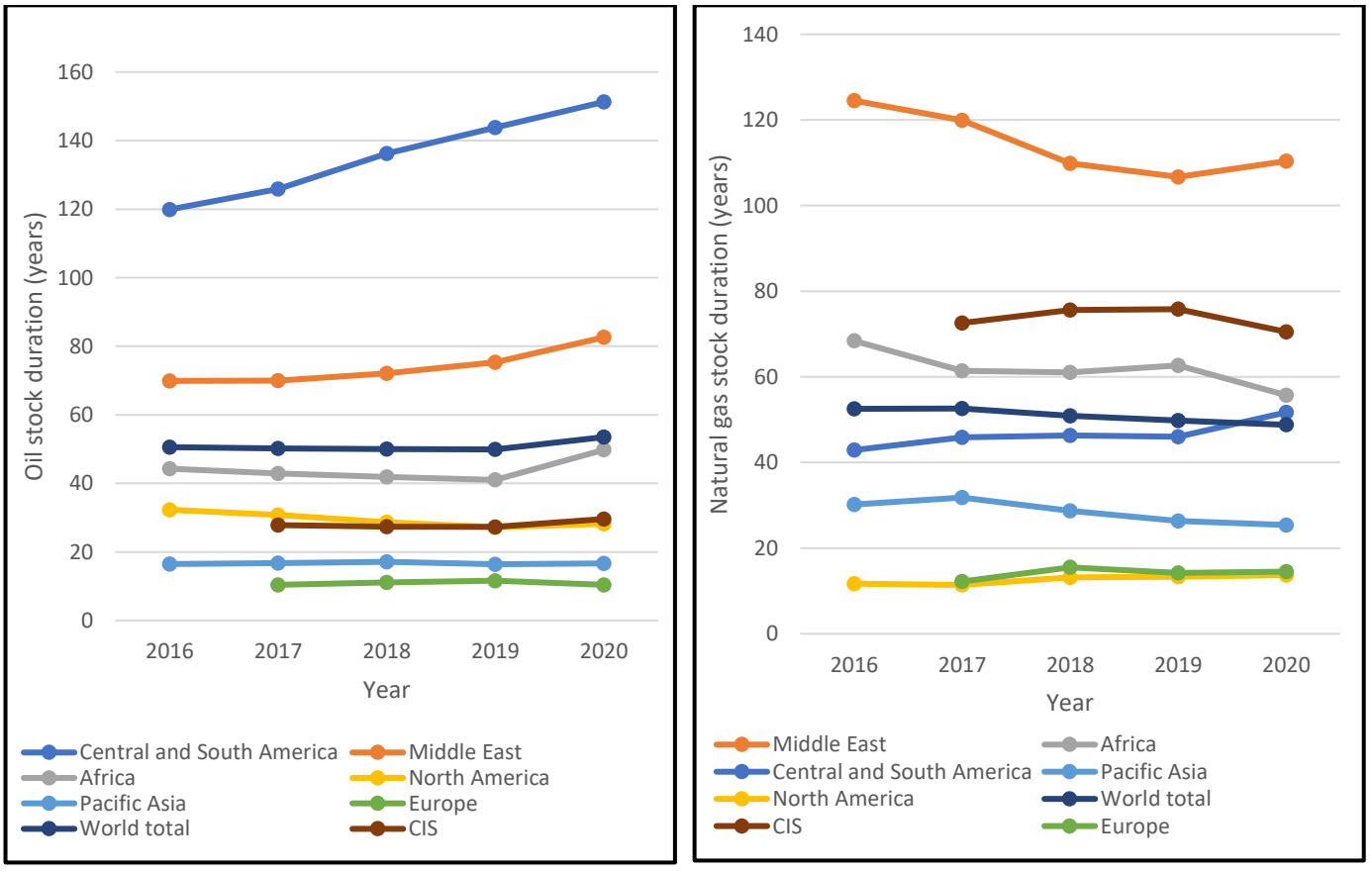
Table 6. Oil, Natural gas, and Coal stock duration and feq per region/continent

	Region/ Continent	**Annual Average (years)**	**feq**
Oil	Central and South America	135	1.0
	Middle East	74	1.4
	Africa	44	2.3
	North America	29	3.4
	CIS	28	3.6
	Pacific Asia	17	6.0

	Europe	11	9.2
	World total	51	2.0
Natural Gas	Middle East	114	1.0
	CIS	74	1.4
	Africa	62	1.6
	Central and South America	47	2.1
	Pacific Asia	28	3.5
	Europe	14	7.1
	North America	13	7.9
	World total	51	2.0
Coal	North America	377	1.0
	CIS	358	1.0
	Europe	229	1.0
	Central and South America	166	1.0
	Pacific Asia	83	1.2
	Middle East	55	1.8
	World total	138	1.0

The growth of oil stocks can be justified with the substitution of oil derivates technologies with renewable energy. Another factor may be increased prospecting.

Figure 1. Evolution of oil and natural gas stock duration



The most common fossil fuel is coal, as can be observed in Table 6. The average world coal stock duration is 138 years.

4.3. Ranking of mining countries

On Table 7 we can observe the nations' weight in the global extractive industry. As expected, the countries with the highest number of occurrences are among the world's largest economic powers, with most of them being members of the G20. This group represents approximately 80% of the global gross domestic product (GDP) and about two-thirds of the world's population.

It is impossible to separate the influence of these countries on the mineral resource market from their economic and industrial strength. This strength and search for more control over the resources often leads to disputes with smaller countries and economies, either through peaceful means such as investments and mine acquisition, or through more aggressive actions such as armed conflicts and political subversion.

Table 7. Nations' weight in the global extractive industry

Productions		Reserves	
Country	**Score**	**Country**	**Score**
China	44	USA	41
USA	33	China	33
Russia	33	Russia	28
Canada	29	Australia	22
India	28	Brazil	22
Australia	27	India	22
Brazil	25	Canada	19
Mexico	23	Turkey	15
Turkey	20	South Africa	15
South Africa	20	Kazakhstan	12
Kazakhstan	19	Peru	12
Peru	17	Mexico	11
Republic of Korea	13	Vietnam	8
Germany	12	Indonesia	7
Japan	11	Iran	6

Note: Reserve data by country was not available for 10 of the 64 minerals, only data on total world reserves.

On Table 8 we can observe the nations' weight in the energy transition. We find similarities and differences with Table 7. The main countries with the greatest influence on the market, exploitation and depletion of resources are the same. By controlling the production of the mineral resources that are key for the energy transition, these countries are guaranteed to continue their dominance in the mineral resources markets.

Table 8. Nations' weight in the energy transition

Productions		Reserves	
Country	**Score**	**Country**	**Score**
China	74	Australia	68
Australia	64	China	61
Russia	43	Brazil	50
Canada	29	Russia	45
Brazil	27	Indonesia	27
USA	27	India	20
India	24	USA	20
Guinea	20	Vietnam	20
Chile	19	Chile	20
Congo	17	Mexico	16

Indonesia	16	Peru	14
Philippines	16	South Africa	14
Madagascar	16	Canada	13
Peru	11	Cuba	13
Norway	10	Congo	11

However, there are less developed countries in the table, either African, South American, or Asian, which are also able to generate high levels of production due to the natural abundance of resources in their territories. Still, these scores are achieved due to only one or two specific resources, in which these countries are one of the main producers. In many of the least developed countries that have achieved a high score, productions are controlled by the countries at the top of the table.

Of the fifteen countries listed, nine of them belong to the G20, which means that these countries have sufficient resources to maintain strong economies and be world leaders in societal development and energy transition. We see that some of these countries did not score as high at the production level, which means that the reserves of the minerals in question are more distributed than the productions indicate.

On the other hand, some of the countries listed show that they have the potential to play a more relevant role in the energy transition than they currently have, such as Brazil, which scored much higher in terms of reserves than in terms of production, demonstrating the country's potential for exploitation of the mineral resources considered. This entails however further environmental risks.

5. Conclusion

Regarding water resources, among the 152 countries assessed, 9 face extreme water stress, above 100%; 38 experience high or very high water stress levels, between 25% and 100%. There is an overconsumption of water by the most arid, populous countries, with larger mining, agricultural and industrial activities. In addition to social and economic consequences, increased water stress entails negative environmental consequences, such as the degradation of aquatic systems, food availability, climate regulation, or even the total disruption of habitats and ecosystems. Increases in consumption may result in a new set of countries reaching severe water stress values. However, equal water stress values can mean different things, depending on the criteria used to define environmetal flow requirements.

Concerning mineral resources, 39 out of 64 examined have a low stock duration, with less than 100 years of reserves available. Among them, 15 minerals exhibit a very low stock duration of less than 25 years, raising concerns about their long-term availability. Data on stock duration is unavailable for 7 minerals. Oil and gas show about 50 years of stock duration. Unsurprisingly, the rankings of mineral production and reserves are largely dominated by G20 countries, which represent the largest global economies. China stands out as the largest producer of mineral resources. Australia holds the largest reserves for the energy transition.

This paper aims to provide a better understanding of resource scarcity and identify the main actors responsible for their exploitation. There is sufficient and accessible information that allows to quantify and compare the global availability of resources at global, continental, and national scale. Available information suggests that there is an intensive exploitation of resources made by the most industrialised countries with the largest economies, which can cause serious environmental and social consequences not only in their territories but also in adjacent territories, e.g. by high levels of pollution or fostering political instability.

The trend of increasing resource exploitation generates risks of negative consequences for poorer countries and regions, with growing inequality of power and influence, institutional fragility, and diminishing control of resources. Scarcity levels may raise even further, with global consequences for availability, economics and environmental consequences. Resources with higher stock duration are less economically constraining and can be seen as potential substitutes.

Current patterns of exploitation, whether of minerals or water, are unsustainable and jeopardise the intergenerational future. They can be reduced by considering and assessing the risks and impacts of decisions that may lead to resource depletion. Access to information on resource scarcity is fundamental for innovation, planning, decision-making, awareness and public participation. Information on resource scarcity also plays a key role in more robust life cycle assessment.

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Water Research in Support of The Sustainable DevelopmentGoal 6 in Malaysia

Mohd Yusoff Ishak[1], M L Y Abdul Basek[2]

[1,2] Department of Environment, Faculty of Forestry and Environment, Universiti PutraMalaysia, Serdang, Selangor, Malaysia

m_yusoff@upm.edu.my Corresponding author's e-mail address

Abstract. Water resource management has become more contentious as a result of water scarcity and pollution, affecting over two billion people and quality of life. Thus, Sustainable Development Goal 6 on water and sanitation with its eight global priorities that span the entire water cycle is fundamentally important to the achievement of sustainable water resources management. The purpose of this study is to analyze articlespublished in the subject categories of water research and water resources over a period from 2015 to 2022 in support of SDG6 and each of its targets midway of Agenda 2030 in Malaysia. We use bibliometric analysis to evaluate the field's scientific performance and report sustainability. The trend of journal from author's keyword, growth trend of the journal, and trend of different affiliations were also investigated to unravel the influence on SDG6. The findings indicated that additional research should address water scarcity and shortages caused by water quality, as this is a critical component of increasing water efficiency by optimizing the water quality matchbetween supplies and demands, in addition to saving physical volumes of water. This would support policy development and organizational learning through integration of solution and strategies to balance the 5P of SDG.

1. Introduction

The 2030 Agenda for Sustainable Development Goal 6 (SDG 6) aims to ensure availability and sustainable management of water and sanitation for all by 2030 (UN General Assembly, 2015). The progress for achieving SDG Goal 6 targets has been significant in addressing the global challenges related to access to clean water and sanitation. According to the United Nations, significant progress has been made towards achieving SDG Goal 6 targets. However, it is essential to consider opposing arguments and challenges faced in attaining these targets.

Water is a worldwide resource in both the natural water cycle and international trade, so regional water consumption can have an impact on the environment on a bigger scale or even globally. Yet, despite the acknowledgment of water as a human right and the inclusion of Goal 6 in the global political agenda, there are still barriers hindering progress towards achieving these targets. Onechallenge is the affordability and quality of clean water. While access to clean water is recognized as aright, ensuring that it is affordable for everyone remains a significant obstacle. Many regions, particularly those with low-income populations or marginalized communities, struggle to access affordable clean water due to various factors such as infrastructure constraints or lack of investment in water supply systems

SDG 6 has eight global priorities that span the entire water cycle, including provision of drinking water and sanitation for target 6.1, hygiene services for target 6.2, treatment and reuse of wastewater and ambient water quality for target 6.3, water-use efficiency and scarcity for target 6.4, integrated water resources management (IWRM) including through transboundary cooperation for target 6.5, protecting and restoring water-related ecosystems for target 6.6, international cooperation and capacitybuilding for

target 6.a and participation in water and sanitation management for target 6.b (UN Water, 2016). According to the report of (UN Water 2018), water supply and water quality are critical for human advancement, environmental health, and economic prosperity.

2. Literature Review

Bibliometric analysis is a useful tool for describing the historical progress and quantitative patterns of research papers on a certain topic by combining quantitative and statistical analysis. In general, it is a strong tool that assists academics in quantitatively exploring, organising, and analysing enormous volumes of data such as publications, nations, institutions, authors, journals, categories, and keywords. First, Bibliometric analysis is more capable of managing a wide body of knowledge from the literature than other methods of literature review studies, such as content analysis and meta-regression analysis. Second, the output of active writers, prominent institutions, key articles, forward citations, and keywords can all be studied using bibliometric research. Therefore, through the results of bibliometric research, detailed data can be delivered to help future studies. Third, powerful visualisation Scholars may use networks in bibliometric analysis to establish relationships between writers, organisations, and keywords, as well as to define research goals for future studies.

A proper documentation on water research and water resources could help fulfill the knowledge gap pertinent to achieve the Sustainable Development Goal 6 (SDG 6) on the clean water andsanitation. An immediate response is needed to redefine water scarcity and further improve evaluation methods and tools in order to provide insights and useful suggestions for reducing regional water scarcity (Jia et al., 2020) since pre-treatment and wastewater treatment are more expensive and use more resources.

Thus, this study was established to analyse article in the subject category of water research and water resources during 7 years of period from 2015 to 2021 in support the achievement of SDG 6 and each of its target; to summarize key finding of current knowledge on water related research and SDG 6 connection in Malaysia and to evaluate the trend of research in water research and water resources based on the output of the Scopus database.

3. Methodology

Our analyses involve searching existing bibliographic databases using a set of specific thematic keywords. Text mining is a complementary technique facilitated by new internet browsing technology. Bibliometrics and text mining were applied to identify and evaluate research hotspots and tendencies of Malaysia water research in general.

Particularly, we analysed current and historic peer-reviewed literature body addressing topics related to SDG 6. We applied multiple search queries and text mining based on authors' keywords to portray the water research according to research hotspots and time frame we had decide.

We use Scopus website (www. scopus.com) since Scopus is the world's largest abstract and citation database for peer-reviewed scientific literature. Scopus currently indexes 24,600 titles from over 500 foreign publishers, including journals, magazines, and studies (Scopus Elsevier, 2016). To start for search the articles effectively, we were using an initial list of 1057 terms suggested by the United Nations University for the bibliometric study of water science (Mehmood, 2019), to searched for terms such as water quality, water management, water stress, and water equity based on article titles, abstracts, and keywords. We took a few steps to correct some errors and adapt the list to only include words relevant to SDG 6 and its goals. In the first step, It was decided to exclude words based on five criteria: off-topic, too general, too narrow, redundant, and duplicated terms. Only English- language documents were considered. Articles, conference papers, reviews, book chapters, and other sorts of publications can be divided into five categories. Because the purpose of this paper was to explore water research and water resources, only the papers were used as raw data sources. Citation data from journal publications was far more dependable for this purpose. The article was downloaded as a raw data source for further analysis, together with the relevant citations and bibliographical details. Each piece of information, including the title and abstract, was examined and filtered for repetitive or irrelevant material. Only a few article records were deemed to be sufficiently relevantafter the screening process. Simple statistical data, such as the number and growth of publications according to year, journal, and country, research category of

publication, and subject areas of publications were analysed. VOSviewer was used to analyse and show the bibliometric networks. The VOSviewer was used to detect the keyword clusters in addition to the bibliometric network analysis. All the compiled publications were analysed in 5 main aspects included growth of publication number,journal and research category of publication, institutions, authors, and clustering that connection between the research keywords.

4. Results and Discussion

The total number of water publications in Malaysia amounted to 4620 publication, the first being published in 2015 and from that, more article regarding to water studies were published. Article was the most frequently published in document type such as article (72%), conference paper (19%), reviewpaper (5%) and book chapter (3%). Overall, 39% of Malaysia water research was published with and open-access (OA) and remaining of it in gold, hybrid, bronze and green. Regarding to year ofpublication starting from 2015, about 11% of publication was happen and increase by year such as in 2016 (12%), 2017 (13%), 2018 (16%), 2019 (17%), 2020 (18%) and 2021 (14%). For the language use, most of it use English as their first language that was internationally use in all publication and also some of it use Malay, Chinese, Japanese and Persian. In relationship to cited publication, most cite publication are water research, desalination, separation and purification technology.

4.1. Cited document

Extensive researches have been undertaken by experts from different areas on this water research and water resources for exploration of Sustainable Development Goal 6. This is proved by the rising quantity of documents connected to water research and water resources publish from 2015 to 2021 on this SDG 6. Various elements have been explored in these published publications such as wastewater treatment, water desalination, thermal energy storage, contaminated water sources, magnetic nanomaterials and demulsification procedures. Table 3.1 provides the list of top 20 highly cited documents acquired from Scopus concentrating on water research and water resources in SDG 6 from the past years. Although there are other highly cited document with small talk on water research and water resources, those documents are not included here as the objective of the publications is mostlyon SDG 6 and its indication that to achieve access to water and sanitation for all.

It also worth mentioning that water research and water resources focused documents are not the only documents included in the indicator of SDG 6, a few other publications focusing on the technology, experiment, and monitoring with considerably significant discussion on water research and water resources are also included. So, referring to the stated document in table 1, they are judgedto extensively address water research and water resources to highlight the significance on the SDG 6of clean water and sanitation.

The most cited document by Lee et al., (2016) had extensively discussed the issue about water pollution is the residual dyes from different sources such as textile industries, paper and pulp industries, dye and dye intermediates industries, pharmaceutical industries, tannery and craft bleachingindustries, and a wide variety of persistent organic pollutants have been introduced into our natural water resources or wastewater treatment systems. This study is vital to knowledge of fundamental science, which may be utilized in waste pollution management via enhanced photocatalytic oxidation processes in order to produce the healthy living environment for our next generations. It can also be seen that most of the highly cited publications have review the development of advanced membrane technologies such as surface modification, incorporation of inorganic particles in polymer membrane and the creation of ceramic membranes. Also, almost all documents discuss and summarize the main the most exploited demulsification techniques such as chemical, biological, membrane, electrical, and microwave irradiation for both oilfield and synthetic emulsions while complying with the environmental regulations and imposing the least economic burden.

Additionally, a growing number of researchers have been focused on the study of wastewater-irrigated fields, which have the potential to contaminate soil and groundwater with heavy metals, posing a concern to human health. The poisoning of the aquatic environment with heavy metals has garnered global attention due to its quantity, durability, and environmental toxicity (Ali et al., 2016). Some of its describe that the volume of sewage water generated by domestic, industrial and commercial sources has

increased along with the increasing population, urbanization, improved living conditions, and economic development (Balkhair & Ashraf, 2016). Some of the desirable features of this water research and water resources are progress in Graphene research for water desalination using novel methods such as Nanoporous Graphene (NG) sheets as well as Capacitive Deionization (CDI) method (Aghigh et al., 2015). These observations emphasise the procedures that have been adopted forwater treatment such as ion exchange, reverse osmosis and distillation. It also employed the approaches that limitations owing to self-contamination, massive power needs and exploitation of intense resources and not being economically feasible.

The majority of publications that are released throughout thet years of 2015 and 2016 is substantially more mentioned compared to next year and above, reaching 12 documents during thistwo years. The aspects that more focus on this 2 year relate to basic problem and advance in water problem impact and conservation while the next year starting from 2017 and above, it more specific focus deeply into the factor and molecular need to be consider and technology to counter the issue by apply and enhance

4.1.1. Basic growth trend

The number of publications on water research and water resources per year from 2015 to 2021 is shown in Table 3.2. It demonstrated that the publication growth trend increased concurrently from 2015 to 2020 and then decreased slightly in 2021. This year's publication may be influenced by the author's activities or the scope of keywords in previous years. This phenomenon demonstrated that researchers have only recently begun to pay significant attention to water research and water resources. The growth trend of publications exhibits four fascinating phases: stagnant, start-up, booming, and stable. Prior to 2015, there was a period of stagnation, as very little to no water research and water resources were reported in each of these years. Prior to 2015, it was discovered that the majority of studies focused on conventional water treatment processes, either in water treatment plantsor reverse osmosis desalination plants, and were recognised as a more green remediation technology toassist in their sustainable management of waste water. Prior to 2015, the low number of publications could be attributed to technical difficulties associated with improving the performance of technologyin potentially hazardous wastewater, as well as with realising the potential of processes in water research and water resource application.

After 2015, the publishing numbers climbed consistently until the year 2020, where the number doubled as compared to the previous year. The increasing amount of publication can be attributed to the limited fresh water resources that seriously affecting the terrestrial, aquatic, and aerial flora and fauna that considerably improve the performance of classical wastewater treatment technologies such as adsorption, catalysis, separation, and disinfection (Rasel Das et al., 2017).

This marked that the countries like Malaysia which has its one part of major economy turnover solely based on the agricultural sector produces more than 2 million tonnes of agricultural waste annually which are either dumped or burned in an open landfill which leads to extensive environmental related issues such as groundwater contamination or air pollution (Thines et al., 2017). Associated with this pollution, this difficulty can overcome by the development of magnetic biochar with the attachment of various metallic ions on the surface of biochar to enhance magnetic effect and application as an adsorbent in wastewater treatment for the removal of contaminants and can increase the capacitance and electrical conductivity as well.

Subsequently, the water research and water resources publications started a growing slowly phase, where the number climbed from 2018 to 2019 publication each year approximately 22 publication per year. Such as sluggish in publication number might relate to the concentrating factor ofwater research and water resources. Prior to this, research was largely centred on performance and improvement. After the year 2018, water has been one of the primary necessities of human civilisations. Although, water covers more than 70 percent of the earth’s surface, just less than 1 percent is available for human use. Numerous anthropogenic activities have surged the contamination of the available water resources that resulting in the shortage of potable and good quality water aroundthe world (Fernando et al., 2018). In 2019, the evaluation and forecast of the surface water quality is required for successful management of river basins so that sufficient actions may be implemented to guarantee that the pollution levels remain below allowed limits. Several models for water quality such stochastic and deterministic models have been designed to give optimum approaches to conserve the quality of water. Nevertheless, getting efficient and precise water quality model in complex water resources is still difficult because of the variations and complications in the actual world (Najah Ahmed et al., 2019). Due to this problem, several

methods such as aeration, coagulation, and adsorption have been implemented to remove silver nanoparticles from the water that each method hastheir advantage base on the time consider and type of pollutant happen to free all of the toxic material (Syafiuddin et al., 2018).

An increase in discharge of oily wastewater leads to major environmental problems. Oily wastewater pollution affects drinking water, groundwater, and seawater owing to the percolation of contaminants into the water sources beneath the soil (Ismail et al., 2020). Additionally, this phenomenon poses a threat to human health by contributing to atmospheric pollution, particularlywhen oil burners are involved. This phenomenon has rekindled scientific interest in the distribution, environmental fate, transport, and chemical properties of contaminants in affected environments in order to develop appropriate, cost-effective, and environmentally friendly strategies for the restoration and reclamation of affected environments that are faster, more practical, and adaptable to a variety of physical settings (Ossai et al., 2020). After 2000, approximately 70% of desalination plants used membrane processes due to their effectiveness and lower energy and cost requirements than thermal desalination (Al-Amshawee et al., 2020). Membrane processes use a membrane film as a physical barrier to separate pollutants from wastewater, whereas thermal desalination uses high energy to vaporise the feed water and leave the contaminants as solids.

4.1.2. Author analysis

Table 1 summarizes the top twenty most productive authors in terms of publications in various papers related to water research and water resources. As can be observed, authors from Universiti Teknologi Malaysia are the most prolific, with ismail a.f., shahid s., and jaafar j. ranking in the top five most prolific authors in Malaysia. Interestingly, the author is now ranked among the top five representativesby el-shafie a. and juahir h. from Universiti Malaya and Universiti Sultan Zainal Abidin. Other authorsfrom other universities are Universiti Kebangsaan Malaysia, Universiti Putra Malaysia, Universiti Sains Malaysia, and The University of Nottingham Malaysia Campus. In general, this group of scholars' present affiliations aligned well with the most productive universities.

Table 1. The top 20 most productive authors in water research and water resources

RANKING	AUTHORS	PUBLICATION	AFFILIATION
1	ismail a.f.	86	Universiti Teknologi Malaysia
2	el-shafie a.	42	Universiti Malaya
3	shahid s.	35	Universiti Teknologi Malaysia
4	juahir h.	31	Universiti Sultan Zainal Abidin
5	jaafar j.	30	Universiti Teknologi Malaysia
6	toriman m.e.	30	Universiti Kebangsaan Malaysia
7	aris a.z.	27	Universiti Putra Malaysia
8	lau w.j.	27	Universiti Teknologi Malaysia
9	abdullah s.r.s.	25	Universiti Kebangsaan Malaysia
10	sopian k.	25	Universiti Kebangsaan Malaysia
11	matsuura t.	24	Universiti Teknologi Malaysia
12	ismail s.	22	Universiti Sains Malaysia
13	foo d.c.y.	21	The University of NottinghamMalaysia Campus
14	ahmed a.n.	20	Universiti Tenaga Nasional
15	kazi s.n.	20	Universiti Malaya
16	othman m.h.d.	20	Universiti Teknologi Malaysia
17	praveena s.m.	20	Universiti Putra Malaysia
18	sanagi m.m.	20	Universiti Teknologi Malaysia

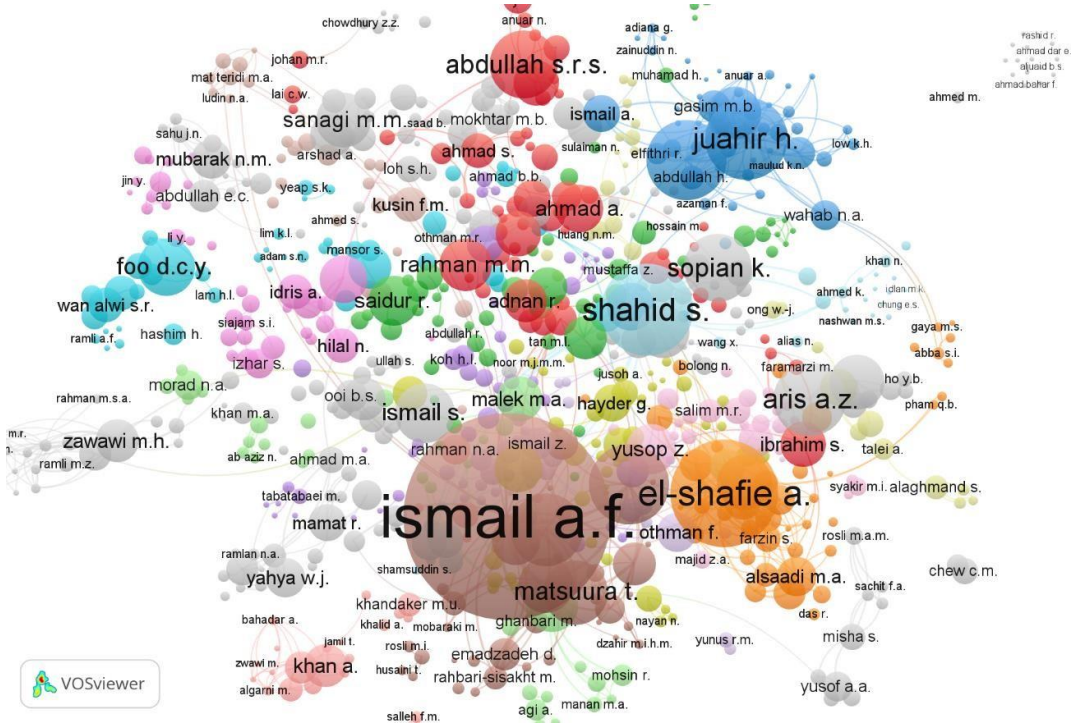
19	amiri a.	19	Universiti Malaya
20	ismail i.	19	Universiti Teknologi Malaysia

Table 3.4. Link strength and citation details of the top 20 productive authors in water research andwater resources

RANKING	AUTHORS	PUBLICATION	LINKS	TOTAL LINKS STRENGTH	CITATIONS
1	ismail a.f.	86	69	265	2641
2	el-shafie a.	42	46	163	613
3	shahid s.	35	42	98	434
4	juahir h.	31	54	139	312
5	jaafar j.	30	50	121	413
6	toriman m.e.	30	52	141	242
7	aris a.z.	27	12	36	447
8	lau w.j.	27	29	99	1097
9	abdullah s.r.s.	25	11	46	261
10	sopian k.	25	7	17	556
11	matsuura t.	24	26	91	827
12	ismail s.	22	16	30	276
13	foo d.c.y.	21	5	18	174
14	ahmed a.n.	20	41	96	126
15	kazi s.n.	20	17	54	470
16	othman m.h.d.	20	31	92	229
17	praveena s.m.	20	9	28	291
18	sanagi m.m.	20	10	42	645
19	amiri a.	19	14	45	520
20	ismail i.	19	19	47	249

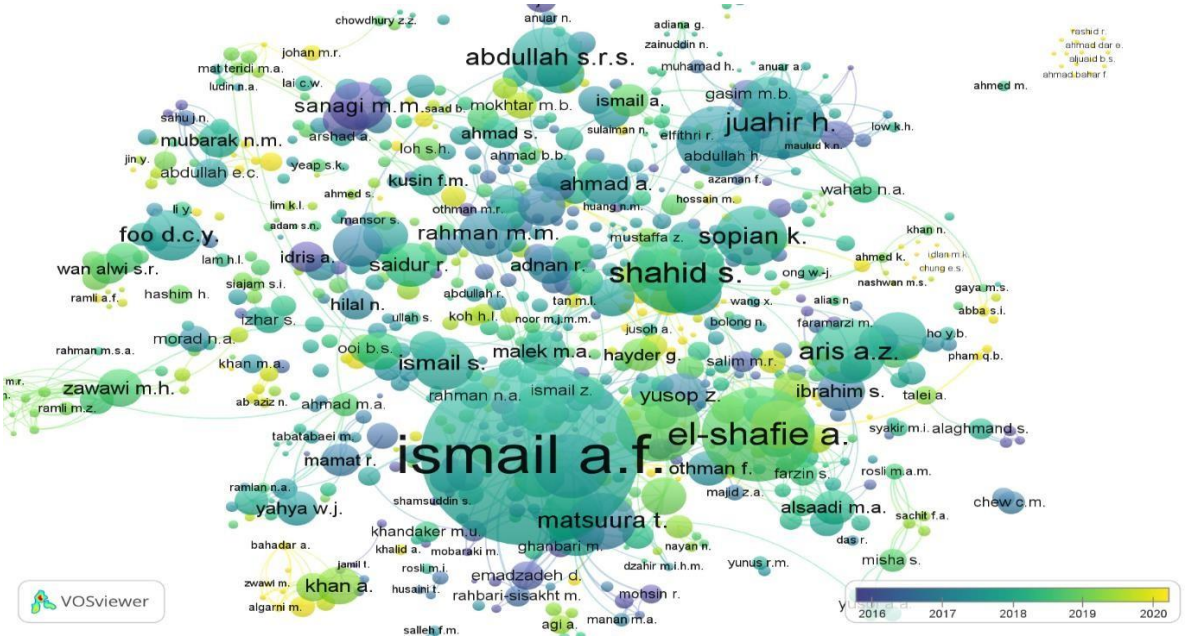
Based on Table 3.4, the link strength and citation detail for the top 20 productive authors was been consider by the number of publications influenced the link strength and quantity of citation. The biggest or highest link strength amount the author and number of citations would not been a topic to consider the number of publications by looking to the highest publication from author ismail a.f, that has highest in publication and low total link strength but highest number of citations. This term refers to the collaboration of this author and strength of the researcher in reflect the documents they publish. It can be observed in the figure 1 of the most productive author in water research and water resources that have stronger collaboration strength and have more comparable publication with the researcher within that cluster. In other words, the link strength reported for each author in table 4 did not reflect the genuine relationship the author had, as the remainder of the researchers are not included.

Figure 1. Productive network author in water research and water resources



The citation information revealed the number or time publication under an author was being cited. Figure 3.1 also displayed the overall collaboration network that reflect the collaboration for author as this analysis was center on the highly prolific author publication. The three greatest clusters seen along with their respective main authors are brown cluster led by author ismail a.f., orange cluster by author el-shafie a. and light blue by author shahid s. These authors present large number of co-authorship connection and moderately good collaboration link strength with their co-authors, which 8 emphasizes their substantial research collaboration activity. While in figure 3.2 illustrates the cooperation network of writers in each of year with their co-author to showcase through the thickness of the link curves. Collaboration network, ismail a.f. is the most author with greatest number of collaborations among the highly productive 20 writers as well as having large jump in collaboration strength in each year with other co-author. Besides that, the author in the cooperation with the productive author in 2021 have manage to control this research field as accomplish considerable collaboration strength and normalized citation score in the water research and water resources.

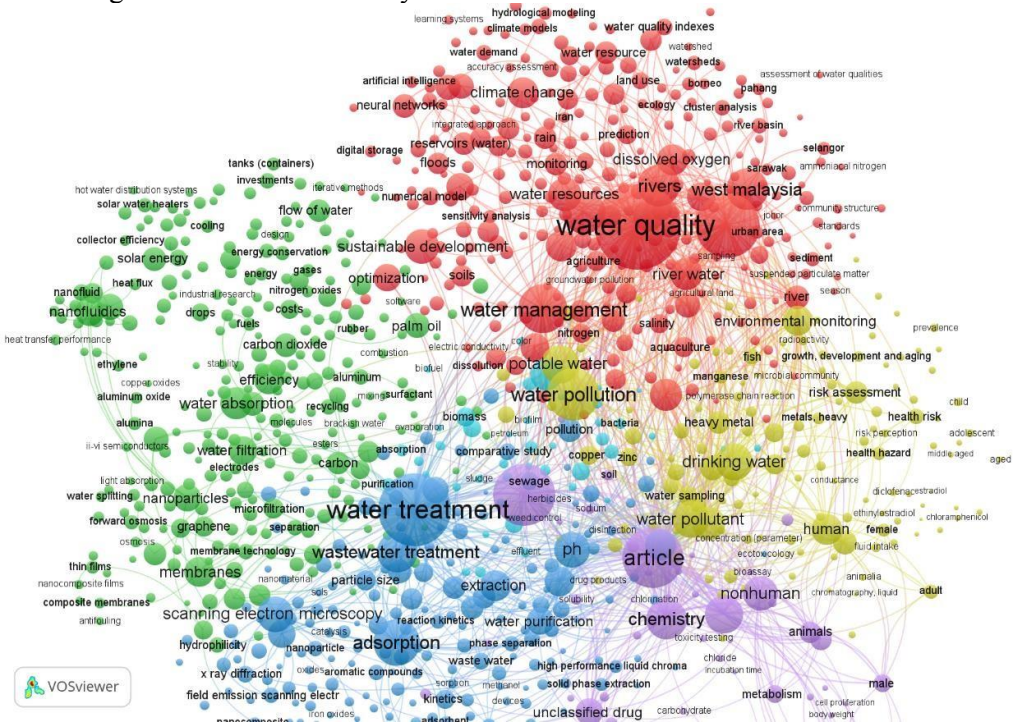
Figure 2: Collaboration network between author from 2015 until 2021 in water research and waterresources



4.1.3 Keyword analysis. Write your content here. (11pt Times New Roman)

Author keywords are terms that describe a publication's field of study or research topic. Authorsare obliged to specify relevant keywords to guarantee that a publication is able to attract scholars inthe same field of study, hence raising its citation score. Regarding water research and water resources, the bibliometric data analysis revealed a total of 22875 keywords. Additional analysis and simplification were performed using VOSViewer to build the keywords co-occurrence network, whichillustrates the relationship and relevance of keywords, as shown in igure 3.

Figure 3: Cluster author keywords in water research and water resources



Each keyword is represented by a circle, the size of which represents the number of occurrences. The larger the circle, the more frequently a keyword is used in water research and water resource management. The arcs connecting the circles illustrate the link between them. As predicted, the phrase "water quality" dominated the author's keywords, with the highest co-occurrence in the publication (shown in table3. 5 and also by the biggest circle in figure 3.3), and the broadest connectivity to other keywords (expressed by the number of links and link strength). Additionally, as seen in Figure 3.3, keywords may be categorized according to their associated color cluster, which includes red, blue, green, yellow, purple, and turquoise. The circles in the cluster become closer together as the keywords become more relevant. Keywords with the same color cluster showed thatthe articles covered a somewhat related subject.

With reference to the six major clusters, appropriate water research and water resources subfield categorization could be assigned based on the clusters' dominant keywords. In cluster 1, which is highlighted in red, keywords such as water quality, Malaysia, water management, water supply, west Malaysia, rivers, sustainable development, water resources, and composition concentration appear to be related to the study of natural resource management for water use by consumers. As for the green keywords in cluster 2, they represent the study of the performance of filtering water, which can have a variety of effects, and they focus on the planning that must be done prior to beginning the process of filtering water.

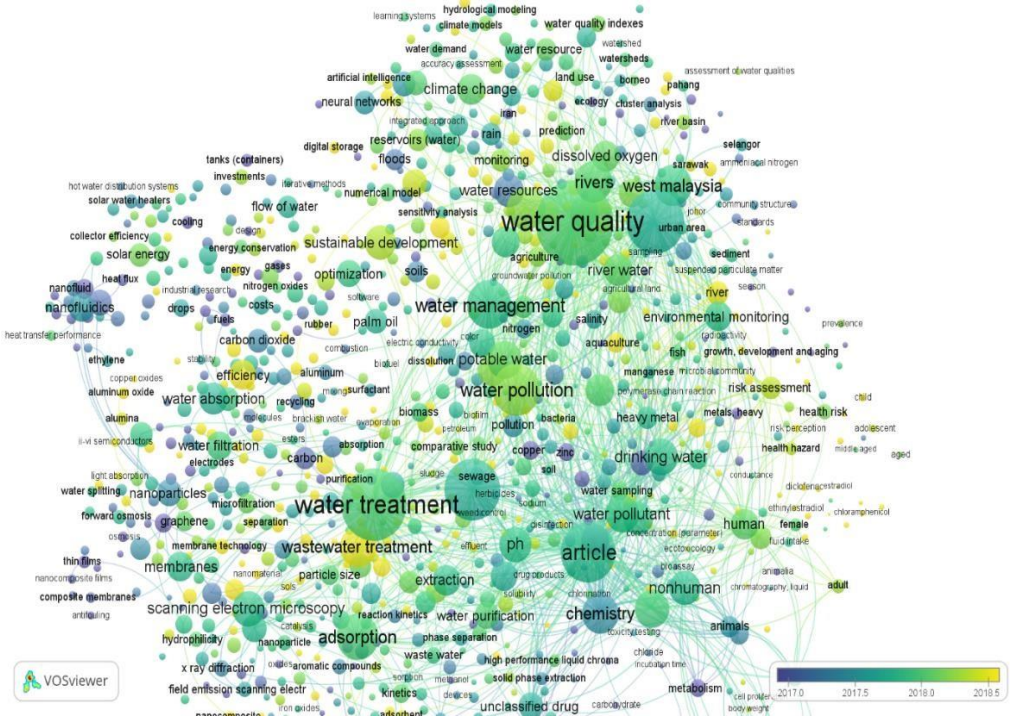
The use of keywords such as water absorption, membranes, efficiency, water filtration, nanofluids, nanoparticles, heat transfer, palm oil, desalination, carbon dioxide, solar energy, and emulsification indicates this area of research. For cluster 3, which is blue, keywords such as water treatment, adsorption, wastewater treatment, scanning electron microscopy, ph, procedures, extraction, and priority journal represent the study of methods for managing treated water by following the guidelines provided in the booklet to control the water's quality. As for the yellow keywords, they represent the study of the quality of water that can be used by humans and is safe to use in their daily lives. The use of keywords such as water pollution, potable water, water pollutant, drinking water, and humans indicates this area of study. Cluster 5, which is purple, contains keywords such as water, article, chemistry, controlled study, nonhuman, unclassified drug, and animals. This cluster focuses on studies that examine the utility of water to flora and fauna as well as humans who can use it directly and without adverse effects in the long term. Finally, cluster 6 is a turquoise study on the waste of treatment water on the flora and fauna impacted by microorganisms, bacteria, and plankton. It also refers to the contamination of the land and the production of energy from the waste generated during treatment.

Apart from the term "water quality," several other terms appear frequently in water research and water resources, including sustainable development (110 occurrences), water resources (108 occurrences), water pollutant (105 occurrences), concentration (103 occurrences), heavy metals (101 occurrences), river water (99 occurrences), and water absorption (98 occurrences). Water pollution and water absorption are two components of waste that may impact the quality of water, such as toxic, heavy metal, and suspended particles. They also influence the water absorption and distribution processes that result in a toxicant concentration in the river.

The term "sustainable development" has gained considerable popularity as a term that refers to a system that is managed to meet changing demand, both now and in the future, without deteriorating the system, emphasizing the importance of considering the long term as well as the immediate. Additionally, referring to the keyword groundwater (92 occurrences) in cluster red, this critical resource can act as a natural reservoir, buffering against surface water shortages such as those experienced during droughts, and contaminate.

When analyzing keywords in terms of publication years, Figure 4 depicts the visualization of author keywords based on the keywords that were in focus each year. Between 2015 and 2017, researchers conducted keyword research on desorption, isolation, and purification, carbon, nanocomposite films, composite membranes, heat transfer, gases, and global positioning system. The keywords imply that during this time period, the water research and water resources scope of study is more focused on removing harmful substances from something, such as the contamination of water with toxic and chemical substances that use a satellite as a receiver to record and analyze data.

Figure 4: Collaboration network between author keywords from 2015 to 2021



Between 2017 and 2018, the most frequently used keywords were rain, accuracy assessments,integrated approach, support vector machine, cancer risk, genetics, chemistry, and unclassified drug. It is demonstrated that during this time period, the researcher focused on the effect of contaminated water on humans by utilizing support vector machines, a very effective algorithm for performing data classification and regression problems. This can be used to determine which two classes exist in order to separate or classify them.

Finally, between 2018 and 2021, the keywords adsorbent, efficiency, aluminum oxide, energy, sustainability, deterioration, environment, ecosystems, and urbanization will receive increased attention. According to these keywords, the study's focus is on the step of changing the management and process of water through new planning and adhering to modern trends. Water research and water resources are focused on fundamental technology and its ability to treat a variety of pollutants with theleast amount of environmentally toxic byproducts possible.

4.1.4 Journal analysis. Write your content here. (11pt Times New Roman)

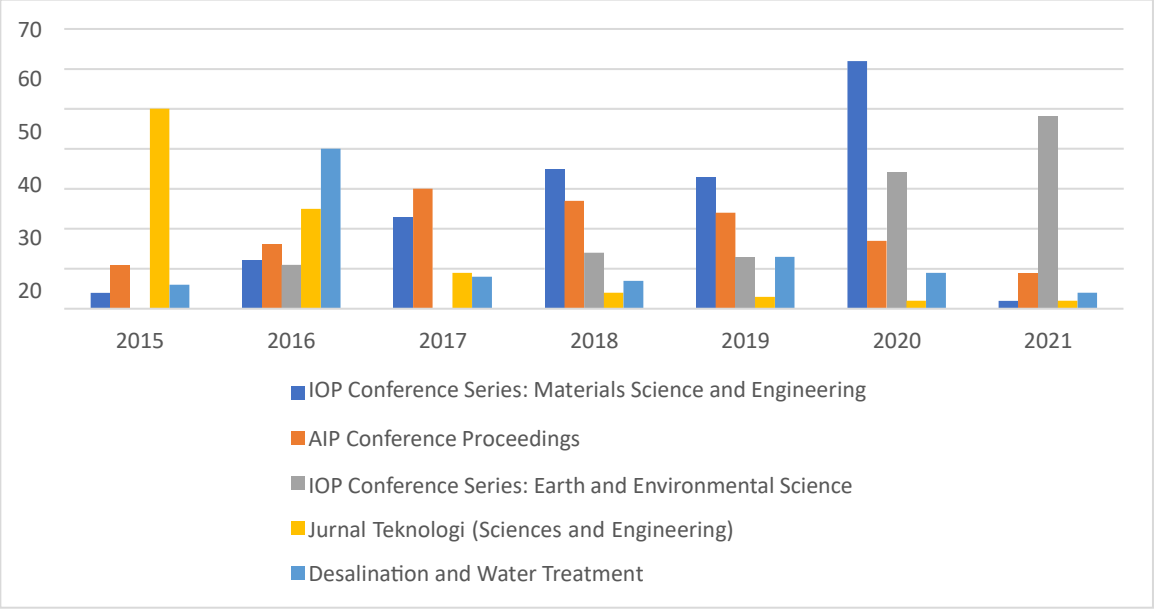
Table 3.6 displays the top 10 most productive journals that accounts for 19% of total water research and water resources publications. The top 3 journals with the highest number of publications that are more than 100 paper each on water research and water resources are journal from Iop Conference Series Materials Science And Engineering, Aip Conference Proceedings And Iop Conference Series Earth And Environmental Science. This finding was not surprising as the water research and water resources was aligned with the aims and scope of the aforementioned journals emphasizing on the research related to environmental considerations and technology.

Table 3.6: The top 10 most productive journal in water research and water resources

Ranking	Journal	Publication number
1	Iop Conference Series Materials Science and Engineering	171
2	Aip Conference Proceedings	135
3	Iop Conference Series Earth and Environmental Science	125
4	Jurnal Teknologi	95
5	Desalination And Water Treatment	87
6	Sains Malaysiana	65
7	Journal Of Cleaner Production	62
8	Arpn Journal of Engineering and Applied Sciences	58
9	Malaysian Journal of Analytical Sciences	54
10	Journal Of Physics Conference Series	51

Figure 3.5 shows the rise of publishing in the 5 most prolific journals from the year 2015. Publication before the year of 2015 was not included since some of the journals has not been founded and the publication number was not substantial in number.

Figure 3.5: Publication according to journal



It can be noticed that there were notable growth spikes for the top 5 journals. In the journal of Iop Conference Series Earth and Environmental Science, the publication was started in the year 2016 around 9 percent from the publication and increasing year by year until year 2021 around 41 percent from the publication. This journal emphasizes on the topic area of earth and planetary sciences and environmental science. Some of the keywords that primarily utilized by the author in this article such as water quality, sustainable development, rivers, biochemical oxygen requirement a dissolved oxygen. As an example from the publications of (Norshafa Elyza et al., 2016), the main objective of this paper is to evaluate the performance of water quality for small scale bioretention system under tropical climate via MUSIC model because bioretention system had been introduced as an important topic namely Urban Storm Water Management Manual for Malaysia (MSMA) by the Department of Irrigation and Drainage Malaysia (DID) in May 2012. The MUSIC program displays a considerable percentage of decrease for Total Suspended Solid (TSS), Total Phosphorus (TP) and Total Nitrogen (TN) (TN). The prediction of pollution reduction by employing MUSIC has the harmony for required in MSMA.

On the other hand, the journal of Aip Conference Proceedings was founded in the year 2015till now where the number of articles exhibited increasing until 2017 and drop until now connected to area of research. In this magazine greater concentrate on the subject area of physics and astronomy, agricultural and biological sciences and environmental science. As example in the subject area of physics and astronomy, the review paper on (Nogueira et al., 2014), it presents a literature review on performance measurement and indicators addressing the general aspects of this area of knowledge and contextualizing it for the water supply sector including international applied cases. By focusing on the performance measurement systems, it allows managers to quantify the efficiency of resources and inputs use and the effectiveness of the services provide, and can developed according to systems' characteristics based on performance goals in a collaborative process involving stakeholders and technical actors. Most of the keywords that utilized by this article such as SPE, water footprint, water quality, activated carbon and activity relates to measurement of natural radionuclides in Malaysian bottled mineral water and subsequent health risk calculation

TRACK 2
Education

2a. Provision, quality of and access to education

Abstracts

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CLIMATE-DISPLACED CHILDREN AND THE DEPRIVATION OF THEIR EDUCATION RIGHTS IN MALAYSIA

Dr NURUL HIDAYAT AB RAHMAN[1], MR. MUHAMAD ZUHAILI MAT RANI[1], MR MOHAMED RUHIZAT ABDULLAH[1], MS AZARAORNI ABD RAHMAN[2]
[1]UKM, BANGI, Malaysia. [2]UKM, Selangor, Malaysia

Abstract

The mobility crisis caused by climate change jeopardises the development rights of children, including their education. In 2019, weather-related disasters forced 23.9 million people to leave their homes forcibly, outnumbering the 8.5 million people who left their homes forcibly due to the most common causes of migration and displacement, which are conflict and violence. Children displaced by climate change events will face barriers to enrolment in school because Malaysia has a deliberate policy of excluding them from national education systems. Even though access might be accessible, relocation to new regions can result in procedural, financial, and linguistic barriers that frustrate children and, if not resolved, can lead to school dropout. Thus, governments must examine the implications of climate change on the right to education and devise solutions to address this problem. This study will investigate the education rights of climate-displaced children under international and Malaysian law. In addition, the practises of Thailand and the United Kingdom will be observed, as these two countries have received a large number of climate-displaced children and have adequate laws and policies in place to safeguard the educational rights of these children. The work is based on doctrinal and comparative legal research, as related legal concepts, principles, and selected statutory materials are reviewed and compared to implement applicable practises in our country. The data were obtained via library research and analysed using content analysis. The preeminent factors are the child's best interests and the principle of equality. The results demonstrate that Malaysian legislation needs to adhere to international legal standards that recognise children relocated due to climate change as having a right to an education. Therefore, the government must make adjustments to safeguard the developmental potential of every child.

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Exploring best practices of teaching delivery methods for new climate change policy and law postgraduate program

Assoc. Prof. Dr. Ani Munirah Mohamad[1,2], Dr. Wan Norhayati Wan Ahmad[3,2], Assoc. Prof. Dr. Haslinda Mohd Anuar[1,2], Assoc. Prof. Dr. Harlida Abdul Wahab[1,2], Dr. Mohamad Farhan Mohamad Mohsin[4,2]
[1]School of Law, Universiti Utara Malaysia. [2]Climate Change Law Research Unit, Universiti Utara Malaysia. [3]Tunku Intan Shafinaz School of Accountancy, Universiti Utara Malaysia. [4]School of Computing, Universiti Utara Malaysia.

ASSOC. PROF. DR. ANI MUNIRAH MOHAMAD

Abstract

It is a truism that law and policy play a vital role in the governance and regulation of climate change issues. Nevertheless, climate change law is seldom taught formally as a program at institutions of higher education. Accordingly, it is unclear as to how climate change law lessons should be delivered. Drawn from ongoing research on development of new climate change policy and law postgraduate program in Malaysia, this paper focuses on the exploration of best practices of teaching delivery methods of the program. The study engaged in purely qualitative methodology, involving interviews with experts in environmental law and climate change from academia and industry partners, as well as environmental law alumni. In total, 10 respondents have been interviewed using focus group discussion. The study found that among the recommended best practices of teaching delivery methods for the program are service learning, global learning, article contributions to newspapers and project-based learning (PBL). Service learning involves implementation of credited projects by the students for the benefit of a targeted community focusing on climate change issues. Meanwhile, global learning involves collaborative events with member institutions within Malaysia or abroad, in which experts, academia and industry practitioners can join and participate for sharing of experiences, skills and knowledge on climate change current issues and challenges. Students can also be encouraged to write their piece of articles to be submitted to newspaper portals, either printed or online sites. Finally, lecturers can prompt specific PBL projects to the students, in which students are to "carry out" climate change-related projects in this innovative and inspiring learning strategy. The findings of the study are expected to be incorporated into the new climate change policy and law postgraduate program soon to be offered. Hopefully, this paper will become a catalyst for future studies on climate change curriculum development, particularly on teaching delivery practices. The findings are highly pertinent to United Nation's Sustainable Development Goal SDG13 on climate action, focusing on Target 13.3 in improving education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. In the broader context, the findings of the study will be a great contribution towards the attainment of sustainability efforts on climate action, particularly in capacity building of the people on teaching delivery methods of climate change policy and law, protecting the planet, promoting prosperity, maintaining peace and establishing connections and partnerships in the teaching methods, such as global learning.

Keywords: Best practices, teaching delivery methods, climate change, policy and law, SDG13

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Does Smart Indonesia Program Have an Impact on Disabilities?

Achmad Kautsar[1], Grace Wulandari[2], Ni Putu Mia Tarani[2], Dini Widiani[1]
[1]Universitas Pertamina, Jakarta Selatan, Indonesia. [2]Universitas Pertamina, Jakarta, Indonesia

Abstract

Background: Disabled people have poorer schooling, labor market, and poverty outcomes than non-disabled people. Only 5.48 percent of disabled people aged 5 or older attend school, and 23.91 percent have never attended. Factor economics makes it difficult for students to fund education, both operational and personal.

Objective: The objective of this study is to analyze the probability of people with disabilities and the impact of government subsidies on school participation.

Method: This study uses logit models to compare people with disabilities with non-disabled in-school participation. The logit model is used to analyze the probability of events.

Result: People with disabilities have a lower probability of school participation around 17.4% compared to people non-disabled. The government program has an impact on disabled people to school participation. The result shows people with disabilities who receive Smart Indonesia Program and Smart Indonesia Card have a positive impact on school participation with outcomes of 6.4% and 9% respectively.

Conclusion: The government education subsidy has a positive effect on increasing school attendance, particularly among low-income families and individuals with disabilities. The government should increase subsidies and encourage disabled individuals to enroll in the Smart Indonesia Program.

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FAIR DEALING IN EDUCATIONAL REPROGRAPHIC RIGHTS IN SINGAPORE, UNITED KINGDOM, AND MALAYSIA TOWARDS SDG 4 AND SDG 10.

UMI HASHEIDA HUSSAIN, Prof.Dr Zinatul Ashiqin Zainol, Assoc. Prof. Dr. Safinaz Mohd. Hussein
UNIVERSITY KEBANGSAAN MALAYSIA, BANGI, Malaysia

UMI HASHEIDA HUSSAIN

PROF.DR ZINATUL ASHIQIN ZAINOL

ASSOC. PROF. DR. SAFINAZ MOHD. HUSSEIN

Abstract

The United Nations' Sustainable Development Goals (SDGs), established in 2015, aim to end poverty, protect the environment, and foster prosperity. SDG 4 specifically advocates for lifelong learning and quality education for all, while SDG 10 strives to reduce inequalities within and among nations and ensure equitable access to resources. Access to educational materials is crucial for individuals to realize their full potential. However, many students and educational institutions face financial constraints when acquiring textbooks and academic materials. To address this issue, copyright and reprographic rights laws play a vital role in making educational resources more affordable and accessible. In Malaysia, the Copyright Act of 1987 governs reprographic rights in educational institutions, regulating the use of copyrighted works. Under this Act, educational institutions are permitted to replicate and distribute copyrighted works for research, private study, and teaching purposes. However, fair use principles must be applied, taking into consideration the purpose, amount, and potential impact on the market of the original work. Violations of copyright can result in legal repercussions and reputational damage. To contribute to SDG 4 and SDG 10, Malaysian schools should prioritize raising awareness of reprographic rights and copyright regulations among teachers, staff, and students. By doing so, educational institutions can ensure compliance with copyright laws while providing students and teachers with the necessary materials for their education. Moreover, the promotion of fair dealing in educational reprographic rights should extend beyond Malaysia to include Singapore and the United Kingdom. By aligning with SDG 4 and SDG 10, educational institutions in these countries can foster equality, justice, and the principles of fair use. Raising awareness and educating stakeholders about reprographic rights will further support the achievement of these sustainable development goals.

TRACK 2
Education

2b. Educating for sustainability

Abstracts

2

Responsible Management Education: The Nordic Approach

Associate Professor Ali Farashah
Mälardalen University, Västerås, Sweden

Abstract

Background: To realize a sustainable future, a different paradigm for management and governance of the businesses and new sets of managerial competencies and practices are required. In this regard, the role of business and management education is vital and it should adjust to the new needs. Management education itself should go through a sustainable transition. Business and management educators worldwide are increasingly engaged in integrating ethics, corporate responsibility and sustainability into their programs. This inclusion is called responsible management education (RME).

Problem and Purpose: RME is a broad concept and is still partly undefined. Some initiatives such as the United Nations initiative of Principles for Responsible Management Education (PRME) attempt to develop platforms to promote and guide RME and higher education institutes eagerly attempt to include ERS in their programs. However, there is no comprehensive framework to identify the content (i.e. theories and models) that should be included. Furthermore, the know-how (e.g. through rethinking pedagogy, assessment techniques, research scholarship and engagement with stakeholders) should be developed. Universities are currently experimenting to develop and learn content and methods for RME. Therefore, the purpose of this research is to identify common themes and patterns of RME pedagogy developed by Nordic universities. Nordic countries are not only leaders in sustainable development but also in education and welfare state. Therefore, examining the context of Nordic countries can provide us with the best practices and advances in RME.

Method: To identify pedagogical approaches and competencies targeted by RME, quantitative thematic analysis through conducting textual data mining is used. The texts subject to quantitative thematic analysis include RME reports made by Nordic Universities. University members of PRME (over 800 business schools and management departments) provide self-written reports about their RME plans and activities and regularly share information on their progress in implementing RME. The reports are publicly available via https://www.unprme.org and information-rich texts that define the direction and strategies of RME and provide a concise and comprehensive overall picture of RME-related activities at the university level. Reports of 28 Nordic business schools and management departments (11 from Sweden, 9 from Finland, 4 from Norway, and 2 from Denmark and Iceland each) were subjected to analysis by Leximancer software. Leximancer applies data mining algorithms and is able to identify and elaborate themes and their connections. It has been shown that machine-based theme identification is in close agreement with expert judgment. This technique has successfully been used in research related to ethics and business education (e.g. Berti et al. 2021). The reports were published in 2021 or 2022.

Findings: The themes identified include gender equality, environmental economic value, co-producing sustainable knowledge, responsible management competencies, and impact are themes identified. The core concept of each theme, theoretical contribution to sustainability and education research, and practical implications for management and business educators are discussed.

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ESD assessment model as enabler for education for sustainable development

M.Sc. Constanze Pfaff, M.Sc. Martin Ulber, Prof. Dr. Marlen Gabriele Arnold
University of Technology Chemnitz, Chemnitz, Germany

Abstract

In order to shape a more sustainable future for all of us and to create a basis for well-founded and forward-looking decisions, the type, content and location of learning must be designed in a way that is fit for the future. In order for teaching at universities to contribute effectively to education for sustainable development (ESD) in the long term, it is necessary to examine whether the courses offered provide the competencies that are necessary for the societal transformation towards sustainability.

The University of Technology in Chemnitz (TUC) is advancing ESD in a targeted and scientifically sound manner within the framework of its university teaching with diverse, transdisciplinary and numerous projects and teaching offers. The aim of this article is to analyze and systematize selected research and teaching activities of a specific professorship at the TUC to support, raise awareness of and achieve ESD goals. First, a literature review was conducted and the most important sustainable criteria, related to education, were identified. For this purpose, teaching modules and projects are shown, clustered and compared on the basis of a specially created, generic procedure and evaluation model using various ESD criteria. Example network diagrams for each module are then derived from the evaluation, showing strengths and weaknesses with respect to ESD. Pointing out the weaknesses can be used to eliminate them in the future and bring ESD more to the forefront to make students more aware of sustainability. The assessment model has the advantage of being universal and applicable to events at different universities.

The article supports SDG 4, especially SDG 4.7. First, it sensitizes teachers to question their teaching and align with the criteria for ESD. When this has taken place, students can build and implement more knowledge and competencies in the field of sustainable development. The assessment model helps to consider and support the 5 Ps. On the one hand, students acquire more knowledge about the path to sustainability and about sustainable development. On the other hand, teachers are also encouraged to reflect on their teaching activities. These two perspectives contribute to the need to build partnerships, for example among teachers, as well as to increase knowledge about planetary boundaries and social life.

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Preparing Students for the Sustainability Skill Requirements of the Engineering Labour Market

Ms Orsolya Barna, Dr Mária Szalmáné Csete
Budapest University of Technology and Economics Faculty of Economic and Social Sciences, Budapest, Hungary

Abstract

The quality of human capital is a key factor in successfully facing complex problems of our era, such as sustainability and climate change. Identifying and developing the skills, knowledge and attitude required by these complex problems, new technologies, new challenges are fundamental to successfully integrating them into the education systems. Organizations and researchers have long focused on sustainability competencies, seeking to identify and categorize the key skills needed for a sustainable future. Technology is one of the main drivers in the economic transition; therefore, engineering has a crucial role in addressing sustainability challenges and facilitating the sustainability transition. Our research aims to examine the transversal skill requirements of the labour market for engineering positions and see how transversal and sustainable skills are represented among them. The study provides an analysis of the job offerings at the job fair at the Budapest University of Technology and Economics in March 2023. Our results show that the most common transversal skills for engineers are teamwork, communication skills, and independency. The need for specific sustainability skills however is very low. Based on our results, we recommend promoting the concepts of sustainability and transversal skills through educational publications including and collaborating with industrial stakeholders.

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Future Proofing Business Education: the promise of a dialogical teaching approach

Dr Olga Cam[1], Prof Joan Ballantine[2]
[1]University of Sheffield, Sheffield, United Kingdom. [2]Ulster University, Belfast, United Kingdom

DR OLGA CAM

PROF JOAN BALLANTINE

Abstract

There are no agreed solutions as to how humanity becomes sustainable. Yet, the acknowledged reality is the danger to the planetary and human well-being posed by unsuitable living. Higher business education is vital in enabling sustainable living by educating future business leaders. However, without answers, these solutions cannot be taught in the traditional didactic manner. Education for the future demands a re-think of teaching and assessment strategies. This autoethnographic study contributes to the business education literature concern with seeking ways to educate for the unknown by turning to Paolo Freire's dialogic education ideas. It proposes ways to embed sustainability into the higher education business curriculum by showing how the dialogic education approach can be adapted by looking at the example of bringing dialogic elements into undergraduate accounting education.

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A 5Ps approach to teaching and e-learning sustainability: The case of Universidade Aberta

Mahsa Mapar[1,2], Paula Bacelar-Nicolau[1,3], Marco Dias[4], Celia Dias-Ferreira[1], Helena Manuelito[4], Rute Martins[5], Ana Paula Martinho[1,6], Pedro Pereira[1,7], João Simão[1,6], Jorge Trindade[1,8,9], Paula Vaz-Fernandes[1,6], Sandra Caeiro[1,2]

[1]Department of Science and Technology and CEG, Center for Global Studies, Universidade Aberta, Lisbon, Portugal. [2]CENSE, Center for Environmental and Sustainability Research, Nova University Lisbon, Lisbon, Portugal. [3]CFE, Center for Functional Ecology, University of Coimbra, Coimbra, Portugal. [4]Universidade Aberta, Lisbon, Portugal. [5]Research Centre for Tourism, Sustainability and Well-being (CinTurs), University of Algarve, Algarve, Portugal. [6]CAPP, Center for Public Administration and Public Policies, Universidade de Lisboa, Lisbon, Portugal. [7]Centre for Functional Ecology, Science for People and the Planet, Associate Laboratory TERRA, Universidade de Coimbra, Coimbra, Portugal. [8]Centre of Geographical Studies, Institute of Geography and Spatial Planning, Universidade de Lisboa, Lisbon, Portugal. [9]Associated Laboratory Terra, Universidade de Lisboa, Lisbon, Portugal

MAHSA MAPAR

PAULA BACELAR-NICOLAU

MARCO DIAS

CELIA DIAS-FERREIRA

HELENA MANUELITO

RUTE MARTINS

ANA PAULA MARTINHO

PEDRO PEREIRA

JOÃO SIMÃO

JORGE TRINDADE

PAULA VAZ-FERNANDES

S A N D R A C A E I R O

Abstract

Education is one of the key transformations needed for achieving Sustainable Development Goals (SDGs) to empower students to tackle social and ecological problems and enable them to put sustainability into practice. In this context, approaches to how students learn to reflect and act on sustainability issues on the scope of UN Agenda 2030 are pivotal and will influence their actions as change agents in society. However, education on sustainability based on the SDGs is still in its early stages at Higher Education Institutions. Recognizing this need, a micro-credential module was developed at Universidade Aberta (UAb), Portugal, which takes a 360-degree approach to teach sustainability in the context of five areas (5Ps) of critical importance for humanity and the planet (People, Planet, Prosperity, Peace, and Partnerships). This module helps students grasp the complexity of the SDGs by highlighting how the SDGs are intertwined frameworks in the context of 5Ps, instead of being perceived as a list of independent goals. This paper aims to present the pedagogical approach and the structure of this newly developed module and assess the outcome of its pilot teaching at UAb.

The full module entitled “Sustainable Development Goals”, comprised 156 study hours, was designed in e-learning mode, and was structured in 6 micro-credential lessons: i) Introduction to Sustainable Development, ii) People, iii) Planet, iv) Prosperity, v) Peace, and vi) Partnerships. Various learning materials were developed ranging from the text and slides to introduction videos for each lesson and narrative presentation. Different individual/collaborative activities were applied by using engaging and captivating tools such as Padlet, WIKI, and Forums. An extra lesson at the beginning of the module welcomed students inside the content and online environment, inviting them to collaboratively build a “Mural of Happiness”, which was later revisited by them, in the last week, in a reflective approach.

Led by 10 educators, the training was offered to all undergraduate students of UAb and 43 students were enrolled. To assess the module, two sets of questionnaires were developed i) a pre-questionnaire to evaluate students' pre-knowledge on Sustainability and SDGs, and ii) a post-questionnaire to evaluate students' perceptions of the training structure, materials, topics, as well as their knowledge improvement. The findings show that 94% of the students were satisfied with the module, rating the “diversified learning resources” as the most qualified aspect of the training. Among those, the narrative presentations and the introduction videos were acknowledged as paramount materials. Within the topics, Peace and Prosperity stand in first and second places. The module was successful in increasing the students' knowledge on both "Sustainability" and “SDGs” issues. The results of the "Mural of Happiness" show that interacting with "nature and family", by addressing People and Planet, was the main contributor to developing positive-thinking approaches to achieving a sustainable life. The Module is ready for refining to be taught in the next semesters within different courses, thus contributing to the progress toward the 5Ps approach, particularly SDG4, target 4.7.

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Raise awareness in day centers and senior universities communities about marine litter

Sara Bettencourt[1], Sónia Costa[2], Sandra Caeiro[3]
[1]UAb, CENSE, OOM, MARE/ARDITI, Funchal, Portugal. [2]OOM, MARE/ARDITI, Funchal, Portugal. [3]UAb, CENSE, Lisbon, Portugal

Abstract

Ocean pollution, particularly marine litter, is a global challenge identified in Agenda 2030. Marine litter can be defined as the processed solid waste accumulated and deposited in the marine and coastal environment and has been acclaimed as an urgent issue to be addressed. Such debris problem is mainly attributed to human activities and behaviors therefore, education and behavioral change actions are presented as tools to tackle it. Considering that education for sustainable development is a lifelong learning process where learners of all ages are empowered with the knowledge and skills necessary to face global challenges, the main goal of this work was to educate and raise awareness in daycare centers and senior universities communities about marine litter. Almost 150 participants from several community centers and senior universities in Funchal (Madeira Island, Portugal) participated in the study. A two-sessions intervention was developed, with an one-hour session per week. Marine litter definition, composition, sources/pathways, impacts, estimated degradation rates, national and regional reality, and prevention measures were explored in the sessions. Moments of oral sharing were privileged, as it was an activity where seniors feel more comfortable. Examples of the past versus the present were presented, where the evolution and greater use of plastic were discussed. Also, was reinforced the necessity of avoiding putting garbage in streams, as streams have been identified as a potential marine litter pathway on the island in previous studies. To assess the interventions, two tools were employed: 1) a flipchart for a question and answer session where the researcher registered participants' perceptions and answers to questions (what marine litter is, its impacts, sources/pathways, and solutions) before and after sessions, 2) interview assessment sheet, whose questions were read and the answers recorded by the researcher with the help of employees of the institutions because some of the seniors had many difficulties in writing. Globally, lack of human civility and nature care, together with animals suffering, were the ideas mostly associated with marine litter. Participants identified plastic, metal, and cigarette butts as common in the marine environment but did not hold the estimated degradation rates of such items. Ocean tides, streams, sewage systems, boats, and human negligence/behaviors were pointed out as responsible for litter accumulation. Referring to old practices, several seniors reported that in the past, goods were packed in paper, glass was used instead of plastic, and when objects got broken they were repaired. Altogether, the results indicated that interventions were positive: seniors become more aware of the subject and understood that human behaviors are essential for sustainable development and ocean conservation. Moreover, as marine litter is a global problem that requires an all-inclusive approach, education for sustainable development must be explored as a lifelong learning process to offer a quality education on the subject. (SDG4/target4.7; SDG6/target6.3; SDG12/target12.5; SDG14/targets14.1/14.2/14.c)

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Circular Economy in Higher Education Curricula: The Portuguese case

Dra. Carla Farinha[1], Professor Tomás Ramos[2,3]
[1]CENSE, NOVA FCT, NOVA University of Lisbon, Lisboa, Portugal. [2]CENSE, FCT, NOVA University of Lisbon, Lisboa, Portugal. [3]DCEA, NOVA FCT, NOVA University of Lisbon, Lisboa, Portugal

DRA. CARLA FARINHA

PROFESSOR TOMÁS RAMOS

Abstract

The Organisation for Economic Co-operation and Development (OECD) recognizes that Higher Education Institutions (HEI) play a crucial role in promoting economic growth and social development. HEI contributes to knowledge creation and dissemination through research and teaching, respectively, while also engaging with the wider community through outreach activities. Circular Economy (CE) principles in higher education (HE) curricula could be central to the sustainability performance of HEI, in particular in its offer of advanced training. As the current generation of students will be future leaders and decision-makers, it is essential to equip them with the knowledge and skills necessary to understand and implement circular strategies and practices. Integrating CE principles into HE curricula, institutions can prepare students for the challenges and opportunities of the circular economy, such as designing and implementing circular business models, products, and services that are less wasteful, more efficient, and more sustainable, replacing the 'end-of-life' concept. It can also help students understand the systemic nature of sustainability challenges and develop interdisciplinary problem-solving skills. This paper aims to investigate the current state of the Portuguese higher education system in addressing the concept of CE. This research will identify and explore the key topics related to circular economy education in higher education programs in the second cycle within public HEI. A content analysis will be conducted through the analysis of academic programs and courses already assessed and accredited by A3ES, which is the national Agency for Assessment and Accreditation of Higher Education, whose purpose is promoting and ensuring the quality of HE. The findings of this study will provide valuable insights into the current state of the Portuguese higher education system in addressing the CE and may be used to identify areas where the higher education system can improve its offerings and better prepare students for the challenges of a circular economy. A further discussion of the findings concerning the development of CE education and its contribution to the growth of a more sustainable and resilient economy in Portugal and beyond will take place.

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3D models in education

PaedDr. Daniel Dancsa[1,2], Dr. habil. PaedDr., PhD. Melinda Nagy[1], Ing., PhD. Ondrej Takáč[1]
[1]J. Selye University, Komárno, Slovakia. [2]Eszterházy Károly Catholic University, Eger, Hungary

PAEDDR. DANIEL DANCSA

Abstract

Sustainability is perhaps one of the most important issues today. This is no different in education. Thanks to developing technological tools, we can incorporate photogrammetry methods into the teaching process. Models have been used in education for a long time and have always facilitated writing. Our aim is to present the possibilities to develop 3D models, specifically defined as arthropod models, and of course to include them in the teaching process. Mobile phones, cameras and other technical devices have reached a level of technology where the photographs they help us to take are of sufficient quality to create 3D textured models. The use of such 3D models in education can be justified not only in online education. It can make the classroom more interesting even for students with possible phobias, as it is possible to study the species without the physical presence of a living animal, which often involves the destruction of the specimen, and without seasonal restrictions. Furthermore, 3D models can have the great advantage that only a single individual is needed to create a model, so that the number of individuals is not reduced, which is a welcome feature for a rare species, as a single individual can be used to create a 3D model that is easily accessible to all and can faithfully represent the characteristics of the species. The 3D models created carry elements of reality and are not just idealised models created in a graphics editor. This allows learning to reach a new visual level. The models we produce can bring students closer to a world and its structure that we do not see every day. It can also alleviate any phobias about arthropods, as what students see up close they are less likely to reject. And in the case of repeated online education, it may be virtually the only way for the teacher to replace the common field or laboratory demonstration. From a sustainability point of view, our achievements are not negligible, as the 3D arthropod models make it easy to access and study even seasonally linked species without destroying individuals. Our results are likely to be welcomed not only by education,as it is also much easier to store a 3D model, so that it can be used in classrooms and possibly museums and lecture halls.

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Education for Sustainability in the University-Society Relationship: possibilities and challenges in the contemporary Brazilian context

Miss Jaqueline Silva Melo, Mr. Armido dos Santos de Sousa Teodósio, Mrs. Carolina Costa Resende, Miss Virgínia Simão Abuhid Burkhardt
Pontifical Catholic University of Minas Gerais, Belo Horizonte, Brazil

MISS JAQUELINE SILVA MELO

MR. ARMIDO DOS SANTOS DE SOUSA TEODÓSIO

MRS. CAROLINA COSTA RESENDE

MISS VIRGÍNIA SIMÃO ABUHID BURKHARDT

Abstract

Universities face major challenges in contemporary reality. The production of fake news, the questioning of science, and the challenges of producing knowledge capable of leading societies to advance in the transition toward Sustainability are some of these challenges. In this context, the relationship between universities, different civil society groups (social and environmental movements, NGOs, communities, and traditional communities), and market actors (large corporations, small and medium-sized companies, and entrepreneurs) is marked by the difficulty of recognizing knowledge valid, whether formal or informal, scientific or popular and communitarian, for the promotion of Sustainability. The socio-environmental programs and projects that built the relationship between universities and societies are initiatives that can integrate Teaching with Research. They are also the locus of student protagonism, in which the greatness of social justice and the relevance of integral ecology are learned. Currently, in view of the complexity of the socio-environmental problems of our reality, the programs, projects, and actions of interaction between the university and society face renewed challenges linked to the modernization of academic work as one of the places where the university's social function is exercised. Brazilian legislation establishes that activities linked to the interaction between universities and society seek “the construction of collaborative projects, which allows, in an effective way, to materialize an agenda of social inclusion, citizenship, and humanist education, in the perspective of integral development of the human being. In this perspective, the educational activities beyond the walls, promoted by programs, projects, and actions between the university and society, enable more people to learn the value of equality, freedom, autonomy, plurality, solidarity, and justice, principles adopted by universities and reflected in their community and social projects and programs. Aware of the importance of extension in the integral formation of students in the context of Brazilian higher education, the Brazilian National Council of Education (CNE), through resolution number 7 of 2018, establishes guidelines for the circularization of these interaction activities between universities and society in higher education. They become mandatory and must compose, at least, 10% of the total student curricular workload of undergraduate courses, becoming part of the curricular matrix of the courses. The legal norm came into force in 2023. In

this context, academic work began to be developed through the most diverse mechanisms, within which we will seek to analyze in the present study the experience of modernizing its relations with

society developed by a large higher education institution in Brazil. In order to achieve this objective, we developed a case study of a qualitative nature, focusing on the analysis of projects carried out within the scope of a Brazilian university present in seven Brazilian cities and which currently involves eighty thousand students. The results point to possibilities of modernizing the role of the university as one of the relevant actors for the promotion of Sustainability in contemporary societies and the challenges linked to institutional inertia and horizontal, democratic, and participatory articulation between academic and non-academic actors in the production of relevant knowledge for current socio-environmental challenges.

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Sustainability Research on Service Design of Art Classroom Teaching Experience in Primary and Middle Schools

Prof. zhigang Chen[1,2], Mr. Chenyu Sun[1]
[1]Shanghai University, Shanghai, China. [2]Shanghai Academy of Fine Arts, Shanghai, China

Abstract

As people pay more and more attention to user experience and service systems, service design has begun to be gradually applied in the education field. At a time when aesthetic education is increasingly being valued, fine arts education in primary and secondary schools, as an important part of the practice of aesthetic education in primary and secondary schools, also urgently needs to optimize the teaching experience to adapt to the trends of technological development and educational innovation. This research uses service design methods and tools to provide insights into the teaching experience, cuts into fine arts education from the perspective of experience, explores the current situation of the fine arts education system in primary and secondary schools, and establishes a large framework of teaching experience and an evaluation model of classroom teaching experience. The opportunity points and design strategies of experience design were extended, and classroom teaching experience service system of art in schools was constructed.

This paper adopts a research path that combines theory and practice, focusing on the classroom teaching experience of fine arts education in primary and secondary schools, using research and analysis tools of service design to deconstruct and reconstruct the specific context and abstract structure of fine arts education and classroom experience. Through the desktop research method and document analysis method, the relevant concepts, specific categories, pattern distribution, content scope, and current situation of fine arts education and teaching in primary and secondary schools have been defined, so as to understand the overall appearance of fine arts education in primary and secondary schools; secondly, the author through user research methods such as user interviews and questionnaire surveys, we have made a three-dimensional analysis and structure of the overall experience of fine arts education and teaching. With the help of the service blueprint and the stakeholder map of fine arts education in primary and secondary schools, a basic fine arts education in primary and secondary schools has been established Teaching experience framework; Next, the author cuts into the classroom teaching experience based on the "front-end experience" of the experience framework, reorganizes and visually integrates the information according to the corresponding relationship between the teaching process and content, draws user portraits and experience journey maps, and then discusses classroom teaching The basic composition of experience and an experience evaluation model are proposed.

The author systematically sorted out the problems of classroom teaching experience, analyzed the core crux of the classroom teaching experience and potential design opportunities, proposed three design strategies, and carried out the classroom teaching experience system accordingly. The design practice part is the design of service blueprint, service supply map, art education community platform and its evaluation system. This project aims to optimize the classroom teaching experience of fine arts in primary and secondary schools, and to provide references for the exploration and practice of fine arts teaching and other types of aesthetic education. It hopes to further promote the development and integration of service design in the field of education and even other fields.

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The community-based sustainability education with sensory stimuli: A practical approach

Adjunct Lecturer Cheng Hui Liu, Adjunct Assistant Professor Mei Ya Lan
National University of Kaohsiung, Kaohsiung, Taiwan

ADJUNCT LECTURER CHENG HUI LIU

ADJUNCT ASSISTANT PROFESSOR MEI YA LAN

Abstract

The challenge to engage students in sustainability learning in higher education is getting more difficult nowadays due to neoliberalism, credentialism, and slacktivism. Educators must search for new teaching approaches to change it. Community-based learning and the idea of sensory stimuli have shown the potential to improve students' engagement and advance sustainable teaching. This paper describes the process of how we followed the steps of action research to lecture two courses in the field of liberal education, with an emphasis on sensory stimuli and collaboration with people in the communities. It also demonstrates the result of a survey to investigate students' attitudes and learning results of the projects to promote sustainability in the community.

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Impact of Environmental Knowledge on Pro-Environmental Behaviour of College Students: Applying the Conservation of Resources Theory

LU ZHANG, Dr. HANAFIAH MOHD HIZAM
The National University of Malaysia, Bangi, Malaysia

Abstract

Climate change is a serious global issue. The 2030 Agenda for Sustainable Development provides a comprehensive development framework for all countries in the world to promote and achieve the United Nations sustainable development goals. In response to climate change, the Chinese government has set a clear goal to reach its carbon peak by 2030 and achieve carbon neutrality by 2060, endeavouring to gradually realize net-zero carbon dioxide emissions. Besides, organizations have been held accountable for climate change as they continue to emit carbon dioxide and harmful chemicals into the air and water. Addressing environmental challenges requires action from governments, industry, and organizations, as well as pro-environmental behaviours from individuals. Pro-environmental behaviour is defined as behaviour that minimizes humans' negative environmental consequences. As individuals have relatively fixed and limited amounts of time and energy, they have the motive and motivation to acquire, foster and assimilate more resources from their environment according to the conservation of resources (COR) theory. Following the COR theory, this study aims to explore the influence of environmental knowledge on pro-environmental behaviour among Chinese college students by examining the mediating effect of student relational energy and the moderating role of student self-construal. As college students are one of the main bodies of future employment and consumption, promoting their pro-environmental behaviour plays an important role in protecting the environment. The quantitative research design is applied in this study. And the study would employ a self-administered survey questionnaire to collect data from respondents, to investigate the relationships among variables at the single point of time, which is a cross sectional approach. To be regarded as appropriate for the study, the survey's participants will be required to be Chinese college students, who are from several different universities/college from Qingdao City, Shandong Province, China. The appropriate unit of analysis for this study is individual students.

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Recent Trends and A Future Direction of Malaysia's Climate Change Postgraduate Law Program

Assoc. Prof. Dr. Haslinda Mohd Anuar[1,2], Assoc. Prof. Dr. Harlida Abdul Wahab[1,2], Dr. Mohamad Farhan Mohamad Mohsin[2,3], Assoc. Prof. Dr. Ani Munirah Mohamad[1,2], Dr. Wan Norhayati Wan Ahmad[2,4]
[1]School of Law, Universiti Utara Malaysia. [2]Climate Change Law Research Unit, Universiti Utara Malaysia. [3]School of Computing, Universiti Utara Malaysia. [4]Tunku Puteri Intan Shafinaz School of Accountancy, Universiti Utara Malaysia.

ASSOC. PROF. DR. HASLINDA MOHD ANUAR

Abstract

Climate change is a critical global issue that is predominantly caused by human activities. To equip students in higher education institutions (HEIs) with the necessary knowledge and skills to play an active role in mitigating the effects of climate change, HEIs need to incorporate climate change-related programs into their teaching curricula. These programs should emphasize law and policy, enabling students to become environmentally aware and motivated to act. The Climate Change Institute (Institut Perubahan Iklim or IPI) at Universiti Kebangsaan Malaysia is among several (HEIs) in Malaysia offering a Master's program in Climate Change (Coursework), with a specialization in Environmental Science and Earth Science. This paper aims to analyse the structure of existing climate change programs at both public and private HEIs in Malaysia. Desk research is conducted to gather various information from the available structures involving seven public universities and two private universities in Malaysia which offer 23 environmental-related programs both in undergraduate and postgraduate studies. The findings were analysed by a constant comparative approach that is guided by the key themes of the study. The finding shows that all universities that offer law programs do not have climate change postgraduate law programs offered at their faculties. Other faculties, should they have such a similar program, are more related to sciences, engineering, technology and management. This paper concludes by providing insights into the key features of recent trends in the offering of climate change postgraduate law programs in Malaysia. Accordingly, the findings of the study would serve as a significant guide for the development of any new climate change policy and law programs in the future in line with United Nation’s Sustainable Development Goal SDG13 on climate action which focus on Target 13.3 in improving education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. The new climate change postgraduate law program will also contribute to the sustainability of climate action, particularly in capacity building of the people on teaching delivery methods of climate change policy and law, protecting the planet, promoting prosperity, maintaining peace and establishing connections and partnerships in the teaching methods, such as global learning.

Keywords: Trends and direction, climate change, postgraduate law program, policy and law, education, SDG13

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Teachers' Inner changes for sustainability

Dr. Elis Ossmane[1,2], Professor João Simão[1], Professor Sandra Caeiro[1]
[1]Universidade Aberta, Lisbon, Portugal. [2]Instituto Politécnico de Setúbal, Setúbal, Portugal

Abstract

As a key element in promoting sustainability, many authors emphasize the importance of changing mindsets to reach social transformation. This approach argues that sustainability can be achieved if peoples' mindsets in relation to different spheres of life, especially regarding self-perception, connection with others, and with nature, alter to a more ecologic way of living. In other words, sustainability depends on behavior, which depends on peoples' mindsets – deep leverage points for the necessary behavioral change.

In this scope education is a powerful tool to promote capacity building for sustainability, especially through inner changes fostering, at all education levels, namely at higher education level.

However, many authors have studied the subject field of education for sustainability, regarding sustainability competencies development or mindset changes in student's education, but less have done such research regarding teachers. As agents of change, it is important for teachers to have a sustainability mindset by playing an intervening role in developing students' mindsets as well as in the educational institutions' transformation, considering the need for holistic approaches to sustainability.

This work aims to present an integrative literature review paper regarding teachers' inner changes and its relation to education for sustainability, as it seems to be a relatively new topic that needs a specific framework. The paper lies on the premise that, despite education's transversal character on Agenda 2030, people must acquire the knowledge and skills to live a sustainable life (SDG 4 – target 4.7), which is here explored regarding the importance of peoples' inner dimensions. On the other hand, to deliver efficacy in sustainability learning, teachers must be prepared to promote inner changes, which will allow learners and other stakeholders to deeply engage with sustainability and behave in accordance. In this sense, the authors believe that the presentation addresses the Conference topic especially because it relates to education for sustainability efforts to change attitudes, behaviors, and lifestyles and to develop a more ecological and inclusive self (mainly addressing "people" and "planet" from Agenda 2030).

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How do students feel about the SDGs? Towards better embedding of emotions and the mind-body connection into sustainability learning

Dr. Antje Disterheft[1], Dr. Olga Cunha[2], Cristina Quadros[3], Arlete Meneses[4]
[1]CENSE – Center for Environmental and Sustainability Research & CHANGE - Global Change and Sustainability Institute, NOVA School of Science and Technology, NOVA University Lisbon, Caparica, Portugal. [2]Faculty of Social Sciences and Humanities, NOVA University Lisbon, Lisbon, Portugal. [3]Association Conhecer-Se, Lisbon, Portugal. [4]NOVA University Lisbon, Lisbon, Portugal

DR. ANTJE DISTERHEFT

Abstract

In the field of Education for Sustainability, scholars and practitioners advocate for a "head – heart – hands"-approach, aiming to integrate holistically our mind and body in our learning design and processes. However, most often rational and cognitive approaches are chosen, particularly in higher education. With the focus on competitive performance, evaluation and comparison, schools and higher education institution today put a lot of pressure on pupils and students, causing fear and exhaustion already in early ages. Additionally, the current multiple crises like the recent pandemic, wars, natural disasters and catastrophes, climate change and global injustices can put extra weight on young people who do not see a bright future ahead. Psychological distress about climate change and worsening environmental conditions – often referred to as eco-anxiety or fear of environmental doom – can be observed increasingly in children, adolescents, and young adults.

This work presents results from a questionnaire survey that was applied to all 2nd year Bachelor students at a Portuguese university about their emotions towards the SDGs, obtaining 244 responses (response rate 25%). Students responded after having completed a 5-weeks-module on sustainability, where they worked in groups on a chosen SDG, developing causal loop diagrams. The survey was developed within the European Erasmus+ project MP4S about Mindfulness in Higher Education, of which the authors are consortium members, and which aims to develop adequate mindfulness programs that can easily be integrated in higher education institutions. Students could choose up to 3 SDGs they felt most familiar with and then use the Plutchik Wheel of Emotions to select respective emotions, adding also personal comments in open text fields. Furthermore, students were asked about the importance of the development of inner skills and whether they do contemplative practices.

The results of the questionnaire were analysed using descriptive statistics and content analysis of open questions.

The top five emotions chosen were (i) interest, (ii) sadness, (iii) trust, (iv) vigilance and (v) grief, and the respondents were divided about the likeliness that the SDGs can be achieved or not. Only a few students (16%) have experience with contemplative practice, but the majority considers the development of inner skills of "high" or of "extremely high importance". Many students wrote long personal comments (over 70, 35%) that allowed to understand better their feelings, and of which some indicate pessimistic perceptions about the future.

Scholars call for more consideration of eco-anxiety and related emotions and propose adjustments to educational programmes directed towards sustainability learning. Such adjustments can e.g. encompass nature-connectedness and hope through
- creating more opportunities for expressing emotions (small group discussion, integrating art-based and place-based pedagogies, etc.);

- developing coping strategies, e.g. through mindfulness-related activities, being in nature, embodied experiences;

- offering role models (e.g. people who love and care for nature, and who admit their personal emotional difficulties and how they deal with them).

This work relates to SDG4, target 4.7, and indirectly to SDG3. By strengthening the youth and empowering young people to deal constructively with adversities and uncertainties, also the 5P's are strengthened.

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3D models in education

Daniel Dancsa[1,2], Melinda Nagy[1], Takáč Ondrej[1]
[1]J. Selye University, Komárno, Slovakia. [2]Eszterházy Károly Catholic University, Eger, Hungary

Abstract

Thanks to developing technological tools, we can incorporate photogrammetry methods into the teaching process. Models have been used in education for a long time and have always facilitated writing.

Our aim is to present the possibilities to develop 3D models, specifically defined as arthropod models, and of course to include them in the teaching process. Mobile phones, cameras and other technical devices have reached a level of technology where the photographs they help us to take are of sufficient quality to create 3D textured models. It can make the classroom more interesting even for students with possible phobias, as it is possible to study the species without the physical presence of a living animal, which often involves the destruction of the specimen, and without seasonal restrictions. Furthermore, 3D models can have the great advantage that only a single individual is needed to create a model, so that the number of individuals is not reduced, which is a welcome feature for a rare species, as a single individual can be used to create a 3D model that is easily accessible to all and can faithfully represent the characteristics of the species.

Full Papers

Preparing Students for the Sustainability Skill Requirements of the Engineering Labour Market

Orsolya Barna[1], Maria Szalmáné Csete[2]

[1, 2] Department of Environmental Economics and Sustainability, Faculty of Economic and Social Sciences, Budapest University of Technology and Economics,
Műegyetem rkp. 3., H-1111 Budapest, Hungary

[3]barna.orsolya@gtk.bme.hu

Abstract. The quality of human capital is a key factor in successfully facing complex problems of our era, such as sustainability and climate change. Identifying and developing the skills, knowledge and attitude required by these complex problems, new technologies, new challenges are fundamental to successfully integrating them into the education systems. Organizations and researchers have long focused on sustainability competencies, seeking to identify and categorize the key skills needed for a sustainable future. Technology is one of the main drivers in the economic transition; therefore, engineering has a crucial role in addressing sustainability challenges and facilitating the sustainability transition. Our research aims to examine the transversal skill requirements of the labour market for engineering positions and see how transversal and sustainable skills are represented among them. The study provides an analysis of the job offerings at the job fair at the Budapest University of Technology and Economics in March 2023. Our results show that the most common transversal skills for engineers are teamwork, communication skills, and independency. The need for specific sustainability skills however is very low. Based on our results, we recommend promoting the concepts of sustainability and transversal skills through educational publications including and collaborating with industrial stakeholders.

1. Introduction

Sustainability and climate change are among the most complex problems of our era. The required transition towards a low-carbon and sustainable economy not only brings new or transformed jobs, and new workflows but also the disappearance of specific jobs (Barna and Szalmáné, 2022, p. 683). Therefore, the transition requires equipping future employees with the required knowledge, skills, and attitude to face the upcoming challenges. Engineers play a crucial role key in designing and implementing innovative solutions to complex problems such as sustainability or climate change (Qureshi and Nawab, 2013, p. 110). They can develop new technologies, design eco-friendly products, and create renewable energy systems. Based on their technical expertise, we can use fewer resources, reduce pollution, and minimize our impact on the environment. However, their technical skills might not be enough to successfully solve sustainability related challenges, since a certain level of transversal, or soft skills are necessary to complement the technical expertise and are essential for both their career progression and solving complex problems (Kovacs et al., 2020, p. 932). Transversal skills enable engineers to communicate effectively, collaborate well with others, be flexible with changes and adapt to them, frame and solve problems, demonstrate leadership, and maintain a strong work ethic. In university engineering programmes, therefore there should be an intense concentration on balancing hard skills as the basis of engineering curricula together with soft skills (Martins et al., 2007). Transferable skills are also part of the learning outcomes of these programmes (most commonly leadership, communication, collaboration, etc.), however, these skills are often not taught within the programmes - they are more expected from the students to possess already or improve them individually outside of the programme. The soft skills in practicality are usually only part of the course assessments – for example, the students need to provide a presentation on their assignment in front of the class at the end of the semester. However, the students often do not receive training or in-depth instructions on the necessary presentation

skills within the engineering education program. Opinions are divided on to what extent the development of soft skills is the responsibility of engineering university programs.

In this study, we explore what transversal skills are expected from graduate students when they either enter the job market as interns or entry-level candidates or even later when they have already years of professional interest. To do that we explored the 2023 spring job fair of the Budapest University of Technology and Economics by a quantitative analysis of the transversal skills requirements of the engineering job positions advertised through the website of the event. Our aim is to bring the educator and employer sides closer by identifying the employers' skill requirements. Our purpose was to highlight the most important transversal skills on the job market so that higher education institutions, especially engineering education programs could verify their curricula accordingly and align their programme outcomes to the market's needs and the skill gaps between the graduates' skillset and employers expectations can be minimalized. Additionally, we also aimed to examine the need for sustainability skills in the engineering labour market. Our findings could support reshaping the content of engineering curricula to better prepare students for the labour market challenges.

2. Literature Review

The aim of our literature review was to develop a solid scientific basis to our research considering sustainability skill requirements of the engineering labour market. Firstly, we reviewed the usage of terminology related to skills and competences and green or sustainable skills and competences as there seems to be some confusion in the literature. Then, we examined scientific papers that used job fairs in their analysis, so that we can build up our own study based on the existing research experience. Thirdly we analysed the literature about transversal skills, their definitions, different categorizations, etc. Finally, we reviewed the most widely known sustainability competences. Based on our literature review we built up our theoretical framework to analyze the skill requirements of the job fair of the Budapest University of Technology and Economics.

Within the relevant literature, multiple terms are used to describe the essential skills associated with sustainability: 'green' or 'sustainable' and 'skills' or 'competences'. The term 'green' originates from the concept of the green economy, primarily emphasizing its relevance to employment and employability. Meanwhile, the term "sustainability" finds extensive use in both employment and education contexts. Based on our review, the definitions and categorization of skills and competences often overlap, which can lead to confusion. While the terms 'skills' and 'competences' are frequently used interchangeably, it is important to note that there exists a distinct difference between the two. Skills are usually referred to as a subset of competences, since competences encompass knowledge, skills, and attitudes So the scope of competences is wider, they refer to the ability to use knowledge – competence includes skills, values and attitudes (UN, 2015, p. 43; Bianchi et al., 2022, p. 10; Lizzio and Wilson, 2004, p. 471). In policy and scientific discourse, the terms 'green skills' or 'skills for sustainability' are often used interchangeably with competences.

Many different terminologies are used related to the transversal competences as well, for example, key competencies, core skills, generic skills, transferable skills, soft skills, employability skills, 21st century skills, etc (Devika et al., 2020, p. 350). So what are these transversal skills? UNESCO (2013, p. 487) defines it as skills that are generally regarded as not being specifically tied to a particular job, task, academic discipline, or area of knowledge and they have broad applicability in a wide variety of situations and work settings. Devika et al. (2020, p. 353) define them as fundamental skills, values, and attitudes that play a significant role in the holistic development of an individual. These attributes empower them to adapt effectively to varying situations and conditions, aligning themselves with evolving needs and demands. According to Nagele and Stadler (2020, p. 741), there is no single definition of transversal skills, however, they explain as skills that are essential for individuals to act efficiently in diverse real-life situations, and these skills could be both technical and non-technical abilities. They also reviewed several definitions and they found that even though these definitions vary, they all emphasize the transferability of these skills, meaning they can be effectively applied across different contexts and situations. Whittermore (2018) describes transversal competences among others as transferable (across the context of different domains, geographies, work and life), and related to social and interpersonal relations. We also found that even though the name itself refers to transferability, some scholars question whether these skills indeed could be applied in different contexts (Nagele and Stadler, 2020, p. 742). Some scholars agree that relying solely on technical competences is no longer adequate to fulfill the demands of the modern labour market, it is essential to cultivate transversal competences as well (Graczyk - Kucharska et al., 2020, p.653).

Different scholars list different skills under transversal/soft competences/skills. Nagele and Stadler (2020, p. 744) mention fundamental skills, people-related skills, conceptualizing skills, business-related skills, and community-related skills as the most often listed transversal skills in the literature. According to Whittemore (2018) transferable competences are collaborative problem solving; learning to learn, continuing to learn; digital skills and mindset; initiative and independent thinking; initiative and independent thinking; resilience; adaptability; cultural awareness and expression. Villan -Vallejo et al. (2022, p. 487) who examined soft skills in STEM education, found that soft skills serve are complementary to disciplinary knowledge and are essential in all professional fields. These skills include personal abilities, competencies related to facilitating effective personal and professional interactions, teamwork and leadership skills as well as work ethic, intercultural fluency, and digital literacy. The European Parliament identified key transversal competences, including the ability to acquire learning skills, possess social and civic competences, demonstrate initiative and entrepreneurship, and exhibit cultural awareness and expression (18 December 2006/962/WE, p. L 394/12).

Some scholars also examined the transferable skills specifically for engineers. According to Kovacs et al. (2020), there is a need for a more balanced educational approach in the field of engineering education between technical and transversal competences due to the emerging challenges and the changing requirements of the labour market. As per De Campos et al. (2020, p. 2135), since engineers fulfil different roles in different domains including project management and development, and they often operate in multidisciplinary teams, soft skills serve them as a vital link that connects different areas of expertise. Based on their literature review, they identified the following transversal skills for engineers: communication; critical thinking; creative thinking; emotional intelligence; ethics; and teamwork.

The job fair analysis method was also in our interest. We revised several relevant scientific papers using this method. Segal, Hershberger and Osmonbekov (2009, p. 72) highlighted the advantages of the content analyses of job advertisements. According to them, content analysis offers advantages due to online data availability and objectivity. It also has its limitations of limited scope and varying degrees of data specificity. They also identified the eight essential steps for the content analysis procedure. Rios et al. (2020, pp. 80-89) provided a descriptive analysis of 142,000 job advertisements. They found that there is a high demand for oral and written communication, collaboration, and problem-solving skills among employers. Steinmann et al. (2013, pp. 1925-1929) investigated 60 job adverts in the German machinery and plant engineering industry to understand the professional requirements for engineers. As per their results, technical expertise was highly requested (72%), followed by communication skills (58%) and teamwork abilities. Finally, Meier and Konopaskova (2023, pp. 1-113) provided a mixed-method (both qualitative and quantitative) content analysis on job advertisements gathered from LinkedIn job advertisements in three countries: Denmark, Germany, and Slovakia. They created a literature review on the most common transversal skills, and they created their categories for the marketing field. This categorization was the basis for our categorization. Based on the results of the literature review, we can say that content analysis of job advertisements is a common way to identify key skills and competencies demanded by employers.

Over the past decades, numerous organizations and researchers have dedicated efforts to identify and classify the primary competences necessary to contribute to a sustainable future. The most frequent understanding of sustainability competence includes sustainable knowledge, skills and attitudes. In some studies, values are additionally included in the definition, recognizing their pivotal role in driving behavior change toward sustainability (Bianchi, 2020, p. 13). Wiek et al. (2011, p. 216) presented one of the earliest and most recognized categorizations, outlining five key competences: strategic, anticipatory, normative, systems thinking, and interpersonal competences. In their updated framework in 2021 (Redman and Wiek, 2021, p. 10), they expanded the categorization by introducing three additional competences: implementation, integration, and intra-personal competences. The science and knowledge service of the European Commission – the Joint Research Centre (JRC) introduced a competence framework in 2022 called GreenComp (Bianchi et al, 2022, pp. 1-56), which focuses on sustainable skills. GreenComp serves as a general reference framework for sustainability competences and aims to establish a shared comprehension of these skills among students, educators, organizations, and other stakeholders. Greencomp identified 4 competence areas with 3 competences each: Embodying sustainability values: valuing sustainability, supporting fairness, and promoting nature; embracing complexity in sustainability: systems thinking, critical thinking, problem framing; envisioning sustainable futures: futures literacy, adaptability, exploratory thinking; acting for sustainability: political agency, collective action, individual initiative.

Based on our literature review, it can be stated that it is pivotal to improve the balance between technical and transferable skills in the engineering curricula. There is no widely accepted definition of transferable skills, they are often referred to as soft skills, transversal skills, etc. We have seen that sustainability skills have also been identified by several scholar groups based on different aspects.

3. Methodology

In our research, we applied the quantitative content analysis method, and we provided a descriptive statistic concentrating on frequency analysis.

The content analysis of job fairs has a long history to analyse required competences and skills in the labour market of a certain industry. According to Segal, Hershberger and Osmonbekov (2009, p. 73) the content analysis of job advertisements to identify and evaluate skills and competence needs is an effective method for not only academics, but employers, HR professionals, and educators as well. The analysis of recent job fairs can also provide a status update on the current skill requirements (Segal, Hershberger and Osmonbekov, 2009, p. 72).

The content analysis procedures include the steps of data gathering, defining the sample, creating categories, training coders, pretesting and revision of the coding scheme; coding; post-testing the coding scheme for reliability; and analyzing and interpreting data (Segal, Hershberger and Osmonbekov, 2009, p. 72). Based on this process we created our own procedure as follows: data gathering (including training of the gatherer), defining the sample, creating categories, creating a sample of analysis, revising the categories, carrying out the analysis and analyzing and interpreting data. For the data-gathering step, we first contacted the organizers of the job fair to provide the data for the research. Unfortunately, this was not possible, so we decided to work with the available public data on the website of the job fair. We asked for student support to conduct the data collection. One student collected the respective data during May and June of 2023. She copied all data from each position to an Excel file where we previously created the main list of data, and also provided around 30 examples. Based on our previous literature review, we created categories to make the collected data fit for analysis. We identified the following 24 categories: credibility, critical thinking, empathy, ethical behaviour, stress reliance, multitasking skills, strategic thinking, creativity and innovation, initiative, system thinking, presentation skills, responsibility, leadership, interpersonal skills (relationship building), flexibility, planning and organisational skills, analytical skills, precision, problem-solving skills, motivation and positive attitude, independency, communication skills, teamwork and other. The categories were tested on 100 examples and then refined to fit the data.

The raw data database we received in an Excel file had to be reorganized so that the categories could be given to all elements. For the main skill analysis, we had to filter for only the engineering positions, check each skill and organize them in adjacent cells if it was needed (the text of the open positions often used a combination of skills that had to be separated). Then we organized all the soft skills in one database where the analysis could take place. Each soft skill was paired with a category. This step had its limitations, since some soft skills did not fit into any categories (we added them to others), and some could fit into more categories. The organization of categories was repeated to eliminate discrepancies, and the questionable items were discussed and reorganized if needed.

The BME job fair is a regular event organized every semester. More than 1000 national and international companies advertise their opening positions usually. The event is hybrid – it is organized in person in the main building of BME on certain days, but the job adverts are also available online on the website of the event beyond the dates of the actual job fair, and potential applicants can register prior to the event and upload their CVs.

In the job fair of March 2023 altogether 120 companies advertised 1328 positions – at least these were the numbers still available on the website during May – June 2023, when the data collection took place.

The aim of our research was to examine what transversal and sustainable skills are required in the engineering job market. We formulated the below two questions:

- What transversal skills are needed in the engineering job market?
- What sustainability-related transversal skills are needed in the engineering job market?

The limitations of our study included several issues. First, the data collection was created by one person, the data were not derived from a database, therefore human mistake could have occurred. The data

collection was not repeated, but spot tests were performed to minimize mistakes. The second issue is that our snapshot does not cover the full engineering industry, only those who registered for the actual event. However, the sample size of 120 companies with more than 1300 open positions out of which 810 are engineering, can be considered a middle range as per the literature (there are examples of a sample size of 142 000 open positions by Rios et al. (2020, pp. 80-89), but also much smaller sample size: 95 job openings (Meier and Konopaskova, 2023, pp. 1-113). We only concentrated on one event, however, in the future, it would be interesting to repeat the study in several events. With this not only the results could be compared, but also the new trends could be analysed.

4. Results and Discussion

As it was previously discussed, there were 1328 job openings available on the job fair website. Some positions target people from different backgrounds, therefore when we analyzed the background of the job positions, the total number became 1711. As can be seen in Fig. 1, the majority, 47% of these open positions were offered to engineers. The other half of the positions were shared between IT operatives (23%), economists (20%), and other sciences, such as natural sciences, humanities, law, and some other fields that could not be categorized. The relatively high number of engineering positions may be related to the fact that the most prestigious technical higher education institution in Hungary organized the event.

Figure 1. Offered job positions per background

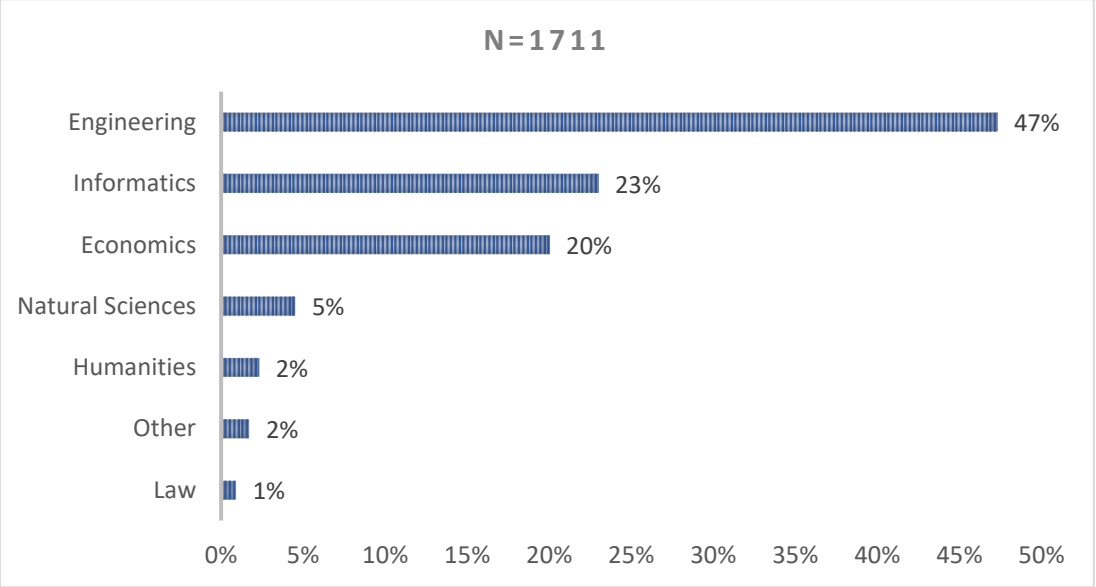
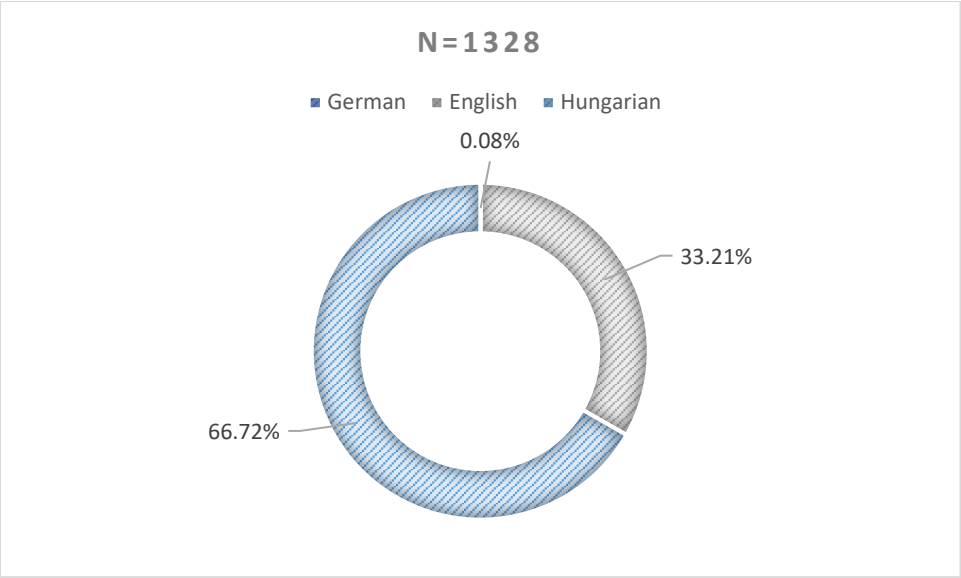


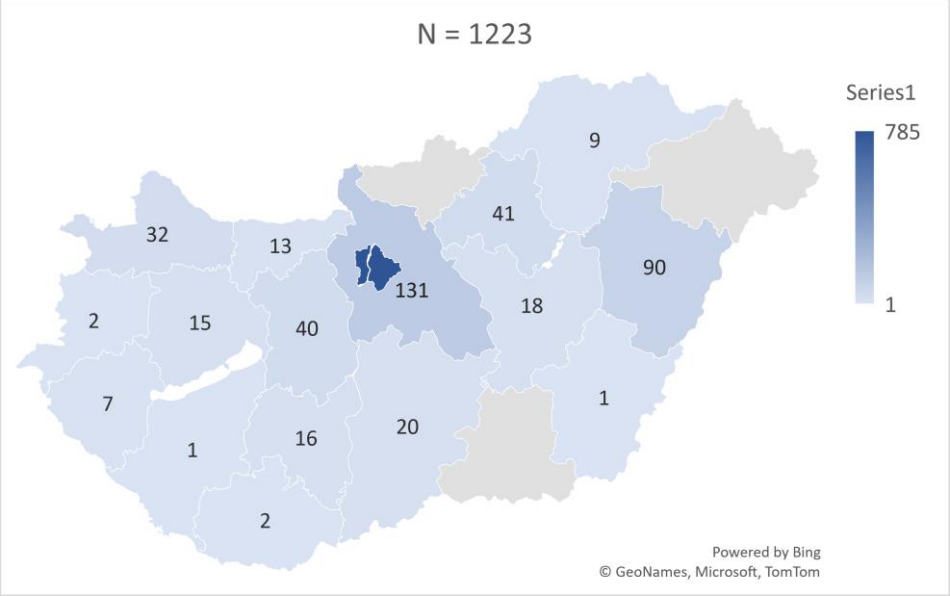
Figure 2. shows the language of the job advertisements. It is no surprise that the majority, almost 70% of the openings used the local native language, Hungarian. Only one-third of the positions used the English language, and there was only one advert in German.

Figure 2. Language of the job advertisements



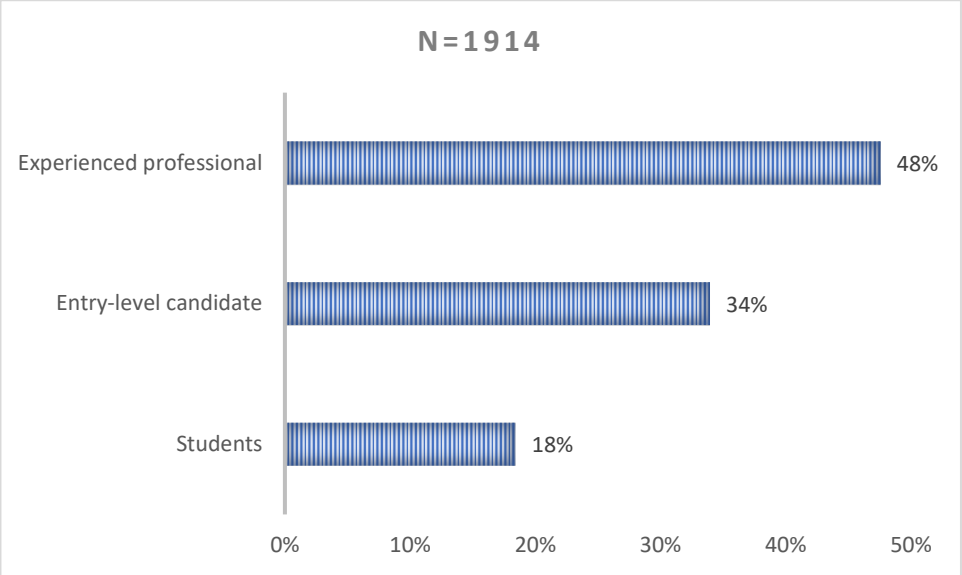
The geographical distribution of the positions is depicted in Fig. 3. Some positions did not specify the location, or only added Hungary, these were taken out of the calculation. The vast majority of positions (785) are located in Budapest, which is the capital of Hungary and serves as an economic centre. The second most positions were offered in the surroundings of Budapest in Pest County, and the third most positions were in Hajdú-Bihar county – where the second largest city of Hungary, Debrecen can be found. There are 3 counties from where there were no positions advertised.

Figure 3. Locations of the job positions by counties



Half of the positions targeted experienced professionals, and the other half of the positions are divided between entry-level candidates and students (Figure 4.). The total number of data is again higher than the number of positions since some of them targeted several experience levels. Even though the event was organized at a university, it is open to external people as well, so anyone could register as a job seeker on its website, therefore the companies did not limit their registered open positions to entry-level.

Figure 4. Level of experience required



As per the language requirements of the positions, 60% required English knowledge, and 33% did not require any knowledge of foreign languages. German was required only in 6% of the positions, and other languages together less than 2% (Figure 5.) We were also interested in the level of English knowledge requirements: the vast majority almost 70 % required conversational English without a proven language exam. 20% asked for the intermediate level, and only 3% for the advanced level knowledge.

Figure 5. Language requirements

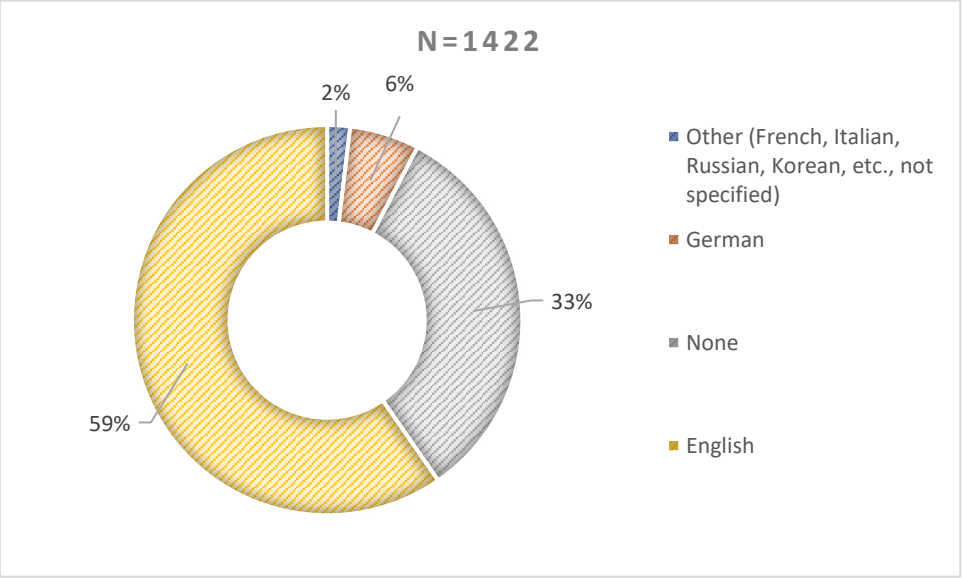
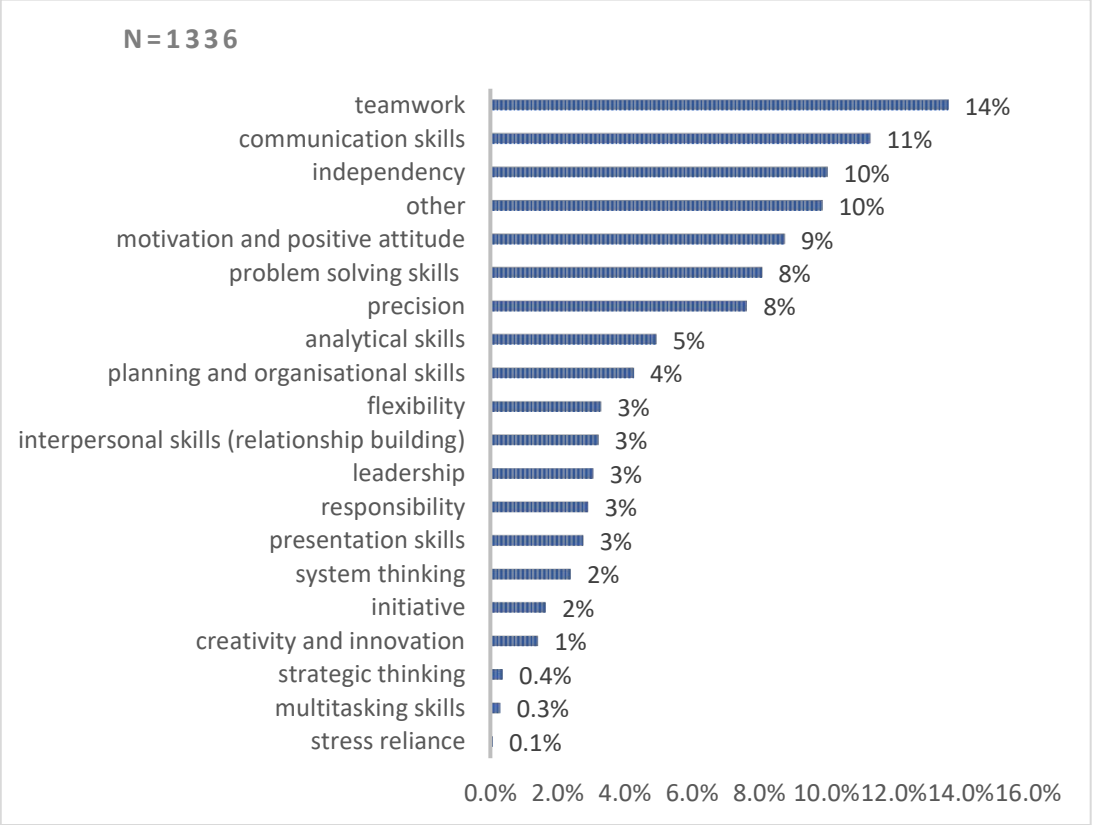


Figure 6. shows the frequency of the transversal skill requirements in the engineering positions – so the total number of positions analysed here is 810. The transversal skills were identified based on the literature review, we selected the most common 19 transversal skills and added an ‘other category for those skills that could not fit in the main categories. Each skill mentioned in the engineering job positions was put into one of the 24 categories we identified (four categories: credibility, critical thinking, empathy and ethical

behaviour received zero results, therefore they do not appear in the figure). Out of the transversal skills, the top 3 are teamwork, communication skills and independency. Very close to the top categories came motivation and positive attitude, problem solving skills, and precision. In the middle, between 2-5% ratio are among others analytical skills, planning and organisational skills, flexibility, interpersonal skills, leadership skills, and responsibility.

Figure 6. Required transversal skills in engineering job position



We were interested in mapping the sustainability transversal skill requirements as well among the openings. We discarded our previous categories and reanalyzed the data as per the sustainability skills discussed in the literature review. First, we used the categorization of Wiek et al. (2011, pp. 203-218) (Fig. 7) and then GreenComp (Bianchi et al., 2022, pp. 1-56) (Fig. 8). We can say that the exact categories were rarely used in both cases. 3.2% of the positions contained interpersonal competences, 2.4% required system thinking, and only 0.4% strategic thinking. The other categories established by Redman and Wiek (2021, p. 10) did not appear in the advertisements. Regarding the GreenComp categories, 2.4% of the positions required system thinking, and 1.65% individual initiative. Problem framing was mentioned only in 0.1% - it is not the same as problem-solving. Adaptability was mentioned in only 0.1% of the cases.

Figure 7. Sustainable competences for engineers based on Redman and Wiek, (2021)

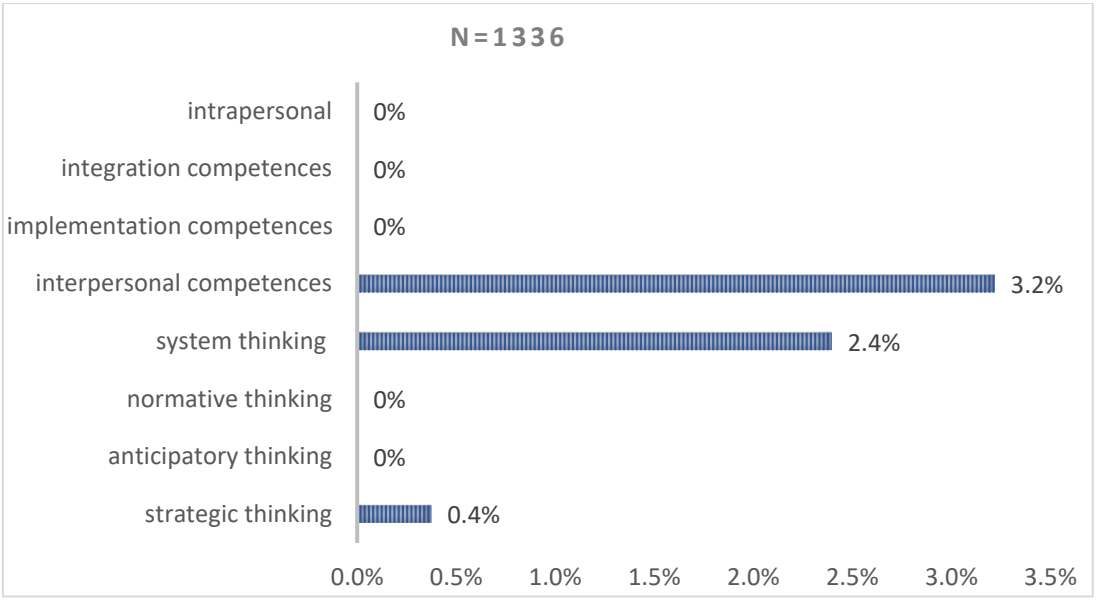
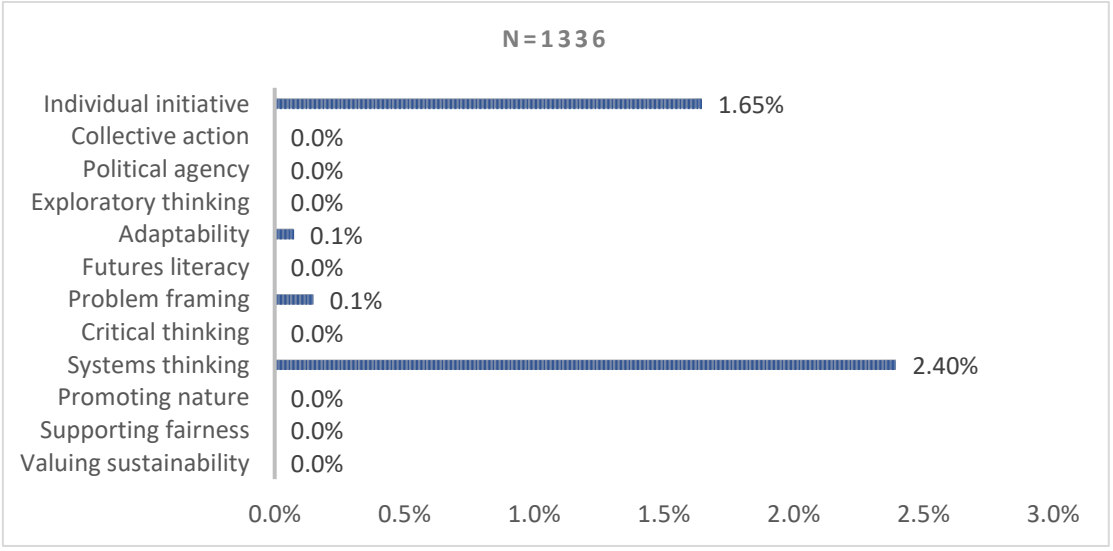


Figure 8. Sustainable competences for engineers based on GreenComp (2022)



5. Conclusion

The described study examined the transversal skill requirements for engineering job openings at the BME job fair of March 2023.

1328 job openings were analysed from the website of the job fair, with 47% of positions targeting engineers, followed by IT operatives (23%) and economists (20%). The language of the advertisements was Hungarian (70%), with only one-third using English and one German. Budapest had the highest number of positions (785), followed by Pest County and Hajdú-Bihar County. Half of the positions sought experienced professionals, while the rest were divided between entry-level candidates and students. English knowledge was required in 60% of positions. The most sought-after transversal skills in engineering roles were teamwork, communication, and independency, while skills like motivation, problem-solving, and precision were also highly valued.

The study emphasized the significance of transversal skills alongside technical expertise, highlighting the importance of collaboration and communication in engineering professions. Furthermore, attributes like problem-solving, motivation, and precision were also highly valued. The study found that there is a lesser emphasis on sustainability-related skills in the advertised position as sustainability skills were rarely mentioned among the skill requirements.

The study has several limitations that could impact the validity and generalizability of its findings. Firstly, the data was derived from a specific job fair website, potentially introducing sample bias and limiting

its representation of the entire engineering job market. Moreover, the data was copied one by one from the website, therefore human could have occurred. The identified transversal skills were limited to 19 categories that might not have covered all mentioned skills in the job openings, thus potentially overlooking other relevant skills sought by employers.

Our findings could be applied in several ways. Universities could apply these results to enhance their engineering programs and curriculum, aligning them with industry demands and emphasizing the development of the identified transversal skills. This would better prepare their graduates to meet the expectations of potential employers and increase their competitiveness in the job market. Our results could support employers who can benefit from this research by gaining insights into prevailing skill trends, enabling them to refine their job descriptions and recruitment strategies to attract the most suitable candidates. Finally, by knowing the most sought-after transversal skills, engineering students could also use the results to develop these competences to increase their employability.

As a continuation of the study, we plan to expand the data sources, incorporating data from several job fairs. The study can also be complemented by qualitative analysis by interviewing recruitment agencies, employers, and also university programme leads.

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A 5Ps approach to e-teaching sustainability: The case of Universidade Aberta

Mahsa Mapar[1,2,12], Paula Bacelar-Nicolau[1,3,] Marco Dias[4], Celia Dias-Ferreira[1,5], Helena Manuelito[4], Rute Martins[1,6], Ana Paula Martinho[1,7], Pedro Pereira[1,8], João Simão[7,9], Jorge Trindade[1,10,11], Paula Vaz-Fernandes[1,7], Sandra Caeiro[1,2]

[1] Department of Science and Technology and CEG, Center for Global Studies, Universidade Aberta, Lisbon, Portugal
[2] CENSE, Center for Environmental and Sustainability Research, Nova University Lisbon, Lisbon, Portugal
[3] CFE, Center for Functional Ecology, University of Coimbra, Coimbra, Portugal
[4] Universidade Aberta, Lisbon, Portugal
[5] CERNAS, Center of Studies of Natural Resources, Environment and Society, Coimbra, Portugal
[6] Research Centre for Tourism, Sustainability, and Well-being (CinTurs), University of Algarve, Algarve, Portugal
[7] CAPP, Center for Public Administration and Public Policies, Universidade de Lisboa, Lisbon, Portugal
[8] Centre for Functional Ecology, Science for People and the Planet, Associate Laboratory TERRA, Universidade de Coimbra, Coimbra, Portugal
[9] Department of Social Sciences and Management and CEG, Center for Global Studies, Universidade Aberta, Portugal
[10] Centre of Geographical Studies, Institute of Geography and Spatial Planning, Universidade de Lisboa, Lisbon, Portugal
[11] Associated Laboratory Terra, Universidade de Lisboa, Lisbon, Portugal

[12] m.mapar@fct.unl.pt

Abstract. In higher education, approaches to how students learn to reflect and act on sustainability issues on the scope of Agenda 2030, influence their actions as change agents in society. However, education on Sustainable Development Goals (SDGs) is still in its early stages. This paper aims to present the structure and pedagogical approach of a newly developed micro-credential module on "Sustainable Development Goals" at Universidade Aberta (UAb), Portugal, with a special focus on the concept of 5Ps (People, Planet, Prosperity, Peace, and Partnerships), as well as assess the outcomes of its first pilot teaching. A collaborative learning approach was adopted in the micro-credential. The module comprised 6 topics, covering the Sustainable Development historical path and the fulfilment of the SDGs that make up each 5Ps. The knowledge improvement and effectiveness of the training were assessed through pre- and post-questionnaires. The training was very successful in increasing the participants' knowledge of both Sustainability and SDGs. The participants were totally satisfied with the training, appreciating the diversified learning resources. The interaction with "nature and family", by addressing People and Planet, was the main contributor to developing sustainable positive-thinking approaches, and the model presented here can be replicated elsewhere.

1. Introduction

Education is one of the key transformations needed for achieving Sustainable Development Goals (SDGs) (Sachs *et al.*, 2019, p. 806) to empower students to tackle social and ecological problems and enable them to put sustainability into practice. In this context, approaches to how students learn to reflect and act on sustainability issues on the scope of UN Agenda 2030 are pivotal and will influence their actions as change agents in society (Caeiro *et al.*, 2020, p. 2). However, environmental, social, and economic problems commonly require synergies from all public elements, including Higher Educational Institutions (HEIs). They are considered significant contributors to the promotion of sustainability (Mapar, Bacelar Nicolau and

Caeiro, 2022. P. 153). and are major driving forces behind shaping knowledge, skills, and values in society (Moreno Pires *et al.*, 2022, p. 2; Cortese, 2003, p. 17), and have a fundamental role in positively driving social changes, by teaching sustainability to their community. Besides their role in shaping a sustainable society, it is essential to emerge their commitment to practice sustainability and to reduce the inconsistency of the development of bonds between theory and practice in higher education (Viegas *et al.*, 2016, p. 269). These actions should be proven within and outside the university (Moreno Pires *et al.*, 2022, p. 14), through defining, implementing, evaluating, and finally reporting the sustainable approaches to ensure their actions and programs are aligned with Sustainable Development Goals (SDGs). One of the key components in practicing sustainability and developing a sustainable HEI is to build and deepen the sustainability knowledge among all elements of HEIs including students, academics, and non-academic staff, and later the wider community. However, effective education on sustainability based on the SDGs is still in its early stages at Higher Education Institutions besides several initiatives (Moreno Pires *et al.*, 2022, p. 3).

Recognizing this need, a micro-credential module of 6 ECTS was developed at Universidade Aberta (UAb), Portugal, which takes a 360-degree approach to teaching sustainability in the context of five areas (5Ps) of critical importance for humanity and the planet (People, Planet, Prosperity, Peace, and Partnerships). This module helps participants grasp the complexity of the SDGs by highlighting how the SDGs are intertwined frameworks in the context of the 5Ps, instead of being perceived as a list of independent goals. This paper aims to present the pedagogical approach and the structure of this newly developed module and assess the outcomes of its first pilot teaching at UAb. Namely, it aims to understand the impact of the SDGs micro-credential module on the participants in the ability to make them more aware of sustainability and SDGs concepts and to empower them as change agents in the community to transform lives and future workplaces towards sustainability.

The paper is built up as follows. Section 2 situates the study in relation to the previous research on sustainability education with a special focus on the concept of 5Ps and micro-credentials. Section 3 describes the paper's methodological approach to developing the module at UAb. Results are presented in Section 4 and discussed further in the same section. The study is concluded in Section 5 by highlighting the future paths of the module.

2. Literature Reviews

The 17 Sustainable Development Goals (SDGs) were introduced by the United Nations in 2015 (UN 2015) and have rapidly come to represent a shared and universal reference framework for sustainability (Fiorani and Di Gerio, 2022, p. 15). As described by United Nations (UN, 2015), "Agenda 2030 is a plan of action for people, planet, and prosperity". It also seeks to strengthen universal peace in larger freedom and all countries and all stakeholders, acting in collaborative partnership (UN 2015). To achieve these approaches, the Agenda established five areas of critical importance for humanity and the planet (United Nations Development Programme, 2016, p. 132), known as the "5Ps": people, planet, prosperity, peace, and partnership. These integrated areas show the potential synergies and trade-offs related to the 17 goals and the classification of their targets (Tremblay *et al.*, 2020, p. 1593). United Nations Development Programme (2016, p. 132) also underlined that achieving the SDGs would transform the status of human development by addressing these 5 critical areas, since a critical analysis of sustainable development, and by extension, the SDGs, can enable the HEIs community to deal with accelerating change, increasing complexity, contested knowledge claims, and inevitable uncertainty (Kopnina, 2018, p. 1268).

To ensure that all above 5 areas are integrated into HEI's main dimensions and fields of action, several commitments and initiatives were promoted and signed worldwide, aiming to integrate sustainability into i) campus organization, ii) education, iii) research, iv) outreach, and v) assessment and reporting (Lozano *et al.*, 2013, p. 11). In the element of "Education", besides the sustainability formal courses, offered by HEIs for both graduate and post-graduate full programs, the HEIs have been recently offering a broad range of informal courses, not only for students but also for those who are working in labor market as well as for the wider community. The most implemented actions are the ones that have a more limited impact, among them, the presence of an optional Sustainable Development course (Lozano *et al.*, 2015, p. 7). Another action that is less frequent, but more critical is having an optional Sustainable Development course for all students (Moreno Pires *et al*., 2020, p. 23), or a set of informal, small, accredited courses known as "micro-credentials" to meet the demands of learners, enterprises, and organizations.

A micro-credential is defined as "a certification of assessed learning that is additional, alternate, complementary to or a formal component of a formal qualification (Oliver, 2019, p. i)". The Council of the

European Union (EU) adopted a Recommendation on a European approach to micro-credentials for lifelong learning and employability which mainly emphasizes the role of micro-credentials in enabling individuals to acquire, update and improve the knowledge, skills, and competences needed to evolve labor market and society (Council of the European Union, 2019, p. 11). Among the micro-credentials, sustainability-oriented ones have newly gained attention worldwide, offering an inclusive approach to learning sustainability to practice and allowing the participants to reflect on their role as change agents in the work or society actively. The topics offered by sustainability micro-credentials are varied, casing from the more environmental sphere (e.g. energy (University of Alberta, 2023), carbon literacy (University of Glasgow, 2023), climate change (Aurora, 2023), among many others), to those integrating all dimensions of sustainability (e.g., sustainability certificate (ENHANCE Alliance, 2023), or micro-credential in Sustainability (una Europa, 2023) which aims to acknowledge the complexity and interconnectedness of the sustainability issue by covering the environmental, economic, and social aspects of the SDGs). However, considering the list of existing micro-credentials, developing an optional course that covers all 17 SDGs in an integrated framework while covering all 5 areas of humanity and the planet (5Ps) is still in its infancy and further action is needed. Also, with the pandemic COVID19, several eLearning courses emerged but were not grounded in a validated pedagogical model (Moreira *et al*., 2020).

3. Methodology

The online micro-credential module entitled "Sustainable Development Goals" was designed at Universidade Aberta through the contribution of the Sustainable Campus Group UAb - a group established in 2021 under the direct supervision of the rector, to promote sustainability approaches at UAb in 5 core elements of sustainability actions at HEIs: i) planning and administration, ii) operation and innovation, iii) academia and research, iv) assessment and reporting, and v) involvement with the community. The module was preliminary developed for undergraduate students, however, it tends to also be taught to the wider community of HEIs in the future, by incorporating it into different disciplines, from all courses and degree types. The module aimed at making students acquainted with the sustainability concepts and SDGs from the field of 5 areas of critical importance for humanity and the planet (5Ps).

Before developing the module, a collaborative approach was adopted by the Group. The team consisted of 9 professors, 1 researcher, and 2 instructional designers from different backgrounds and expertise, but all with scientific fields in environmental science and management, sustainability, and education. In the first step, the preliminary structure was discussed to decide which clustering framework is the most appropriate one for categorizing the SDGs by bearing in mind that the SDGs and their targets are fundamentally interdependent and interlinked (Breuer, Janetschek and Malerba, 2019, p. 1). An initial literature review was done among 11 clustering frameworks, and finally, after 2 rounds of dialogues, the team decided to focus on the SDGs in the context of the 5Ps. A plan was then set to structure the module which was developed in Portuguese language. The pilot training took place in the fall term of 2022-2023 (from October to February), by enrolling the undergraduate students of Environmental Science. The online training was hosted on the open Moodle platform of Universidade Aberta, while all collaborative learning processes served asynchronously, based on the pedagogical model of UAb and further improvements (Pereira *et al.*, 2008, p. 11; Amante and Oliveira, 2019, p. 11)

To assess the effectiveness of the pilot phase, two sets of questionnaires were developed i) a pre-questionnaire to evaluate students' pre-knowledge on Sustainability and SDGs, and ii) a post-questionnaire to evaluate students' knowledge improvement on sustainability and SDGs, as well as assessment the effectiveness of the training based on the participants' perceptions. The pre-questionnaire covered closed-ended questions concerning the concepts and definitions of Sustainability and SDGs, and it served as a brief pre-quiz before starting the training. The post-questionnaire was conducted in 2 parts. The first part was the repetition of the same quiz questions on the sustainability and SDGs to assess the participants' knowledge improvement, and the second part included a set of closed and open-ended questions to assess the effectiveness of the training by covering 5 thematic areas: Structure of the training, its quality, learning materials, topics and content, and total satisfaction.

A five-point Likert scale was applied (from "very low" to "very high" or "very little" to "very much") for the closed questions of the post-questionnaire (Otto *et al.*, 2019, p. 15). The survey was validated by the team engaged in developing the module (Moreno Pires *et al.*, 2022, p. 7). To analyse the closed questions, a descriptive data analysis was performed on the questionnaire data (Figueira *et al.*, 2018, p. 619; Perbandt *et*

al., 2021, p. 809). The open questions on the strengths/weaknesses and suggestions were analysed based on content analysis by grouping, and labelling categories, grounded on the units of meaning of participants' responses (Ghahramani, 2016, p. 284; Moreno Pires *et al.*, 2022, p. 7).

4. Results and Discussion

4.1. The results of the module design

The full module, comprising 156 study hours (equivalent to 6 ECTS workload,), was structured in 6 micro-credential topics (each topic 1 ECTS): i) Introduction to Sustainable Development, ii) People, iii) Planet, iv) Prosperity, v) Peace, and vi) Partnerships. The first module covered the concept of Sustainable Development within the scope of a historical path, and the rest of the topics discussed the importance and fulfillment of the SDGs that make up each 5Ps, respectively.

Various learning materials were developed ranging from text and slides to videos and narrative and interactive multimedia presentations. Also, to cover the scientific content of each topic, a set of 6 introductory videos was produced to assist as the pedagogical material for each topic. Along with the learning materials, different individual/collaborative activities were also applied by using engaging and captivating tools such as Padlet, WIKIS, and Forums (in all topics). This approach followed Moreira *et al*. (2020) call on the use of diverse pedagogical materials and e-activities for a quality process of e-learning. Table 1 shows a summary of the module structure, the educational materials, and the associated activities in each topic.

Table 1. Module structure

Topic No.	Name	length	Content	Educational materials	Activities
0	Presentation of the module	1 Week	- Online environment - Learning roadmap	- Tool (Padlet)	- Wall of happiness (Ice-breaking activity) - Pre-questionnaire
1	Sustainable Development	2 Weeks	- Sustainable Development Concept - Historical context - Ideological conceptions - Transformations	- Video - Interactive multimedia presentation - Text	- Reflection about Sustainable Development (Individual)
2	People	2 Weeks	- The five SDGs that make up the P of People - Compliance with the P for People and SDGs 1, 2, 3, 4 and 5	- Video - Narrative introductory presentation - Text	- Indicators of the "People" pillar (Group work)
Learning pause		1 Week	- Following the activities of the last 2 topics	- Guideline "Be Sustainable"	- Self-assessment checklist (Optional)
3	Planet	2 Weeks	- The concepts of the P for Planet - Interconnection between the Planet and SDGs 6, 12, 13, 14, 15	- Video - Text - Tool (Padlet)	- Creating a MindMap for the "Planet" pillar (Individual)
4	Prosperity	2 Weeks	- The concepts and challenges of Prosperity	- Video - Slides - Quiz - Tool (Padlet)	- Creating a visualization board for a prosperous life (Individual)

Topic No.	Name	length	Content	Educational materials	Activities
			- Interconnection between Prosperity and SDGs 7, 8, 9, 10, 11 - A prosperous life		
Learning pause		1 Week	- Following the activities of the last 2 topics	- Guideline "Be Sustainable"	- Self-assessment checklist (Optional)
5	Peace	2 Weeks	- Peace and the absence of peace - The goals and targets of SDG 16 - The Challenges and solutions to Peace - The role of governments	- Video - Narrative interactive presentation (with quiz) - Text	- Analyse the reasons for the disparities of peace in 2 countries or - Analyse the peace indicators in 2 municipalities (Group work)
6	Partnerships	Week 13 & 14	- The concept and challenges of partnerships and SDG 17 - Interconnection with all SDGs - Inter-sectoral partnerships	- Video - Interactive slides - Text - Tool (WIKI)	identify a global challenge/crisis and suggest global partnership solutions (Group work)
Learning pause (Conclusions)		Week 15	- Following the activities of the last 2 topics	- Guideline "Be Sustainable"	- Wall of happiness (Reflective activity) - Post-questionnaire

An extra topic at the beginning of the module welcomed students inside the content and online environment, inviting them to collaboratively build a "Wall of Happiness", by sharing a photo about a well-being moment or activity in their life which was later revisited by them, in the last week (conclusions), in a reflective approach to link it with the SDGs and 5Ps concepts. All topics had detailed learning instructions, learning materials, and a mandatory activity for assessment, which in the end sum up 100 % of the assessment with the same weight.

Three units were also proposed as the pause weeks to take the opportunity for participants to complete the remaining activities of the last 2 topics. Served as an optional activity, in the pause units, the UAb guideline about "Be sustainable: Some tips to live sustainably on campus and outside" was presented to the participants which gave them the opportunity to self-assess their intentions for improving a sustainable life through a self-checklist available in the guide.

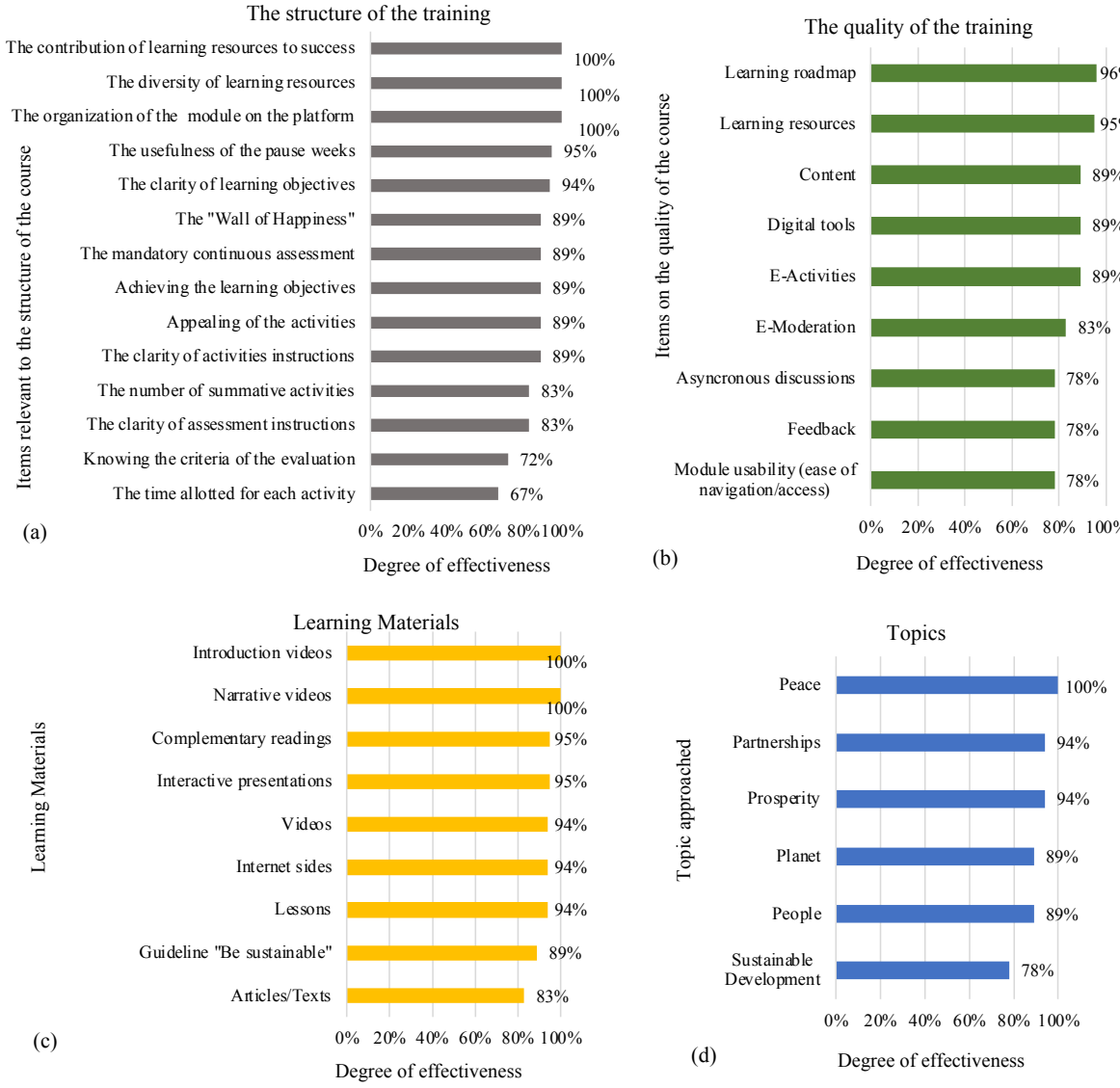
4.2. The results of the pilot phase and discussion

A total of 43 students, mainly from the undergraduate program of environmental Science, freely enrolled in the pilot training, led by 10 educators. Also, 2 instructional designers supported the team during the whole process of designing and implementing the pilot phase. In the end, 22 students finished all 6 topics successfully and responded to the post-questionnaire. Students' perceptions of different content and applied materials of the module are shown in Figure 1.

The participants rated the "diversified learning resources" (Figure 1.a) as the most qualified aspect of the training which helped them to have a successful learning path. Also, as shown in Figure 1.b, the students specifically appreciated the "quality of the learning roadmap" presented at the beginning of the training to familiarize them with the training content, the learning path, and the evaluation methods. Among the learning

materials (Figure 1.c), the “narrative presentations” and the “introduction video in each topic” were mainly acknowledged by students as paramount materials. Within the topics, Peace stands in first place, closely followed by prosperity and partnerships both in second place (Figure 1.d). The results also show that 94% of the students were fully satisfied with the training.

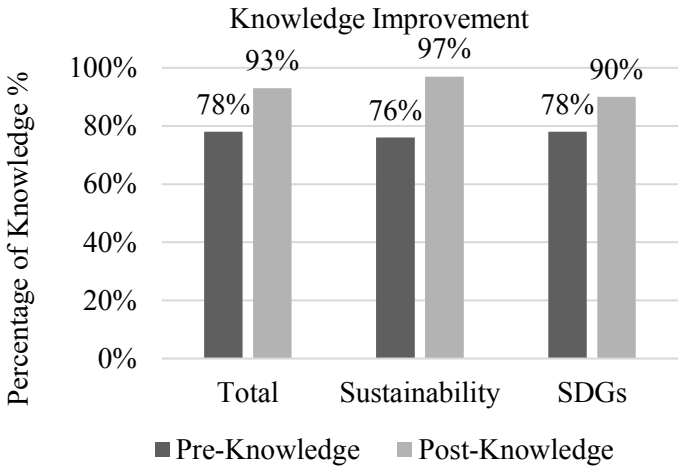
Figure 1. Participants’ assessment of (a) the structure of the training, (b) the quality of the training, (c) the usefulness of the learning materials, and (D) the usefulness of the covered topics



The results of the knowledge improvement (Figure 2) show a total of 15% increase in sustainability and SDGs knowledge, while a high level of knowledge improvement was observed mainly on the “sustainability” concept. This result demonstrates that considering the SDGs as a group of integrated goals (5Ps), not only raises the knowledge of the goals independently but also mainly expands the awareness of participants on sustainability as the main concept behind the SDGs. The results are aligned with the experience of an SDGs course at Netherlands university, where after the training on the SDGs, the students were able to develop a certain degree of critical, creative, and innovative thinking first about sustainable development in general and then the SDGs in particular (Kopnina, 2018, p. 1280).

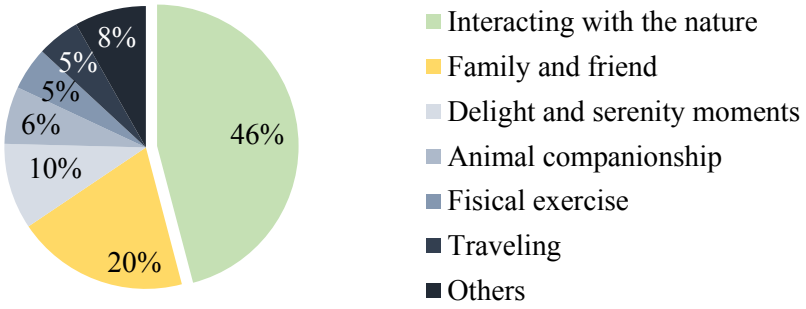
Notably, since the participants in the pilot phase were environmental science students, most of them already had an initial knowledge of the subject. Therefore, achieving a total of 15% improvement was a success for the pilot phase, although the background and natural interest of the participants could somehow have biased these results.

Figure 2. Participants' knowledge improvement



The results of the "Wall of Happiness" (Figure 3.) show that "interacting with nature" and "family", are the main contributors to developing positive-thinking approaches to achieving a sustainable life. Among those, around 60% of the indications pivoted on green conceptions (such as forests, natural parks, etc.), while the rest 40% of the indications, emphasized the blue conceptions (such as the moments of happiness in front of the oceans, seas, or lakes) which also highlights the effect of local and cultural issues on participants sense of wellness and happiness, where the participants were Portuguese and they mainly grew near the green and blue areas existing in the country. These results could be approved by the studies of Bullock and Hitzhusen (2015, p. 14076), that demonstrates culture is among the most important tenets of social responsibility, and "Sustainability has multiple cultures, approaches, and dimensions, there's not one exact path or one way to look at it."

Figure 3. The main themes addressed by participants on the "Wall of Happiness"



At the end of the training, the students were asked to back to the ice-breaking activities ("Wall of happiness") and make the link between the shared photos with the 5Ps. Based on their responses, the People and the Planet were the pillars that were mainly addressed in the wall, jointly followed closely by peace. These results are aligned with Nisbet and Gick (2008, p. 296)'s study which demonstrated the strong connection between health, happiness, and the environment so that well-being has been correlated with sustainability goals in such a way that happy people may be more likely to act environmentally and with a holistic understanding of the world (Albrecht, Albrecht, and Cohen., 2012, p. 7).

Also, the students emphasized that in addition to the planet - where they find their moments of happiness (such as nature, oceans, etc.) - the people who might join them in these moments can change positively their degree of happiness. The students' statements can be accredited by Trembly et al. (2020, p. 1590)' study that showed among the SDGs, SDG3 (good health and well-being) is one of the most compatible SDGs with the pillar of "People".

As the results showed, the team successfully implemented the module in the pilot phase. The Module is now ready for refining and to be taught in the next semesters by addressing a wider community inside and outside the University, thus contributing to the progress toward the 5Ps approach and UN agenda 2030, particularly SDG4, target 4.7. Some improvements will be added, based on lower scores of effectiveness, namely related to reducing the number of mandatory activities. Following Nah et al. (2014, p. 403) it will also be considered adding some gamification activities to students as motivation to those that participate in activities that will not be mandatory.

5. Conclusion

Micro-credentials have been growing significantly in the context of higher education, however, still, the trace of micro-credentials covering the concept of sustainability centered on an integrated approach of all 17 SDGs is in its early stages. Based on a pilot case study at Universidade Aberta, this study aimed at developing a micro-credential e-learning module entitled "Sustainable Development Goals", conceptualized by a multidisciplinary team, as well as assessing the effectiveness of the pilot training and its different educational materials on participants' knowledge growth. In particular, the study explored how considering the SDGs as a group of integrated goals, instead of addressing them as independent goals, affects the level of participants' knowledge achievement on sustainability issues as a general concept.

Based on the participants' perceptions, among the 5Ps, the pillars associated with people and the planet, in line with interacting with nature and family/friends, have been acknowledged as the main influencing factors in developing positive-thinking approaches toward achieving a sustainable life. Rating the "diversified learning resources" as the most qualified aspect of the training, the narrative presentations, and the introduction videos were acknowledged as dominant materials. In terms of topics, all topics reached a high degree of learning effectiveness, particularly Peace, closely followed by Prosperity and Partnerships.

Future work of the UAb Sustainable Campus Group includes offering the SDGs micro-credential, from Oct 2023 onwards to the wider community, targeting also public and private organizations, and later as a formal curricular unit in various degrees, thus enhancing the commitment of UAb on the "involving the community" element. The pedagogical model and the 5P approach can be used and tested in other HEI hoping to contribute to the effective SDGs education.

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The Community-Based Sustainability Education with Sensory Stimuli: A Practical Approach

Cheng-Hui, Liu[1] and Mei-Ya, Lan[2]

[1] Adjunct Lecturer, National University of Kaohsiung
[2] Adjunct Associate Professor, National University of Kaohsiung

[3] Cheng-Hui, Liu: nuevaidee@gmail.com

Abstract. The challenge to engage students in sustainability learning in higher education is getting more difficult nowadays due to neoliberalism, credentialism, and slacktivism. Educators must search for new teaching approaches to change it. Community-based learning and the idea of sensory stimuli have shown the potential to improve students' engagement and advance sustainable teaching. This paper describes the process of how we followed the steps of action research to lecture two courses in the field of liberal education, with an emphasis on sensory stimuli and collaboration with people in the communities. It also demonstrates the result of a survey to investigate students' attitudes and learning results of the projects to promote sustainability in the community.

1. Introduction

With the influence of neoliberalism, credentialism is getting increasingly popular among societies worldwide. Therefore, most university students learn with effort in courses mainly related to whether it is helpful for their career or future competitiveness. They generally ignore enduring social responsibility, one of the main goals of higher education. Not to mention the impact of smartphones and social media, slacktivism is getting increasingly popular (Twenge, 2017, p.81). Students have no feelings or willingness about social issues around them and lack the motivation to think about the world's sustainability. It is critical and urgent for educators to have some change.

Fortunately, as students get involved in community-based learning, they enter a fruitful dialogue with classroom knowledge, readings and beyond, which brings them a high value of learning (Jakubowski & Burman, 2004, p.160). Since community-based education programs have been applied at different levels of education for many years, it has also been adopted into higher education. Taking liberal education at university as an example, because of its broad and flexible characteristics, it makes a great fit with the idea of community-based learning, which helps students comprehend and negotiate their relationship with the larger world and prepare them for lives of civic responsibility and leadership (Schneider, 2004, p.10). As teachers lecturing liberal education, we took two sequence courses, cooperating with communities around the campus and aiming to encourage more students to dedicate themselves to sustainability advancement.

On the other hand, action research which can change people's practices, their understanding of their practices, and the conditions under which they practice (Kemmis, 2009, p.2), was utilised as the methodology for us to combine two courses, modify our teaching, and search for the possible way in these ongoing classes. As a result, we took the methodology and kept adjusting how we lectured in the past two years to argue how we can encourage students in higher education to devote themselves to sustainability actively.

The "walking tour" is the central theme of the first course. Students were guided to visit different townships in the northern part of Kaohsiung, including Ciaotou, Nanzih and Zuoying. In the process, students had plenty of experiences, such as climbing over the dugout in the sugar refinery built by the Japanese, visiting a church for foreign migrant workers or tasting almond tea made traditionally. Meanwhiles, students are led to observe and interview local people to discover the social issues that need solving, such as gentrification, overdevelopment, discrimination of migrant workers, and the gap between rich and poor. For the final assessment of this course, students must make a video to introduce any township in north Kaohsiung.

For the video's description, they must emphasise the sensory experience people can get and reveal the problems existing in the place they researched. We collected some requests from students that they would like more chances to learn from the townships. That is the beginning of how we followed the action research methodology and started to organise the second course - 'Meet the Community and tell their stories' to provide further learning for students.

We set a goal for the second course that students need to develop a proposal to help the communities be sustainable. However, after the first-semester trial of the second course, people we visited from communities and students all agreed that it was still challenging to achieve the goal of the course. Therefore, we decided to look for another teaching approach to improve the effectiveness of it. Based on empirical research, sensory stimuli can build up and strengthen compassion and empathy (Lucre & Clapton, 2020, p.11). Moreover, adopting sensory stimuli can help students have deeper feelings and profound consideration (Wahl & Majchrzak, 2022), and it may let students get involved in the community issue deeper and be more likely to propose their projects. The updated second course is introduced.

Since revealing the stories of communities is essential for any community project, we have a special arrangement for the mid-term assessment of the second course: Students need to 'tell the stories of communities.' Moreover, storytelling provides a productive and authentic way for communities to share their experiences and knowledge with students (Stevenson, 2002, p.187). The storytelling process included sensory stimuli design by applying tactual, auditory, and olfactory sensations, such as pushing, touching, smelling, tasting etc. This part of the work aims to help students have a strong connection with the communities via preparation, and it is an example of action learning. Waddington, Nowlan, & Kaplan (2021, p.263) argues that action learning can help students have compassion. If students have more embodied experience, they can be motivated and better understand the struggles and challenges of the communities. We supposed they might be more likely to propose their suggestions or start some actions for the communities at the end of the semester. At the end of the second course, we were delighted that most students successfully made projects to improve the sustainability of the communities.

Mainly, researchers discuss education on sustainability separately from the ecological, social and economic perspectives (Vallance, Perkins & Dixon 2011, p.342). We proposed that community-based education in the social sustainability category can be the key to triggering learning and promoting sustainability of other perspectives. One of the hinges is that we can bring the idea of sensory stimuli into the course. In this paper, we conducted quantitative research and used open-ended questions to investigate students' behaviours and attitudes.

2. Literature Reviews

Teachers play significant and vital roles in teaching for sustainability, and sometimes they may be the barriers to that (Parry & Metzger, 2003, p.11). Since sustainability teaching may involve multidisciplinary aspects, it is challenging for educators when they need more support of resources, materials, time for collaboration and ongoing professional learning opportunities. One solution to this problem is to seek community assistance and cooperation.

When classes cooperate with communities in higher education, it can be a format of service learning (Fourie, 2003, p.31). It implies that students must provide their time, labour or professional ability to the communities. Similarly, communities are considered collaborative peers for higher education staff to develop their professions (Pedersen, 2017).

In addition, to educate students about sustainable development, we can adopt some experimental learning activities in the communities, such as making students participate and take ownership of their learning (Cantor, 1997). It emphasises that when we talk about sustainability learning, it mainly discusses issues outside the classroom. If we go out and learn with and within communities, we can challenge long-held assumptions about the dominance and the sufficiency of purely conceptual classroom-centred learning (Zlotkowski & Donna, 2010, p.33). When students understand the value of communities, they can start to work on a real-world problem (Schneider, Leydens & Lucena, 2008; Steiner & Posch, 2006). For a long time, higher education needs to be improved in its efforts to prepare students for lives of social responsibility and civic and political engagement (Strand et al., 2003). As a result, higher education should take responsibility for raising awareness of social and moral responsibilities associated with professional practice (Sibbel, 2009, p.74). Some researchers even pointed out that universities must play a more vital role in promoting sustainable development by working with local communities to increase their resilience (Berchin et al., 2021, p.1204).

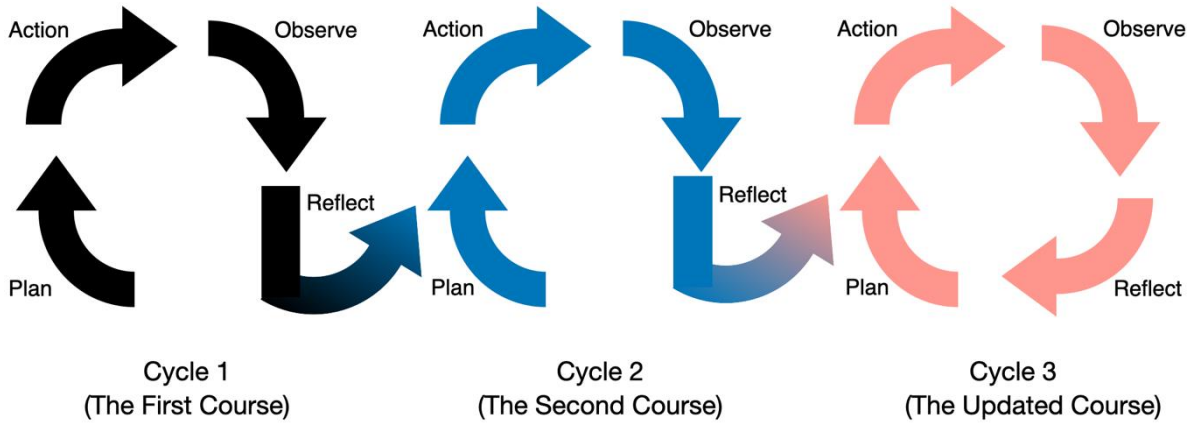
There are also some advantages of community-based learning. For example, Schamber & Mahoney (2008, p.96) indicate that community-based learning strengthens political awareness and social justice attitudes and fosters political knowledge. Nonetheless, community-based education has been taken as an approach that aims to prepare students for future professional work at the community level (Okayama & Kajii, 2011, p.5).

In summary, taking communities as partners and fields for lecturing sustainability in higher education showed its benefits. However, cooperating with communities means the increment of uncertainty. Besides that, the way to adopt learning with sensory stimuli also needs explanation and discussion. Therefore, what educators can execute practically is necessary for further trial and discussion.

3. Methodology

Currently, community-based research (CBR) is carried out through a community-university partnership. It can provide students in higher education invaluable experience utilising their academic skills and benefit the communities (Savan & Sider, 2003, p.303). To achieve this goal, the two courses' development of this research followed the sequence of 'plan,' 'action,' 'observe,' and 'reflect' from action research and consider the future need of students and communities (List, 2006, p.677) and accomplished three loops or cycles.

Figure 1. Three cycles of the research inspired by action research



3.1 First cycle – execution of the first course:

At the begging of our program, we started to plan the first course called 'Walking Tour in North Kaohsiung.' The purpose of this course aimed to let students become familiar with the environment near the campus. Students visited Ciaotou, Nanzih, and Zuoying districts with the tour themes of buildings and the culture from the Japanese occupation period, migrant workers' daily living sphere, and traditional Taiwanese religion and life. Somehow, it took us one semester to negotiate with the university and get approval for conducting this course. For example, students may need travel insurance and the travel time to arrive at the place they visited. That is the 'plan' of the first action research cycle.

For the ‘action’ and ‘observe’ parts of the first cycle, we found that most students took serious of this course. For the final assessment, students must choose a place in the North of Kaohsiung and make a video to introduce it. They do not only need to share the history, interesting stories, and interviews of local people but try to point out the local issues. Some gave us feedback that they would like further learning about those places. To seize the chance, we revised our course plan to prepare for the second course, ' Meet the Community and Tell their Stories.’ Furthermore, it is the start of the second action research cycle.

3.2 Second cycle – execution of the second course:

Students who participated in the second course will be led to have a deeper understanding of those places. Moreover, this course's final goal is that students must apply their academic skills and propose some revising projects for these communities. However, only some students could identify the critical issue of these places. As a result, we decided to revise this class again to conduct the third action research cycle.

3.3 Third cycle – the adoption of the sensory stimuli:

In the second edition of the second course, we had a rigorous discussion with local communities. Thanks to one of the authors of this paper, who had abundant experience in promoting community development, it is vital for us to contact and cooperate with the right partners from communities, who are taken as the collaborative lecturers with the background of the chief of the village, the architect who participates in regional revitalisation, and two owners of local social enterprises. They all have over five years of experience devoting themselves to community development. Students had a clearer picture of the development and obstacles of the communities after the guided tour from those critical persons from the communities.

Meanwhile, while visiting these communities, we ensure students can have visual, tactual, auditory, taste, and olfactory sensory stimuli. For example, students wore wading paints to get into an aquaculture fishery pond and tasted the milkfish cuisine afterwards. The smell and all the brand-new experiences broaden their horizons. To strengthen students’ compassion and empathy with the communities, students are asked to tell stories by demonstrating a drama to reveal the challenges faced by those communities.

The drama tries to extend the ‘Theatre of Oppressed’ idea with readily available tools: students in groups are guided to make drama based on the community they participated in or social issues they researched to reveal their discoveries and the diverse voices of local people. Then, audiences were blindfolded and listened to the local stories by applying tactual, auditory, and olfactory sensations.

Afterwards, students in groups identified the issues of ‘Southeast Asian women who suffered from discrimination,’ ‘injustice expropriation of land from farmers,’ ‘a poor elder selling vegetables along the street,’ and ‘Standalone City Councilor who got unfair treatment’ as themes of dramas. Furthermore, they chose one person from the issue they cared about as the main character; they had to use the second-person point of view to write a script to describe and simulate what the person went through and experienced. To build a comprehensive scenario, students need background checks and data collection before narrowing down the information and transforming it into a script. After that, they will be led to show the audience sensory stimuli designed to reproduce similar experiences of those persons in the communities.

As the demonstration, each story will allow three audiences to come up to the stage who will be blindfolded. One of the members of the student group will be the voice-over, and other team members will take some actions on these three audiences. For instance, when the voice-over talked about the enforcement of the expropriation of land by the government, the team members tried to shake the three audiences' arms vigorously when they were blindfolded to make them have a solid and similar physical feeling of what the farmer has ever taken. We named this approach ‘Simulation Experience Pedagogy.’

In rehearsing the drama to tell the stories, students had chances to put themselves in the protagonist’s place. Therefore, they generally have compassion for the protagonist and are willing to do something to make the change. They can finally propose sustainability plans for the communities, which is the goal of the second course.

4. Results and Discussion

After field trips in the communities and the mid-term assessment adopting simulation experience pedagogy, we taught students some skills and methods of writing a proposal. Moreover, the most important essential for students to accomplish the proposal of promoting sustainability of the communities is the discussion with stakeholders who are our collaborative lecturers. Therefore, we demonstrate the evaluation of adopting simulation experience pedagogy and students' work on the final assessment and further discussion below.

4.1 Students engagement after the adoption of simulation experience pedagogy:

First, for the investigation of student engagement after the adoption of simulation experience pedagogy in the mid-term assessment, we used the Likert scale survey questions. The answers to the questions included 'strongly agree,' 'agree,' 'neither agree nor disagree,' 'disagree,' and 'strongly disagree.' Moreover, twelve students who accomplished the courses participated in the survey—four questions and the results have shown below.

Table 1. Questions about student engagement after the adoption of simulation experience pedagogy

No.	Questions
1	I have a better understanding of the challenges and social issues in the communities after I took the mid-term assessment.
2	I have more compassion and empathy for the communities after I took the mid-term assessment.
3	It's more likely for me to pay attention to the social issues around me or the communities after I took the mid-term assessment.
4	It's more likely for me to start actions to help improve the communities after I took the mid-term assessment.

4.1.1 Understanding of the Communities for Students

66% of students strongly agree with the statement. Furthermore, 34% of students agree with that. It shows that the simulation experience pedagogy, which applies sensory stimuli, can help students understand the community's challenges and social issues.

4.1.2 Students' Compassion and Empathy to the Communities

Students who strongly agree or agree that their compassion or empathy increases after participating in simulation experience pedagogy are 58% and 42%. Students' understanding, compassion, and empathy are proven to increase by adopting simulation experience pedagogy.

4.1.3 Willing to pay more attention to the social issues

34% or 57% of students said they strongly agree or agree with the statement; they will pay more attention to the community's challenges and social issues. However, one student (9%) from the survey disagreed with it.

4.1.4 Willing to start actions to help improve the communities

The answers are diversified about the action to make the change, including stopping injustice, participating in environmental campaigns, or initiating some sustainability plan for the communities. 74% of students showed a positive attitude to it (17% of students strongly agree, and 57% of students agree). 17% of students have a neutral attitude toward it. Nonetheless, the same student (9%) to the previous question showed a negative attitude toward the statement.

In sum, adopting simulation experience pedagogy, which emphasises sensory stimuli, has clear evidence to help students understand and empathise with the community's challenges and social issues. It may further advance the social sustainability of communities and societies. Moreover, after adopting simulation experience pedagogy, most students said they would pay more attention to social issues and even start some actions to make the change. Meanwhile, only some students still have a neural or negative idea of that.

4.2 Description of students' works:
With guidance from collaborative lecturers and us, students adopted their academic skills and proposed four projects to promote the sustainability of the communities at the end of the second course. The result of these projects was introduced below:

4.2.1 Project 1: Map of Mituo with AR Design
The collaborative lecturer from Mituo is a bakery owner whose business is a social enterprise. She said Mituo is suffering from the population exodus, even though there are beautiful sunsets and stable aquaculture businesses. She expected students to help them make a beautiful map with a hand-painted style indicating both spots of tourist sites and stores promoting UN Sustainable Development Goals (SDGs). It can help them attract tourists and apply for government funds easier. Three students from this group are from the Department of Crafts and Creative Design; they made not only a great and clear map but tried to combine the idea of augmented reality (AR) to help the tourists be able to get more information as they arrive at the specific sights. They aim to take work to extend social sustainability to economic sustainability.

4.2.2 Project 2: Audio guided videos for Zihguan
Mr Liu is the chief of the village in Zihguan and also one of our collaborative lecturers. Compared to Mituo, there are more tourists here. However, most tourists only come here to have a meal and leave afterwards, and the chief thought it was a pity that the beauty of the history and culture in their village could not be learned. As a result, the team grouped the students from the Department of Information Management and the Department of East Asian Languages and Literatures and decided to make a series of guided videos of the village and a website including all the information. These videos show some exciting stories, local traditions, and the threat of coastal retreats. The chief believes it can help the visitors pay more attention to the social and environmental sustainability in Zihguan.

4.2.3 Project 3: NFC application for social enterprises in Ganshan
Ganshan is one of the industrial hubs in Kaohsiung, the city our university is located. It is famous for its screw and hardware manufacturing. Since the lack of the tertiary sector of the economy, few young people are willing to stay and come to visit here. There is the threat of urban decay in Ganshan. An owner of a local independent bookstore who hopes social enterprises in this area can make connections to promote social and economic sustainability. Two students from the Department of Computer Science and Information Engineering made a website for the bookstore. They tried to set up the technology of Near Field Communication (NFC) infrastructures to let the payment of local businesses be diversified, more convenient, and safer. Moreover, it can make connections with local social enterprises.

4.2.4 Project 4: The Exhibition of Sustainable Community Projects
The collaborative lecturer of this project runs an exhibition centre in the Ciaotou Sugar Refinery. It is located in a historical building, the guest house during the Japanese occupation Period, and its name is the White House. It was a popular site for people to take wedding photos. The lecturer hopes more cooperating projects of art exhibitions will happen here to attract more tourists. As a result, two students from the Department of Architectures organise an exhibition to show the achievement of other groups' works.

4.3 Collection of students' attitude and feedback:
At the end of the semester, we surveyed to realise students' attitudes and collect feedback for future adjustment, the last stage of the third action research cycle. We adopted part of the questions quantitatively to get the essential attitude of students, and some open-ended questions were submitted to students to evaluate the effectiveness of community-based learning.

4.3.1 Students' Attitude to sensory stimuli:
Twelves students accepted the same investigation as the one after the mid-term assessment. About the first question, 'the adoption of simulation experience pedagogy is helpful for you to understand the problems and community,' ten students (83%) said they 'strongly agree,' and the rest two agreed with the question description. Moreover, half students present strongly agree that 'the adoption of simulation experience pedagogy is helpful for them to have compassion and empathy to the community,' and others said they agree

with it. The result proves again that the sensory stimuli or the approach of simulation experience pedagogy is helpful for students to stand with the communities and have further learning of sustainability.

4.3.2 Students' Feedback to community-based learning:
Integrating three principles of community-based research (Strand et al., 2003), we transformed them into open-ended questions to collect students' feedback.

Table 2. The principles of community-based research (Strand et al., 2003)

No.	Principles
1	CBR is a collaborative enterprise between professors, students, and community members
2	CBR upholds a variety of sources of knowledge and promotes the use of multiple methods of discovery and dissemination of the knowledge produced.
3	CBR has its goal of social action and social change to achieve social justice

Table 3. The questions and answers to understand students' feedback

No.	Questions	Answers
1	Who may benefit from your project?	1. It can help social enterprises in Mituo to be known to tourists. 2. The chief of the village and villagers can market their hometown with the website and videos we made. 3. Shops in Ganshan can start their online campaigns by the template of the website and the NFC infrastructure. 4. More people are aware of the exhibition centre.
2	How did you apply your academic skills and experience to your project?	1. I took the course and learned how to use AR, which is applied to our project. 2. I knew how to build a website and edit videos which helped accomplish our project. 3. I learned the idea of NFC when I was a sophomore student, and it solved the problem of local stores. 4. As a student from the Department of Architecture, I know how to make posters, brochures and PPTs to make the exhibition more professional.
3	What can we learn from the communities?	1. I learned a lot from the field trip in Mituo because it was my first time knowing there are so many people trying to do things to help their communities. 2. The social enterprise in Mituo tries many ways to promote sustainability socially, economically, and ecologically. 3. I felt so touched to see that the owner of the social enterprise in Mituo was so friendly and willing to encourage youths to devote themselves to the sustainability of the community. 4. Being a social entrepreneur is challenging; having more working experiences before starting the change is better. 5. Learning outside the classroom is already a fabulous idea since we can learn so many issues we can't meet inside the classroom. 6. I felt great because I could apply what I learned from previous courses to the project, which can improve sustainability in the world.

4.4 Discussion:
Community-based learning and sensory stimuli should encourage students to participate in promoting sustainability in the communities. We argued that learning with the community will be an approach to make social sustainability. This paper took the structure of action research and followed the stages of 'plan,' 'action,' 'observe,' and 'reflect' from action research and accomplished three cycles. In the last stage of 'reflect,' students who accomplished the project generally agreed that learning with the stimuli to their

sensation and adopting the simulation experience pedagogy was helpful. The result of the open-ended questions shows that students believed that community-based learning could promote social, economic, and ecological sustainability by disseminating various tools. It is the same feedback we collected from the collaborative lecturers of the communities.

However, one thing needed to be addressed: three students withdrew from the second course due to the failure to prepare their drama by adopting the idea of simulation experience pedagogy. Their absence from answering the questionnaire may make the result of the adoption of community-based learning more positive than it was. Including a further survey of students' ideas of who fail or succeeds in accomplishing the course is necessary. Meanwhile, the future development of communities is worthy of following up.

5. Conclusion

While it has been known the help of the implication of community-based learning and the adoption of sensory stimuli for a positive influence on students' learning, the findings of this paper show that most students are willing to pay more attention and start actions to the challenges and the social issues happening around them or in the communities.

The steps of action research developed two courses in liberal education in the universities, and students of these courses learned with the approaches of simulation experience pedagogy, a new teaching methodology inspired by the idea of sensory stimuli, to make them have compassion and empathy to the communities.

At the end of these courses, students in groups applied their academic skills to propose four different projects based on the need of the communities and the guidance of the lecturers from the universities and the communities to help the communities' social, economic, and ecological sustainability.

6. Acknowledgement

We appreciated the participation of our collaborative lecturers from the Mituo, Ciaotou, Zihguan, and Ganshan districts, who were selfless and experienced. They volunteered and devoted their time and shared their experiences with students. Moreover, they also provided constructive suggestions and feedback for both the students and us in these two courses, exemplifying sustainability.

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How do students feel about the SDGs? Towards better embedding of emotions and the mind-body connection into sustainability learning

Disterheft, Antje[1*]; Cunha, Olga[2]; Quadros, Cristina[3] and Meneses, Arlete [4]

[1] CENSE – Center for Environmental and Sustainability Research & CHANGE - Global Change and Sustainability Institute, NOVA School of Science and Technology, NOVA University Lisbon, Caparica, Portugal
[2] Faculty of Social Sciences and Humanities, NOVA University Lisbon, Lisbon, Portugal
[3] Association Conhecer-Se, Lisbon, Portugal
[4] NOVA University Lisbon, Lisbon, Portugal

*corresponding author: a.disterheft@fct.unl.pt

Abstract

In the field of Education for Sustainability, scholars and practitioners advocate for a "head – heart – hands"-approach, aiming to integrate holistically our mind and body in our learning design and processes. However, most often rational and cognitive approaches are chosen, particularly in higher education, and emotions are mostly excluded in the learning processes. This work aims to fill this gap and presents results from a questionnaire survey that was applied to all 2nd year Bachelor students at a Portuguese university about their emotions towards the SDGs, obtaining 244 responses (response rate 25%). The results of the questionnaire were analysed using descriptive statistics and qualitative content analysis for open questions. The top five emotions chosen were (i) interest, (ii) sadness, (iii) trust, (iv) vigilance and (v) grief, and the respondents were divided about the likeliness that the SDGs can be achieved or not. Only a few students (16%) have experience with contemplative practice, but the majority regard these of importance. Long personal comments allowed to understand better respondents' feelings, and of which some indicate pessimistic perceptions about the future. Scholars call for more consideration of eco-anxiety and related emotions and propose adjustments to educational programmes directed towards sustainability learning.

1. Introduction

In the field of Education for Sustainability (EfS), scholars and practitioners advocate for a "head – heart – hands"-approach (Orr, 1992; Sipos, Battisti and Grimm, 2008; Singleton, 2015; Jagannathan, Camasso and Delacalle, 2018), aiming to integrate holistically our mind and body in our learning design and processes. However, most often, rational and cognitive approaches are chosen, particularly in higher education. With their focus on competitive performance, evaluation and comparison, schools and higher education institutions today place a great deal of pressure on pupils and students, causing fear and exhaustion even at early ages (Pascoe, Hetrick and Parker, 2020; McLellan, Faucher and Simovska, 2022).

Additionally, the current multiple crises like the recent pandemic, wars, natural disasters and catastrophes, climate change and global injustices can place an extra weight on young people, who do not see a bright future ahead. Psychological distress concerning climate change and worsening environmental conditions – often referred to as 'eco-anxiety' or fear of environmental doom (Coffey *et al.*, 2021) – can be increasingly observed among children, adolescents and young adults (Hickman *et al.*, 2021; Léger-Goodes *et al.*, 2022). The World Health Organization published alarming key facts about mental health among young people (World Health Organization, 2021) :

- Globally, one in seven 10-19-year-olds experiences a mental disorder, accounting for 13% of the global burden of disease in this age group.
- Depression, anxiety and behavioural disorders are among the leading causes of illness and disability among adolescents.
- Suicide is the fourth leading cause of death among 15-29 year-olds.
- The consequences of failing to address adolescent mental health conditions extend to adulthood, impairing both physical and mental health and limiting opportunities to lead fulfilling lives as adults.

This study is part of an European study within the Erasmus+ project "Mindfulness Practices for Students in Society (MP4s)[1], of which the authors are consortium members, and that aims to address these challenges. The project explores how to integrate mindfulness practices into higher education and how to thereby empower students to deal constructively with current and future challenges in a reflective manner and to help them manage strong emotions such as ecological anxiety, fear of others, workload stress and anxiety about the future. Mapping students' emotions with regard to the Sustainable Development Goals (SDGs) was one the project's tasks. This work presents results from a questionnaire survey that was applied to all 2nd year Bachelor students (coming from 18 different Bachelor programs) at a Portuguese university about their emotions towards the SDGs. Students responded after having completed a transversal and compulsory 5-weeks-module on sustainability, where they worked in groups on a chosen SDG, developing causal loop diagrams. This course was chosen as adequate for the task because some knowledge about the SDGs was necessary to answer the questionnaire.

First, we will present the theoretical context of emotions and the integration of the mind-body connection into learning processes. Then, we explain the methodology chosen for our study. Next, we selected the most relevant results from the questionnaire analysis and discuss them in the light of the literature. Finally, we close with conclusions for better embedding emotions into education for sustainability.

2. Literature Review: Emotions and the importance of the mind-body connection for learning

Many studies – both empirical and philosophical, and from diverse disciplines – have demonstrated the interconnectedness of our physical and emotional states of well-being, which some scholars have called the "mind-heart-body connection" (Levine *et al.*, 2021).

As stated above, in the field of EfS, scholars and practitioners advocate for a "head–heart–hands" approach (Orr, 1992; Sipos, Battisti and Grimm, 2008; Singleton, 2015; Jagannathan, Camasso and Delacalle, 2018), with the aim of holistically integrating our minds and bodies into our learning design and processes. Nathan (2022) offers a useful overview of embodied learning and how to better integrate it into our education systems. While at the levels of pre-school and primary school, physical activities may still

[1] For further information see the project website: https://mp4s.eu/

receive some more attention and the body is incorporated into the learning, this attention diminishes as educational levels get higher (Nathan, 2022; O'Toole and Simovska, 2022). In secondary and higher education, the focus is on stimulating cognitive and rational approaches, with the body rarely being seen as a source of information and knowledge (Lau, 2009; Lehtonen, 2012; Heras and Tàbara, 2014; Levine *et al.*, 2021).

Research shows that the capacities for concentration and focus improve when the body is integrated into learning activities, thus increasing overall well-being (Ratey, 2008; Hrach, 2021; McLellan, Faucher and Simovska, 2022; O'Toole and Simovska, 2022). Such integration can be achieved through, for example, mindfulness, physical activities, movement, being outdoors, and paying attention to all of one's senses (Lau, 2009; Shrivastava, 2010; Lehtonen, 2012; Heras and Tàbara, 2014; Wamsler and Brink, 2018). Furthermore, becoming aware of the mind-body connection is also linked to greater awareness and pro-environmental behaviour in general (Orr, 1992; Netherwood *et al.*, 2006; Jagannathan, Camasso and Delacalle, 2018). Since emotions play a crucial role in learning, educators can purposefully opt for approaches and pedagogies that ignite emotional reactions and help learners to connect with these, thereby creating opportunities for reflection and deep, transformative learning (Tillmanns, 2020; Martiskainen and Sovacool, 2021). Instead, with their focus on competitive performance, evaluation and comparison, schools and higher education institutions today place a great deal of pressure on pupils and students, causing fear and exhaustion even at early ages (Pascoe, Hetrick and Parker, 2020; McLellan, Faucher and Simovska, 2022).

The ecological crises and climate change are putting further weight on students' shoulders. Ecological distress in form of eco-anxiety can be expressed in strong, mostly negative emotions, such as guilt, sadness, anger, despair and anxiety, which can become overwhelming (Hickman *et al.*, 2021; Léger-Goodes *et al.*, 2022). Pihkala (2022) developed a taxonomy of climate emotions.

Major obstacles hindering a better consideration of the mind-body connection in educational settings are based on the circumstances that many classrooms do not allow for physical and social interactions due to immovable furniture or other structural barriers. Furthermore, teachers' professional development has not prepared them to address the mind-body connection, and scholars call for the integration of holistic and embodied approaches into the curriculum for future teachers, in order to improve overall well-being and learning (O'Brien, 2013). Due to the impacts of climate change, the mind-body connection is also a relevant consideration when designing the learning environment. Due to rises in temperature and the increased frequency of heat waves or similar extremes of weather, conditions such as air quality in classrooms or outdoor areas that can absorb heat are important aspects to consider when aiming for the well-being of students and staff (Pfautsch and Wujeska-Klause, 2021; European Trade Union Committee for Education, 2022; Pfautsch, Wujeska-Klause and Walters, 2022).

As summarised by Nathan (2022, p. 17), "the brain, mind, body and environment together constitute an integrated system for learning, communication and intellectual performance". Scholars advocate that a better consideration of this system holds the potential not only to increase well-being, but also our overall awareness that can lead to more sustainable behaviour (Walsh *et al.*, 2020; Wamsler, 2020; Woiwode *et al.*, 2021). The Inner Development Goals Initiative (Inner Development Goals, 2023) follows this line of thought and aims to complement the SDGs with necessary inner skills to accelerate achieving the Agenda 2030. These inner skills are grouped into five areas: (i) Being – Relationship to Self, (ii) Thinking – Cognitive skills, (iii) Relating – Caring for Others and the World, (iv) Collaborating – Social skills and (v) Action – Driving change (see also **Figure *3***).

3. Methodology

This study is based on a questionnaire survey that was adapted from a version in English created within the MP4s project, but modified to address some previously identified shortcomings and can therefore also be regarded as a stand-alone study of the Portuguese context.

3.1. Questionnaire survey structure

The survey was created in LimeSurvey and composed of five sections:

(i) an initial form of consent;
(ii) the respondent's profile (consisting of four questions: age, gender, nationality, country of study);
(iii) Section A – Selection of SDG for answering the survey and perceptions about the chosen SDGs composed of three questions using a- 7point Likert scale where students were asked about their familiarity with the chosen SDG, whether they believe the SDG can be achieved and whether Portugal / Europe is on the right track;
(iv) Section B – Indicating emotions for the chosen SDG. Respondents were shown the Plutchik Wheel of Emotions (Figure 1) and asked to think of the chosen SDG and observe their emotions. Respondents could then select all emotions they associate to the respective SDG and comment in an open-end text field. The list of emotions uses the same colours as in the wheel of emotions for easier identification.
(v) Section C – Perception about the Inner Development Goals and contemplative practices: Respondents were shown the Inner Development Framework (Figure 2) and introduced to the idea of complementing the SDGs with inner skills (Woiwode, 2020; Inner Development Goals, 2023). One question yielded about the perceived importance of inner development goals for reaching the SDGs (7-point Likert scale) and was complemented by a multiple choice questions regarding the importance of the respective thematic skills areas (Being, Thinking, Relating, Collaborating, Acting) and open-ended fields. In an optional section, respondents were asked whether they engage in contemplative practices such as meditation, yoga, qigong, tai chi or others, and in case of affirmation, about the length and frequency of their practices.

Section A and B could be repeated twice, if wished so, to give feedback up to three SDGs in total. Open-ended fields for comments were included in Section B and C, and one open-ended field for final comments at the end of the questionnaire.

Figure 2: Plutchik Wheel of Emotions (Plutchik, 1980; Wikipedia, 2023) and respective list of emotions (in Portuguese, as presented in the survey) that students could associate to the chosen SDG.

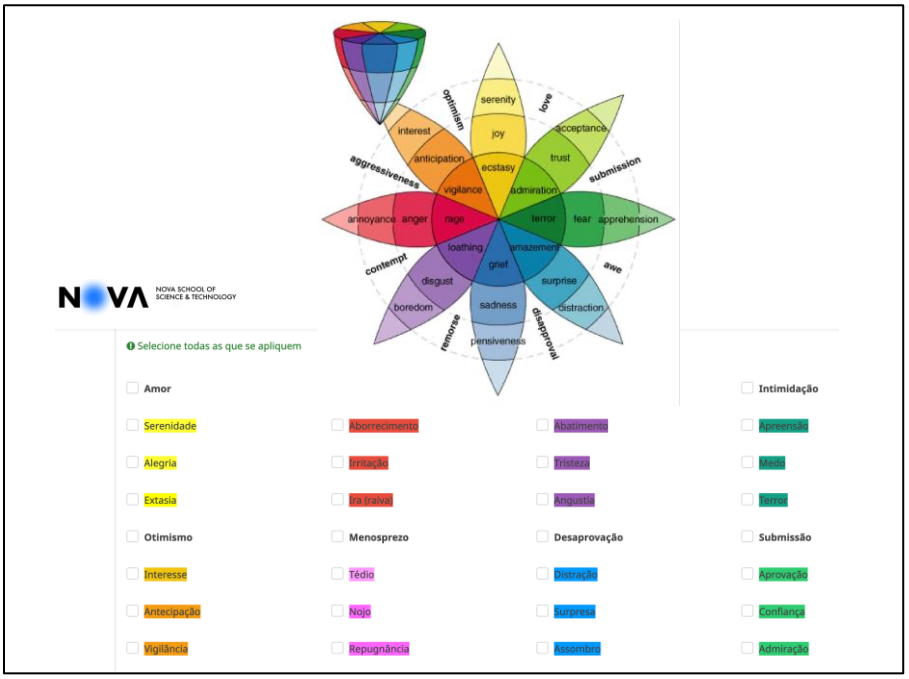
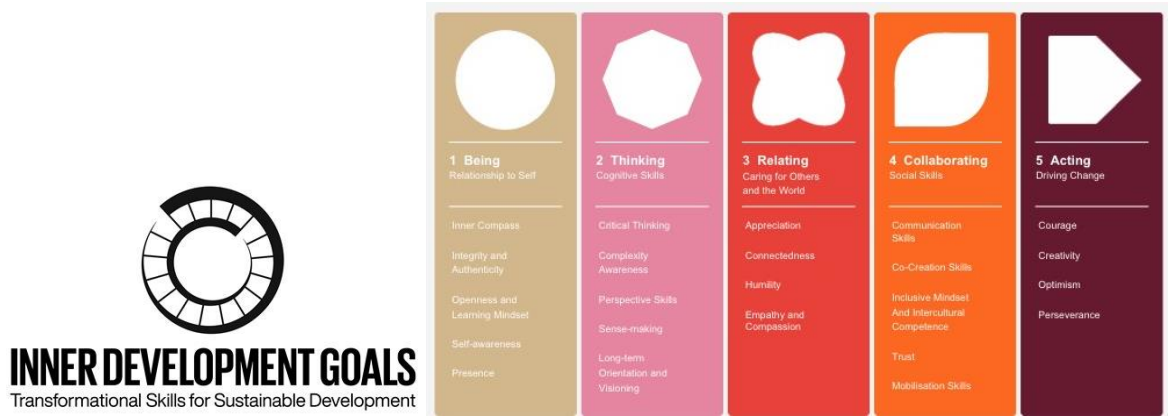


Figure 3: The Inner Development Goals Framework (Inner Development Goals, 2023)



Note: This framework was used for two questions:

(i) How much do you think developing internal skills is important to achieve the SDG(s) you have chosen? Please assign the degree of importance by choosing the following scale from 1 to 7, where 1 means "No importance" and 7 means "Extreme importance".

(ii) Please look again at the image on top of the five areas of the Inner Development Goals. Which areas do you consider the most important to focus on higher education activities? If you want, you can comment on your choice.

3.2 Data collection

The survey was sent by email to 980 2nd year bachelor students of NOVA School of Science and Technology, NOVA University Lisbon, Portugal. The questionnaire was distributed in Portuguese to allow for deep and personal answers, as 97,5% of the respondents were native Portuguese speakers. Data collection took place between 22.02.2023 and 05.03.2023. In total, 244 valid responses were received, which is a response rate of 25%.

3.3 Data analysis

For this paper, data was analysed using descriptive statistics only and qualitative content analysis of open questions. Further analyses are in progress but could not be included in this work.

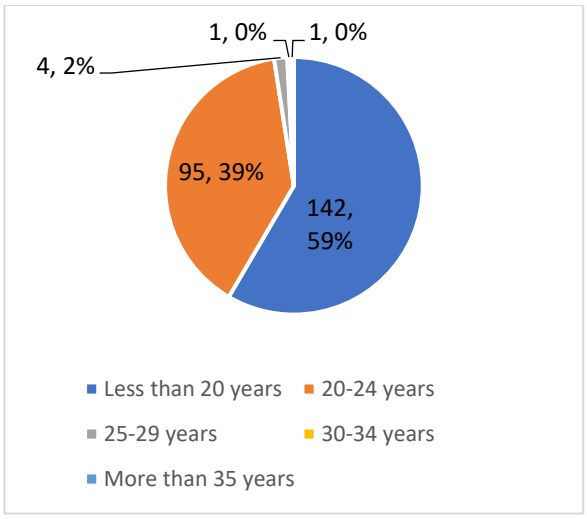
4. Results and Discussion

This section presents first the sample and then the results of the respective survey sections A – perceptions of SDGs, B – Emotions and SDGs and C – Inner skills and contemplative practices. The results are discussed in light of the literature of education for sustainability and transformative processes in higher education institutions.

5. Sample analysis

The sample comprises 244 respondents (response rate of 25%), who are 2nd bachelor students in diverse engineering and technology fields, including as well Informatics, Biology and Chemistry, at NOVA School of Science and Technology, NOVA University Lisbon, Portugal. Students were mostly less than 20 years old (58,20%), followed by the group of 20-24 years old (38,93%) (Figure 3).

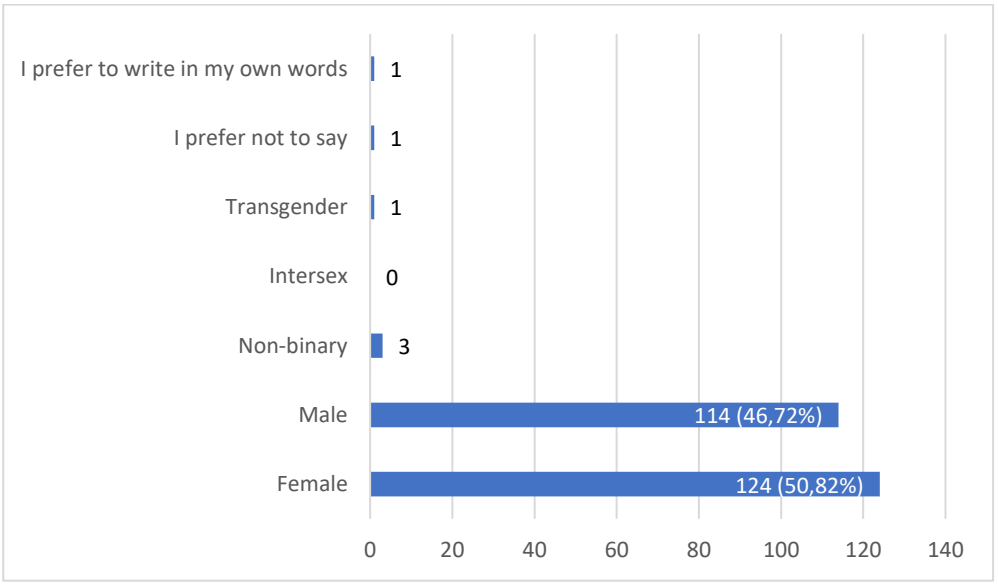
Figure 4: Respondents' age



95% of these students were Portuguese, other nationalities represented were students from Brazil, Venezuela, Moldavia and Mozambique.

Respondents were almost equally distributed between female (50,82%) and male (46,72%), with other gender identities accounting for less than 3%.

Figure 5: Respondents' gender identities



5.1. Perceptions about SDGs – Results from survey section A

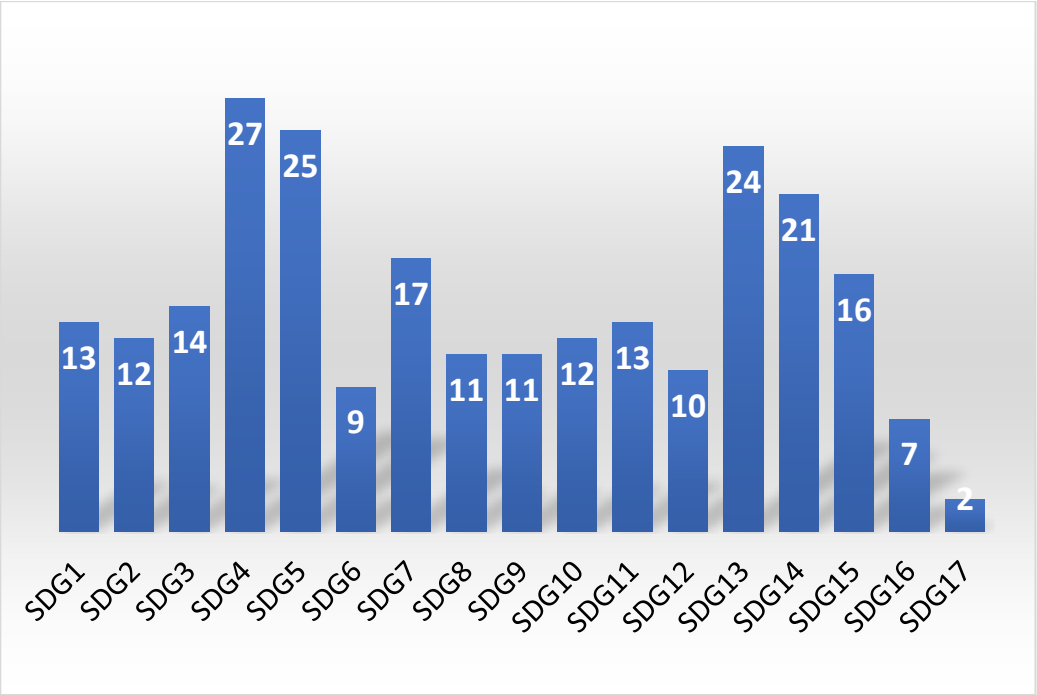
First, students chose a SDG they would like to respond about for the rest of the questionnaire and indicated their level of familiarity with the chosen SDG. Students could respond up to three SDGs in total, but only 24 students (less than 1%) repeated the questionnaire for a 2nd SDG.

The most chosen SDGs to answer the follow-up questions of the questionnaire were (Figure 5):

(i) SDG 4 (11%)
(ii) SDD 5 (10%)
(iii) SDG 13 (9,8%)

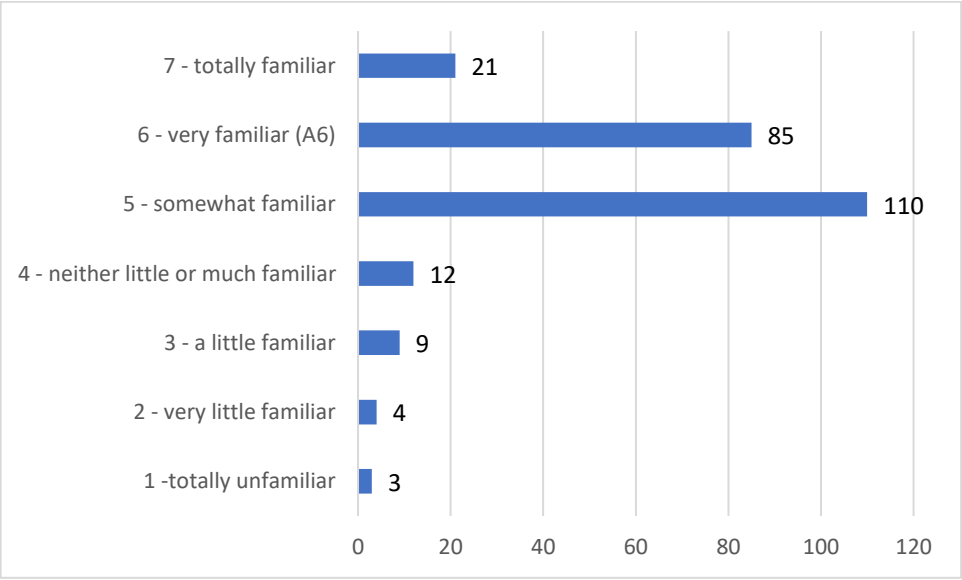
Most students felt “somewhat familiar” (45%) or “very familiar (35%) with the chosen SDG (Figure 6). This relatively high levels of feeling familiar are related to the fact that the students elaborated in small groups a causal loop diagram about a SDG of their choice in a 5 weeks-long transversal module on Sustainability.

Figure 6: SDGs chosen by the respondents of this study’s survey



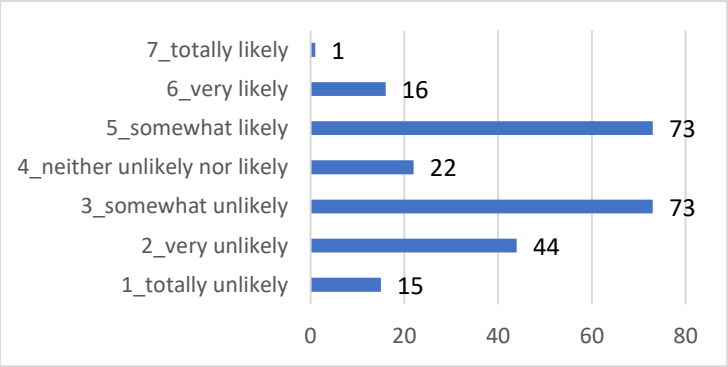
Respondents are divided about the likeliness to achieve the chosen SDG until 2030:
30% perceive the achievement of the SDG as “somewhat unlikely” and another 30% perceive the achievement as somewhat likely (Figure 7). This result might also reflect a first indication of a rather optimistic versus a more pessimistic view of the future which seems to divide the sample.

Figure 7: Familiarity with the chosen SDG



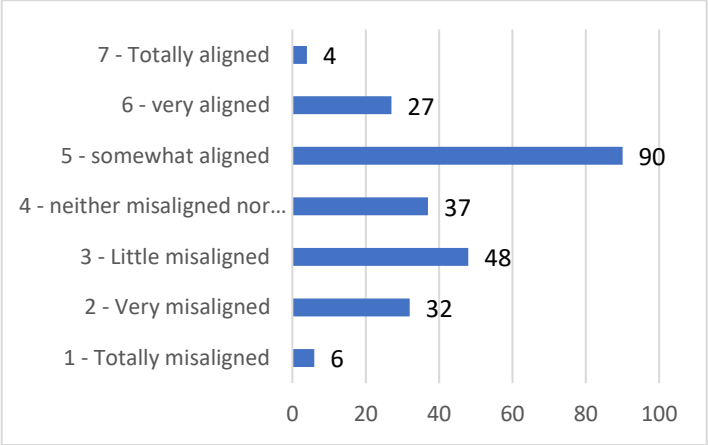
Regarding the perception whether Portugal / Europe is going in the right direction to achieve the SDG, half of the respondents pursue a rather positive outlook (Likert scale levels 5 to 7), in which more than a third of the respondents (37%) see Portugal / Europe somewhat aligned with the desired direction to achieve the goal (Figure 8). 15% opt for a neither/nor position to this question, and 35% of the respondents have a rather pessimistic view about the political direction of Portugal/Europe to achieve the goal (Liker-scale levels 1-3).

Figure 8: Perception of the achievement of chosen SDG(s) until 2030.



While the majority perceives Europe being on the right track to achieve the goal, one cannot neglect that 86 respondents (35%) perceive current European measures as misaligned to reach the chosen SDG and therefore seem not to believe that Europe can fulfil the Agenda 2030. This perception is reflected somehow in the results of the survey's next section about the associated emotions.

Figure 9: Perception whether Portugal / Europe is going in the right direction (i.e. alignment with desired direction) to reach chosen SDG(s)



4.3 Emotions and SDGs

As explained in Section 3.1. of this paper, students could indicate as many emotions as they associated to the chosen SDG, based on the Plutchik wheel of emotions.

Figure ***10*** shows all emotions selected by the respondents, and Table 9 summarizes the top 5 emotions indicated in this survey.

Figure 10: Emotions regarding the chosen SDG

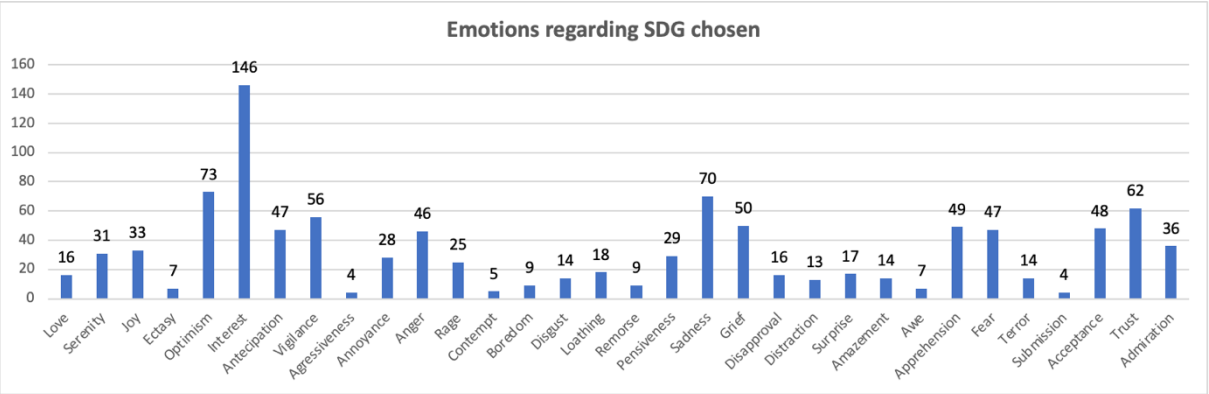


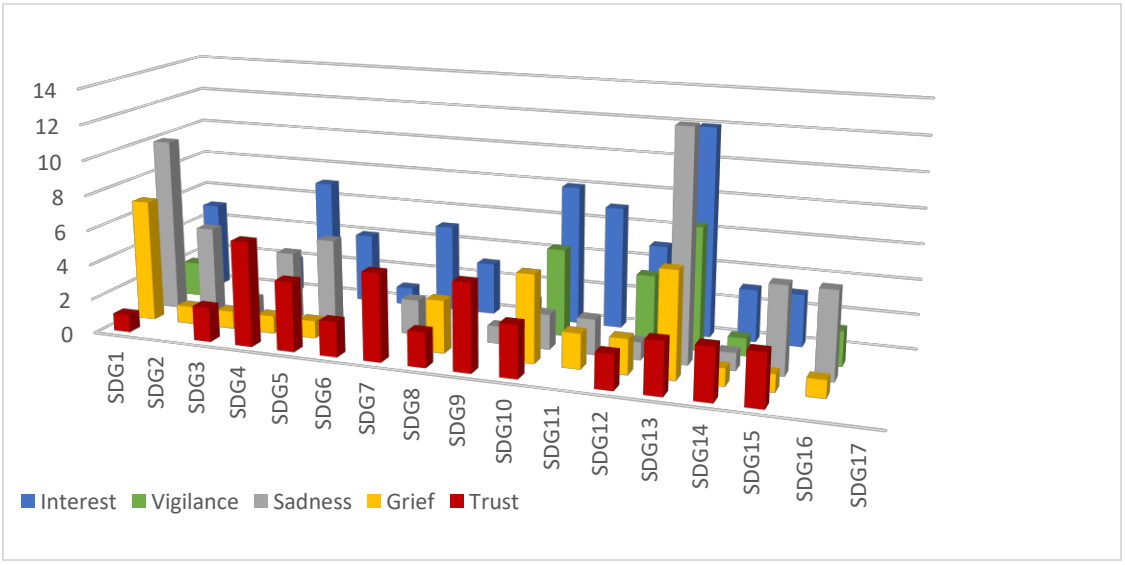
Table 9: Top 5 selected emotions

Emotions	Count	Percentage
Interest	146	60%
Sadness	70	29%
Trust	62	25%
Vigiliance	56	23%
Grief	50	20%

'Interest' as the most often selected emotions appoints to a certain level of curiosity about the SDG, which can be regarded as positive result from the transversal module on sustainability that the students were attending. *'Sadness'*, accounting for 29% of the selected emotions, and *'Grief'* (20%) can relate to the worrying facts of global socio-ecological crises the SDGs are representing, and *'Trust'* (25%) and *'Vigilance'* (23%) might also indicate some positive feelings towards the possibilities of change and the potential of monitoring of the progress towards the SDGs.

When analysing the frequency of the top five emotions per SDG (**Figure 11**), one can notice that *'Interest'* was most often mentioned for SDG 13 (Climate Action), followed by SDG 11 (Sustainable Cities and Communities), and then by SDG 6 (Clean Water and Sanitation) and 12 (Sustainable Consumption and Production). *'Sadness'* was most mentioned also for SDG 11, followed then by SDG 1 (Zero Hunger). *'Trust'* was most often expressed in relation to SDG 4 (Quality Education), indicating indirectly that students believe in the potential of education for reaching the Agenda 2030.

Figure 11: Frequency of Top Five emotions per SDGs



15 students provided qualitative comments at the end of survey's section B, of which the most representative ones were selected and categorised in positive and negative emotions (**Table 2**).

Table 10: Selected qualitative comments of survey Section B – Emotions and SDGs

Category of emotions	Qualitative comment
Negative emotions: Fear Confusion	"This theme arouses a lot of feelings, but mostly to the negative side. The indifference of people, the lack of action of large companies and governments and the non-prioritization of one of the biggest problems facing humanity scares me."
Positive emotions: Hope Negative emotions: Apprehension	"While I admire the efforts and I am hopeful for this SDG to be achieved, because I believe that a decent education for everyone increases the chances of success in many other areas and SDGs, I remain apprehensive and downcast to learn of the number of children who unfortunately do not yet have access to this right, and it is difficult to see the slow pace with which this problem is solved, even if you trust that it is necessary to complete the SDS in the best way."
Positive emotions: Optimism Negative emotions: Irritation Fear	"In a way, I believe that we are taking the right steps towards the decarbonisation of energies. However, I still feel that there is inertia in our rulers to leave things as they are and not improve, hence irritation, abatement and fear."

These comments illustrate that positive and negative emotions are mixed, and that students combine hope and fear often simultaneously.

4.4 Inner skills and contemplative practices

After being introduced to the Inner Development Goals (IDGs) Framework (Inner Development Goals, 2023), students indicated first the importance they attribute to inner skills to achieve the SDGs (

Figure *12*) and then the importance of the IDGs for Higher Education (**Figure 13**). Most of the respondents considers internal skills of *'high importance'* (44%) or of *'extremely high importance'* (32%) and almost all areas of the IDGs equally important for Higher Education.

Figure 12: Importance of inner skills to achieve the SDGs

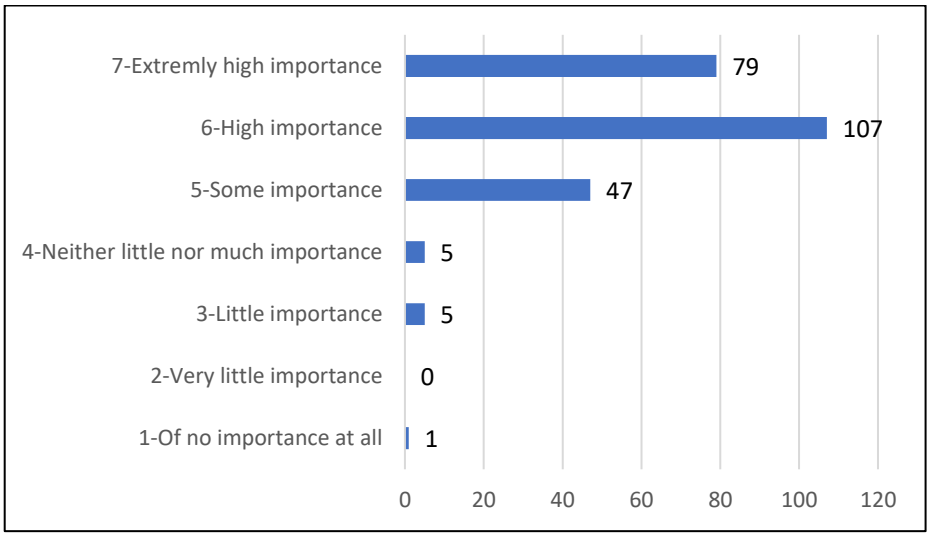
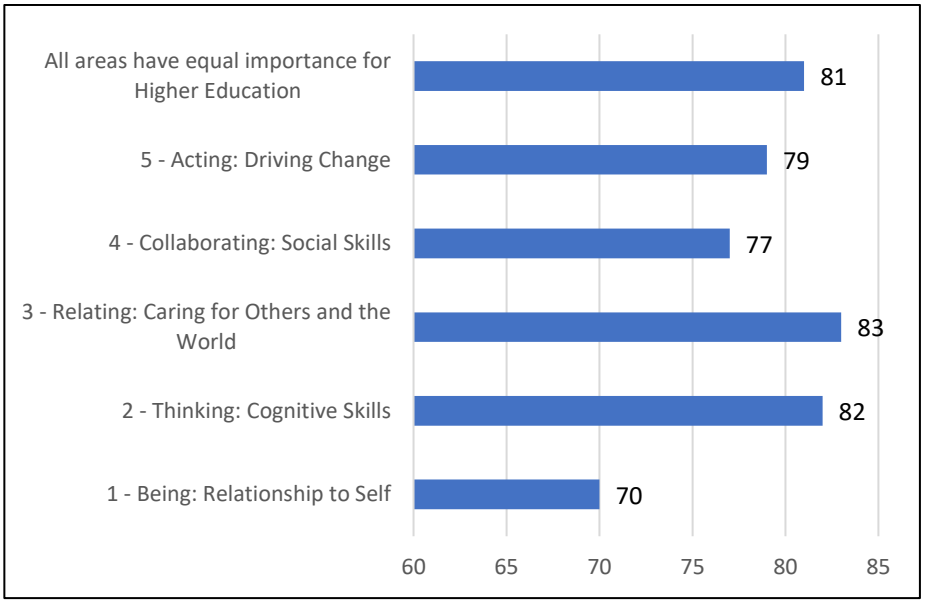


Figure 13: Importance of Inner Development Goals for Higher Education



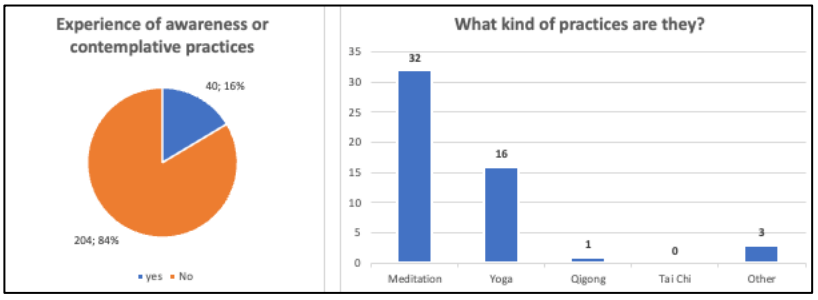
Furthermore, 51 students (21%) commented on their answers, of which the most representative are presented in Table 3. These underline the necessity of integrating inner skills for creating more sustainable societies and for transformation in general.

Table 11: Qualitative comments on the Inner Development Goals

Category of IDGs	Qualitative comment
Being – Relationship to Self	"I would say that it is in adolescence that it is extremely important to develop skills on a personal level. If we want to make the change we must have self-knowledge to better put at the service our best characteristics! In this sense, all the fields covered in the image above are extremely important. It is really necessary to try to improve who we are, and to know how we can do it!"
Relating - Caring for Others and the World	"Having a good relationship with others and with what surrounds us is very important and empathy is increasingly scarce. The same for humility."
Acting – Driving Change	More than knowledge we need to know how to be agents of change."

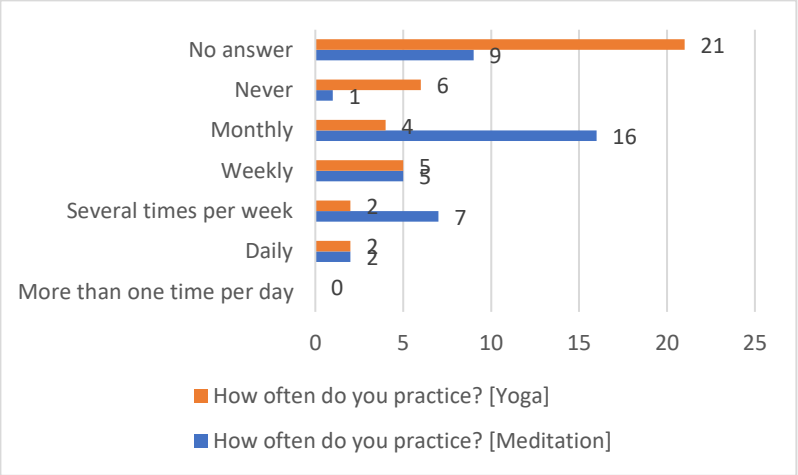
Optional questions were asked about the experience respondents have with contemplative practices. Most students (84%) indicate not having this experience, and the 16% of respondents who indicated to have experience in this field, practice mostly meditation and yoga (**Figure 14**).

Figure 14: Respondents' experience of contemplative practices



When asked about the frequency of their practice, only a few respondents indicate to practice regularly (**Figure 14**). However, the results to this non-compulsory set of questions may not represent correctly students' practices, as the rate of responses was low and cannot be verified as coorect. In a any case, some students seem to have some experience with contemplation.

Figure 15: Frequency of respondents' contemplative practices



4.5 Final qualitative comments: positive versus negative outlooks into the future

Twenty students submitted personal, sometimes long comments in the open-end text field. These comments demonstrate again the division between a positive and negative outlook into the future, of which the most representative ones are presented in Table 12. While some express being 'optimistic and happy', others believe 'nothing will ever change'. Others mention again 'the integration of mindfulness and education into the SDGs is very important.'

Table 12: Selected comments representing a positive versus a negative outlook into the future

Positive outlook into the future	**Negative outlook into the future**
"Not long ago I didn't know agenda 2030 existed. Now that I am aware of the goals, I am optimistic and happy to see progress."	"I don't see a future 2030 where any of the 17 SDGs have been hit. It may be a very pessimistic attitude, but, including what is happening in Portugal and Europe, the future seems far from promising. It seems that there are powerful forces (no, I don't mean divine forces) to prevent progress in some of these areas, which makes the act of having hope difficult. Nevertheless, I try to believe that humanity has the capacity for introspection and that it will be able to solve these problems, even if it takes centuries."
"I think before we talk about SDGs we have to talk about all the values that are behind them and their attempt to accomplish, and deep down is what this questionnaire intends to investigate, something that I value immensely. The integration of Mindfullness and education into the SDGs are very important for them to be achieved since negative feelings are always present when it comes to the injustices of the world and knowing how to deal with these feelings is a step that will be necessary to take sooner or later in the lives of people who really want to make a difference."	"In my view it is very cute and interesting to want to change the world to the opposite of the problems that the respective concepts of the SDGs point to (e.g. Poverty for a minimum sustainable life, etc.), but the truth is that nothing will ever change, at least on a large scale. We are human, and our nature is to conquer, and have more and more, and go over who is to have it. You can't evolve as a society if the big elites don't allow it, and the day you do, it's because those same elites have something to gain from it. Until then, I respect each SDGs very much and i find it very interesting (and I really liked the part of Sustainability, especially how each concept influences the next, almost as a domino effect) but the sad reality is that if they want to change the world significantly for the better it will only be possible with extremist measures. This may be taken as negative thinking and of little faith, but it is the faith that the world has given me and why the external influences (conditions) work and result as a form of revolutionary disarmament."

4.6 Discussion

Scholars are urging greater attention to eco-anxiety and related emotions and suggesting modifications to sustainability-focused educational programs (Chawla, 2020; Pihkala, 2020; Wallace, Greenburg and Clark, 2020). Some proposed adjustments include:

Creating more avenues for emotional expression through activities like small group discussions, art-based learning, and place-based pedagogies.

Developing coping strategies such as mindfulness-related practices and engaging with nature for embodied experiences.

Providing role models who demonstrate love and care for nature and openly discuss their personal emotional struggles and coping mechanisms (Chawla, 2020).

Constructive support for emotions, whether comforting or discomforting, can lead to profound learning experiences, introspection of personal values and worldviews, and empower individuals to take action for the planet (Léger-Goodes et al., 2022, p. 3). Conversely, ignoring such emotions, particularly strong and distressing ones like eco-anxiety, may result in inaction or denial (ibid; Pihkala, 2020). Studies have shown that addressing emotions in the classroom, especially when linked to agency, fosters positive action competences and hopeful visions of the future (Finnegan, 2022; Sass et al., 2023).

To facilitate the expression of these emotions, educators and learning environments must create "safe enough spaces" where students feel comfortable sharing their feelings (Singer-Brodowski et al., 2022). These spaces should be tailored to the specific needs of the age group. Educators need to engage in self-reflection and inner work to design such spaces effectively, and this self-development process should be included in the curriculum for pre-service teachers (Pihkala, 2020; Singer-Brodowski et al., 2022). Wallace et al. (2020) and Pihkala (2020) provide further individual and institutional strategies for this purpose.

Mindfulness meditation and contemplative practices are increasingly being adopted by educational institutions, ranging from pre-school to higher education (Lau, 2009). These practices help learners become more aware of their emotions without judgment and improve self-regulation and coping skills for challenging emoticons (Lau, 2009; Rempel, 2012; Crescentini et al., 2016; Perry-Parrish et al., 2016). While the research on the effects of mindfulness among children and young people is not as extensive as that among adults (Burke, 2010; Crescentini et al., 2016), evidence shows its positive impact on well-being at both individual and collective levels. There is a growing demand for integrating mindfulness into social-emotional learning programs within the school curriculum (Felver et al., 2013). Educators can find various resources, such as the emotional resilience toolkit (Atkinson, Kelsey and Jaquette Ray, n.d.), to support them in this endeavor.

5. Conclusion

This paper presents the results of a questionnaire survey about emotions and SDGs carried out at a Portuguese university among 980 2nd year bachelor students, which obtained 244 valid responses (25% response rate). The study is integrated in the European Erasmus+ project “Mindfulness practices for students in society (MP4s).

The results reveal that students have mixed emotions regarding the SDGs, which can be on the one hand positive and optimistic, and on the other hand also negative and pessimistic, in particular regarding a future outlook. The top five emotions mentioned were ‘interest’, ‘sadness’, ‘trust’, ‘vigilance’ and ‘grief’ that reflect the division between positive and negative feelings about the SDGs. Additional qualitative comments provide a rich picture of these mixed feelings. Most respondents regard the development of inner skills of high importance for reaching the SDGs and building fairer and more sustainable societies. Emotions in general – the comforting and discomforting – should be better integrated in Education for Sustainability to empower future agents of change to deal constructively with challenging situations. They are of special relevance to better address eco-anxiety and other related emotions due to the diverse socio-ecological crises of our times.

Dealing constructively with emotions, developing coping strategies for discomforting feelings and strengthening emotional resilience, for both learners and educators, is of the utmost relevance in increasing overall well-being, providing a sense of hope and motivating students to step into their full potential.

This work relates to SDG4, target 4.7, and indirectly to SDG3. By strengthening the youth and empowering young people to deal constructively with adversities and uncertainties, also the 5P's (people, planet, prosperity, peace, partnership) are strengthened.

6. Acknowledgement

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3D models in education

Daniel Dancsa[1], Melinda Nagy[2] Takáč Ondrej[3]

[1] daniel.dancsa@gmail.com
[2] nagym@ujs.sk
[3] takaco@ujs.sk

Abstract. Thanks to developing technological tools, we can incorporate photogrammetry methods into the teaching process. Models have been used in education for a long time and have always facilitated writing.

Our aim is to present the possibilities to develop 3D models, specifically defined as arthropod models, and of course to include them in the teaching process. Mobile phones, cameras and other technical devices have reached a level of technology where the photographs they help us to take are of sufficient quality to create 3D textured models. It can make the classroom more interesting even for students with possible phobias, as it is possible to study the species without the physical presence of a living animal, which often involves the destruction of the specimen, and without seasonal restrictions. Furthermore, 3D models can have the great advantage that only a single individual is needed to create a model, so that the number of individuals is not reduced, which is a welcome feature for a rare species, as a single individual can be used to create a 3D model that is easily accessible to all and can faithfully represent the characteristics of the species.

Keyword: education, 3Dmodels, photogrammetry

1. Introduction

At present, computing is rapidly evolving, allowing us to apply ICT techniques and procedures in areas where they were not common before. One of these areas is education, including biology. We can create realistic 3D models of biological bodies and arthropods thanks to advanced technological tools. These can then be studied far from their habitat and preserved for future comparison. This leads to another possibility, their use in the educational process. It should also be pointed out that a real 3D model, which preserves scale and real colours, is a much better way to study them than a classic photograph.

According to the literature, a model is an idealised picture of a larger or smaller part of reality, but a law or a concept can also be a model. However, models are most effectively used to describe, analyse and explain how a system works. Modelling therefore facilitates understanding (comprehension of the system) (Kirkby 1987, Zain 2021).
Modelling and the use of models is a common form of communication, because if you ask for directions on the street, the -director will gesticulate and use his hands to point you in the right direction. The same phenomenon can be observed in the playground, when young children play a game of make- believe in the sandpit using branches and various "tools".
In this way, they are doing nothing more than imitating, modelling a phenomenon they have seen so many times before (Gilbert and Ireton 2003, Geda 2011). Models can help learners to understand structures and shapes, and a model can also help them to understand functions and relationships.

2. Biology in education

Biology is a popular science subject that is embraced by both science and arts-oriented students. More and

more students are starting biology each year, but each year students perform poorly in the exams. Teachers as well as parents have expressed concern about the poor performance of students in biology. This has created an educational gap where students are not pursuing their studies in biology in higher education institutions, ignoring the fact that this subject is the basis for studying other science subjects such as medicine, pharmacy, nursing, biochemistry, genetics, etc., which are of great economic importance. This gap can be bridged by developing a more effective approach to improve the situation to meet the needs of students and society. Therefore, it is certain that a teaching approach should be adopted that will help students retain what they have learnt in the long run. In view of this, an inquiry- based learning approach to teaching biology may be useful to improve persistently poor performance in biology. In this context, one may therefore ask: what is the impact of an inquiry-based learning approach on students' attitudes towards biology? (Enebechi 2021)

2.1 Experience-based teaching in biology

Experiential learning is an educational strategy in which students use methods and exercises similar to those of professional scientists to build knowledge. It can be defined as the process of discovering new cause and effect relationships, whereby the learner formulates hypotheses and tests them through experiments and/or observations. It is often seen as an approach to problem solving and involves the application of a range of problem-solving skills. Inquiry-based learning emphasises active participation and learner responsibility in the discovery of new knowledge. In this process, learners often engage in a self-directed, partly inductive and partly deductive learning process, conducting experiments to investigate relationships between at least one dependent and one independent variable. Recent technological developments are further enhancing the success of using inquiry-based learning. Research-based learning is seen by education policy makers worldwide as a vital element in the development of a scientifically literate community. It is therefore valuable to examine research-based learning in more detail and identify its core elements. Inquiry-based learning seeks to engage learners in an authentic scientific discovery process. From a pedagogical point of view, the complex scientific process is divided into smaller, logically linked units that guide learners and draw attention to important features of scientific thinking. These units are called inquiry phases and the relationships between them form an inquiry cycle (Pedaste et al. 2015)
Learning, understanding and applying scientific inquiry thinking has long been a goal of science education. The ways in which this is done are many and varied, providing pupils with many opportunities to explore. This is made possible by inquiry-based teaching. (Nagy and Nagy 2016)
Experiential learning can be used in any subject, in any discipline, and at all levels of education (public and higher). Teachers are the key to quality improvement in education systems and determine the success of curricular reforms and innovations. Teachers' professional development is an essential factor for changing teaching. Therefore, an important way to introduce research-based teaching is to transform the training curricula of prospective teachers. It is important that they gain experience of learning through and from research and discovery during their training. This can be ensured by emphasising both research content and research processes and problems in teacher training. Students are treated as listeners and as participants, i.e. teaching is both teacher-focused and student-focused (Nagy and Nagy 2016).

2.2 3D is the new element in education

The use of the experiential learning method can enable learners to explore, discuss and construct concepts and contexts in contexts that involve real problems and projects that are relevant to the learner. In lifelong learning experiences, learners 'learn' by doing real-life learning tasks that help them acquire the basic skills, knowledge and understandings that they will need and use in other contexts (e.g. in the workplace). This method also allows teachers to assess whether students have built up an accurate understanding of the information they have learned. One of the many strengths of the lifelong learning approach is that it often allows students to interact with the complexities and ambiguities of real life and the "tangles of real-life decision-making" that many traditional teaching and learning approaches cannot create (Lowell and Tagare

2023).
Almost a century ago, John Dewey said that the most effective education is experiential, because learning is through personal experience and action. The nearly a century of educational research that followed proved Dewey right and that active learning and experiential learning are highly effective. Some disciplines have always been capable of experiential learning. Disciplines such as environmental sciences, electrical engineering and other inherently practical disciplines are well suited to this type of teaching and learning. Other disciplines are more difficult to engage in experiential education. In some, hands-on experience is challenging (e.g. medicine), in others, subjects can only be accessed through mediators and models (e.g. molecular biology, theoretical physics). A key feature of 3D technology is that it enables experiential teaching and learning in many disciplines where this would otherwise be challenging or impossible. 3D technology can make the invisible visible, the inaccessible accessible. Perhaps the most straightforward use of 3D technology is to recreate objects and spaces that exist in the real world, but in a virtual environment (Dewey 2011).
Science education has long taught students about the natural world through textbooks, lectures and laboratory experiments. But with the advent of 3D modelling technology, educators can bring science alive for their students with a new, innovative tool. 3D modelling in science education allows students to interact with scientific concepts in a more engaging and immersive way, which helps them to better understand complex concepts and theories (Alhonkoski et al. 2021)

3. Methodology

The virtual modelling of the curriculum allows students and teachers to interactively interact with the learning process in a virtual environment... One of the advantages of this is that students can understand concepts and processes much more easily when they have a virtual model with all the elements of reality. Virtual models allow learners to interactively learn and explore processes and systems in the curriculum. This can help to improve understanding, so that learners can better assimilate abstract concepts and processes and apply them in practice. A virtual model allows learners to simulate and try out different processes and systems without being physically present in a laboratory or other environment (Annuš et al. 2023). Pix4D software was used to create the 3D model. It is a professional photogrammetric software that has already given us positive results.
During the modelling process, we take a 360-degree 360-degree panoramic view of the object to be modelled, or just the side of the object we want to model in 3D, so that we can use the model as a digital teaching material. For small objects, it is advisable to use a turntable to easily take a sufficient number and quality of photographs of the object from all sides by rotating the turntable. When the turntable was used, the device for taking the photographs was fixed. Markers of different colours and heights were placed around the central axis to help the software interpret the movements of the specimen as it was rotated.
When taking a photograph, you should try to keep the subject still. This can only be achieved with arthropods that are no longer alive, so the collected animals are carefully anaesthetised and prepared in a position that represents their species-specific characteristics. In this way, a single specimen is sufficient to create a 3D model. The great advantage of 3D models is that only one individual is needed to create a model, so the number of individuals is not reduced, which is a welcome feature for a rare species, as a single individual can be used to create a 3D model that is easily accessible to all and can represent the species' characteristics in a lifelike way, as it contains elements of reality, which can bring learning to a new visual level.

Figure 1. Method of photography

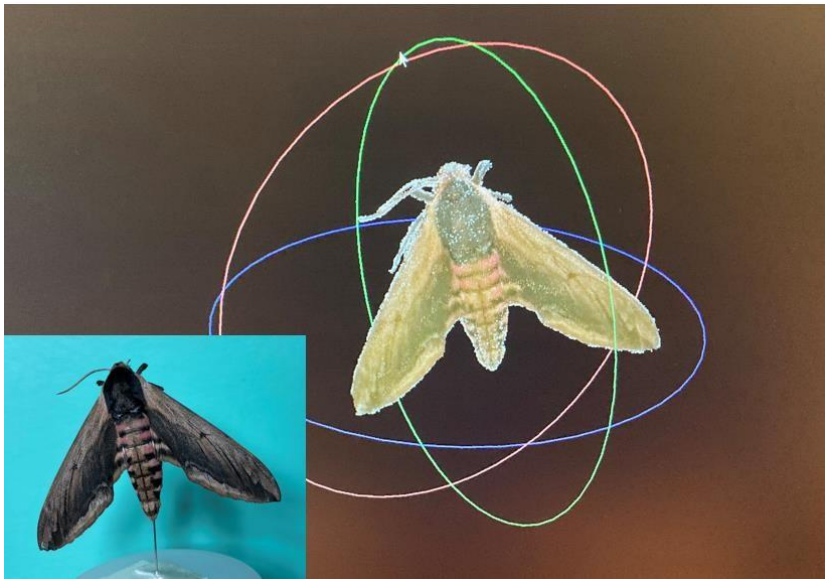
Mobile phones and professional cameras were used to take the photos. No significant differences in the quality of the 3D models were found.

Figure 2. Tools for photography

4. Results and Discussion

It is not possible to specify the exact number of photos, but it is possible to say that better results are obtained if dozens of photos are taken and used, but experience has shown that using hundreds of photos can also reduce the quality of the model, as the number of photos increases in proportion to the number of errors. In addition to the right amount of images, the location of the object is also important. (Takáč et al. 2023) In our experiments, as shown in Figure 3, we found that if the selected object filled at least 80% of the photo, the software was able to interpret the uploaded photo and use it to build the model.

Figure 3. How to take a photo



If the object of interest was not the dominant feature in the resulting photo, in many cases the software could not use them. However, if some parts of the object are missing or stick out in some photos, this is not a problem, as this does not affect the quality of the resulting model. In order to get a model of the right quality, you also need to ensure that the images you take overlap properly. Also during our experiments we found that 50% overlap between images results in good quality models. Once the photos have been taken, the images are imported into a computer, and then we can use software to create a 3D copy of the selected object. We did this using a software called Pix4D. By starting a new project, we can start creating the model by selecting all the photos we have taken and using them to start creating the 3D model.

The final 3D model is shown in Figure 4. In the final 3D model, we can observe that the surface is not perfectly smooth, but contains "noise", especially at the edges, which is a typical defect in 3D modeling. The next step is to remove the unnecessary parts that are not part of the model and interfere with the interpretation of our model. This function is provided by the software and can be used when we need to cut off cloudy excess from the model or when we want to remove unnecessary backgrounds or environments. The mechanism of occurrence of these errors depends on many factors and will occur in all cases. It is a painstaking and slow job to remove this distracting excess, which can take long hours as we want to preserve the detail of the model. In many cases, as can be seen, the finished model can become almost blended into the surrounding noise cloud, making it a challenge to remove. However, with care and precision, the end result is a movable 3D model that can be used in biology lessons, avoiding the destruction of additional animals.

Of course, photogrammetry is not only used in the biological field, it can also play a major role in the conservation of cultural heritage (Takáč et al. 2023), as it can be used to model large-scale structures, even those under protection, which can be preserved for future generations or as a starting point for possible reconstruction. At the same time, the Pix4D photogrammetric software we use can also be used to model surface mines and other large- scale spaces.

Figure 4. The finished model before and after

The models created can be used in biology education, but even more valuable is the experience gained from creating them, as they can help to improve the modelling of biological objects (Takáč and Végh 2021a, 2021b, 2021c, Takáč et al. 2023).
Our planned further research is likely to have a novel impact, as 3D models have so far been used very little in education. The models we produce could bring students closer to a world and its structure that we don't see every day. And if education is repeatedly confined to online settings, they can be virtually the only means for teachers to replace common field or laboratory demonstrations. Our expected results would probably be welcomed not only by education, as it is also much easier to store a 3D model, so that it can be used in classrooms and possibly museums. Of course, it is their incorporation into education that could be of greatest importance.

5. Conclusion

In summary, 3D modelling technology is transforming science education, making it more engaging, interactive and dynamic. By visualising scientific concepts, simulating experiments, exploring scientific data, augmenting reality and stimulating creativity, 3D modelling is revolutionising the way we teach and learn about nature. As this technology develops, we can expect to see even more exciting and innovative uses of 3D modelling in science education.
When the final 3D model is created, it is not perfect, you can observe that it contains "noise", especially at the edges, which is a typical defect of 3D modelling. The next step is to remove the unnecessary parts that are not part of the model and interfere with the interpretation of our model. Removing distracting excess is tedious and slow work that can take long hours as we want to preserve the detail of the model. In many cases, the finished model can almost blend into the surrounding noise cloud, making removal challenging. We have experienced this phenomenon when modelling complex biological objects. When modelling non-complex objects, the length of post-processing is significantly reduced. With care and precision, however, the end result is a movable 3D model that can be used in biology lessons, avoiding the destruction of additional animals.
The use of 3D modelling in virtual and augmented reality can revolutionise science education by providing students with an immersive, interactive and personalised learning experience. By using these technologies to create simulations and visualisations that bring scientific concepts to life, educators can engage students in ways not possible with traditional teaching methods, fostering a better understanding and appreciation of science and technology.

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TRACK 3
Biodiversity and ecosystem services

3a. Life on land

Abstracts

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Cultural Ecosystem Services of Insects and Birds in Urban Residential Areas Towards Young Children's Outdoor Learning

Dr Noraini Bahari[1], Dr Nurul Nadiah Sahimi[2], Dr Mega Suria Hashim[3]
[1]Universiti Teknologi MARA, Selangor, Malaysia. [2]SAITO University College, Selangor, Malaysia. [3]Universiti Teknologi Malaysia, Johor, Malaysia

Abstract

This study explores the cultural ecosystem services (CES) provided by insects and birds in urban residential areas for young children's outdoor learning experiences. These species play a crucial role in urban ecosystems, offering various cultural benefits such as aesthetic enjoyment, sense of place, and connection to nature. However, the value of these benefits to young children's learning has been overlooked in the literature. By reviewing the existing research, this study argues that insects and birds can provide valuable opportunities for young children to engage with nature, develop ecological literacy, and improve their well-being. Through activities such as birdwatching, bug hunts, and habitat creation, children can learn about the diversity and interdependence of urban ecosystems and develop appreciation for the natural world. This study acknowledges the potential challenges associated with incorporating CES into young children's learning experiences, such as limited access to green spaces and safety concerns related to exploring natural habitats. To address these challenges, this study proposes a framework for designing effective outdoor learning experiences that leverage the benefits of CES while minimizing potential risks. This framework emphasizes the importance of creating safe and accessible outdoor learning environments, providing opportunities for children to explore and discover nature, and fostering a sense of wonder and curiosity regarding the natural world. Interdisciplinary collaboration between educators, researchers, and urban planners is essential for the development and implementation of effective outdoor learning programs. This study contributes to the growing discussion about the importance of CES for urban residents and highlights the potential benefits of incorporating insects and birds into young children's outdoor learning experiences. The proposed framework can be a useful tool for educators and researchers to design effective outdoor learning experiences that enhance young children's ecological literacy and well-being. The paper's relevance to the topic of the conference is significant because it focuses on the planet and people aspects of the SDGs. Specifically, the paper explores the cultural ecosystem services provided by insects and birds in urban residential areas for young children's outdoor learning experiences. By emphasizing the role of nature in enhancing children's well-being and ecological literacy, the study aligns with the people and planet goals of the SDGs. The proposed framework for designing effective outdoor learning experiences also underscores the importance of interdisciplinary collaboration among educators, researchers, and urban planners, emphasizing the need for partnership to achieve sustainable development. Overall, the paper provides a practical approach to incorporating nature-based learning into young children's educational experiences, promoting prosperity and peace through environmental awareness and education. Finally, the study relates to the SDGs and targets, including SDG 11: Sustainable Cities and Communities - specifically Target 11.7, which aims to provide universal access to safe, inclusive, and accessible green and public spaces, particularly for women and children, older persons, and persons with disabilities. It also relates to SDG 15: Life on Land - specifically Target 15.1, which aims to ensure the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems and their services.

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ANALYSING THE CONFLICT BETWEEN ANIMAL WELFARE LAWS AND CULTURAL RIGHTS IN SABAH

Dr Siti Sarah Sulaiman[1], Dr Nur Hasreena Nadia Ahlun[2], Dr Anida Mahmood[1], Mrs Fazlin Mohamed Zain[1]

[1]Universiti Teknologi MARA, Shah Alam, Malaysia. [2]Sabah Veterinar Department, Sabah, Malaysia

Abstract

The laws which governed Animal welfare in Sabah are scattered and involved many agencies namely Department of Veterinary Services Malaysia, Royal Malaysian Police, Wildlife Departments and Local Authorities. However, there is conflict between enforcing the laws and cultural rights in Sabah when domestic animal like dog and cat is served as a cuisine. Similar to other exotic food, dog meat is said to be able to enhance energy. The culture of enjoying the exotic cuisine is still very close to the people, although the Act specifically said the doing of extracts any part of live animal through a procedure which causes pain and suffering to the animals for the purposes of getting skins, oils or other animal products were prohibited by the law. Foreigners from Indonesia and Philippines were known to enjoy dog's meat and it is sold openly in the country. The laws seem not be able to stop the selling and consumption of dog or cat meat. Apart from that customary law namely Sogit posed a big challenge in enforcing Animal Welfare Enactment 2015. Knowingly that sogit is applied in Sabah for certain ethnics, some of the cases were settled by applying sogit. This is a conflict between Section 19 of Animal Welfare Enactment 2015 and the application of customary law in Sabah. Rules no 3 of Native Courts (Native Customary Laws) Rules 1995 says that the Court may use any vernacular term in respect of a sentence or penalty recognized under native customary laws in the district in which such Court is established. It can be concluded that animal welfare law is in placed in Sabah but it is difficult for Department of Veterinary Services to enforce it effectively due to scattered law and conflicts with cultural rights. Therefore, this research aims at analysing conflict between the laws and cultural rights and propose for a legal reform in strengthening the Animal Welfare Enactment 2015. Not only that, finding of this research also establish linkages between SDG 1 and 2 to 5P principles namely People and Planet respectively. In achieving the objective, primary data were obtained through statutes, regulations, policy papers and judicial decisions. Furthermore, interview was conducted with officers from Native Court, Sabah, representatives of Sabah Museum, officers from the Department of Veterinary Services, Sabah and the Local Authorities. The laws in Indonesia and South Korea were also studied as a reference.

TRACK 3
Biodiversity and ecosystem services

3b. Life below Water

Abstracts

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Airborne monitoring of water quality in remote regions

Dr. Sharon Maes, Prof. Monica Odlare, Prof. Anders Jonsson
Mittuniversitetet, Östersund, Sweden

DR. SHARON MAES

Abstract

The Intergovernmental Panel on Climate Change (IPCC) points out alpine regions worldwide as climate change hotspots. Expanding and diversifying summer tourism in northern Scandinavian mountains exerts additional severe pressure to these areas and their oligotrophic and sensitive aquatic ecosystems. Previous research at Mid Sweden University has shown that fecal contamination of mountain rivers, indicated by the enumeration of *E. coli*, is frequent in areas that are intensively being used for tourism and reindeer herding. According to the IPCC, climate change is projected to reduce raw water quality, posing risks to drinking water quality even with conventional treatment. Therefore, there is an urgent need for improved monitoring of water quality in such areas to be able to protect the ecosystem as well as the rights of indigenous people, human and animal health and to provide support for water management decision. To be able to monitor the water quality is of great importance for the sustainability of mountain regions and water sources in general. The inaccessibility of the watercourses in remote mountain areas makes it difficult to establish sufficient monitoring programs.

In this research, the use of airborne monitoring systems to assess water quality in remote regions is investigated. Remote monitoring systems based on e.g. drones and satellites have the potential to replace less climate friendly options making use of terrain vehicles, snow mobiles and helicopters. The drones can be equipped with various sensors or sampling equipment, can overcome long transportations as well as time-consuming and expensive field samplings. Drones have great potential to be employed in everyday practices as an essential part of decision support systems for monitoring, evaluation and remediation of contaminated sites. The goal is to use drones to establish water quality monitoring programs in remote regions such as the mountain areas of Northern Sweden. In this research we intend to cover the catchment area of upper parts of river Indalsälven situated in the mountain region on the Swedish/Norwegian border, including the catchment areas of the tributaries Handölan and Enan covering approximately 777km2.

One approach in this research is to image large areas of interest by the use of a multispectral camera on a drone and to identify spectral bands or band ratio´s which correlate to physicochemical parameters that are related to water quality. Another approach is to further explore the use of drone-based water sampling for laboratory or in-field analysis of microbial and chemical parameters.

Both approaches should eventually lead to the development of a drone-based monitoring program for oligotrophic rivers that can image or measure water pollution with sufficient spatial coverage and time resolution to enable early warning of outbreaks of fecal pollution. Results of this research will contribute to SDG 6, targets 3 and 6 and SDG 14.

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Assessment of Possible Intervention Strategies for the Abatement of Plastic Pollution in Rivers

Dr. Tibor Princz-Jakovics, Dr. György Ádám Horváth
Department of Environmental Economics and Sustainability, Faculty of Economic and Social Sciences, Budapest University of Technology and Economics, Budapest, Hungary

DR. TIBOR PRINCZ-JAKOVICS

DR. GYÖRGY ÁDÁM HORVÁTH

Abstract

Plastic waste pollution is posing a mounting problem to humanity. As these stem from various sources across the globe and from different activities, this geographic and sectoral heterogeneity requires complex and carefully designed policies and approaches. Numerous studies discuss the spread of plastics of different densities and physical properties, examining plastic pollution in rivers, riverbeds, beaches, near-shore seabeds and open seas. Beside more efficient prevention techniques, installation of different types of equipment suitable for abatement of microplastic pollution from running water contributes to the fulfilment of strategic environmental goals.

The aim of our research is to compile an assessment framework for future abatement projects or programs including financial and social aspects and increasing the level of sustainability. This framework can be used as a template for intervention projects to improve water quality of our rivers. This research conducted was primarily concerned with the environmental requirements of sustainability. Abatement of microplastic pollution would be evaluated from the effects of greenhouse gas emissions and the level of marginal abatement costs as crucial aspect of sustainability. In general, the shaping of environmental regulation, the selection and appropriate adaptation of the assessment tools can significantly reduce the burden on the environment through the efficient use of resources and decreasing of social costs of pollution. The authors employ the pollution chain model and its corresponding policy approaches in the deliberation of riparian plastic waste pollution. During traditional environmental protection policy planning, the pollution chain is typically monitored in an atomized manner, regardless of the spread of other pollutants and harm. However, in the case of accumulated pollutants, such as PET bottles, this does not lead to the desired goal. While PET bottles in their original form are mostly unpleasant, unaesthetic, and generally make the environment seem degraded and desolate, microplastics accumulate in living organisms, decrease ecosystem services and can even cause serious health damage.

Evaluation methods for identifying financial aspects and social utility would be proposed and assessment of the different types of interventions (for example: collection of plastic using the existing waste management system or collection directly from water) will be given. Intervention options offer solutions of varying cost effectiveness for collection of plastic waste. Comparison of interventions relies on empirical data on the existing operational practices and on corresponding cost estimates. However, it is important to take into account that the regulatory framework and operational business model may alter the actual costs and efficiencies, even substantially. The theoretical contribution of this research is the assessment framework which provides reliable data for decision makers to be able to evaluate the long-term effects of different intervention strategies targeted for decreasing plastic pollution in our rivers. Possible policy implications and the importance of this problem highlight the relevance of the topic and efficiently contribute to the international discussion at the conference.

TRACK 3
Biodiversity and ecosystem services

3c. Ecosystem Services

Abstracts

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Application of Sentinel-2 data to evaluate the role of mangrove conservation and restoration on aboveground biomass

Mrs. Raheleh Farzanmanesh[1], Dr Christopher J Weston[1], Dr. Sebastian Thomas[2]
[1]University of Melbourne, Melbourne, Australia. [2]Curtin University, Perth, Australia

MRS. RAHELEH FARZANMANESH

Abstract

Mangroves are forest ecosystems located in the inter-tidal regions of tropical and subtropical coastlines that provide many valuable economic and ecological benefits for millions of people such as preventing coastal erosion, providing breeding and feeding grounds, improving water quality and supporting the well-being of local communities. In addition, mangroves capture and store high amounts of carbon in biomass and soils that play an important role in combating climate change. The decline in mangrove area has prompted government and private sector interest and investment in mangrove conservation and restoration projects to achieving multiple Sustainable Development Goals from reducing poverty to improving life on land. Mangrove aboveground biomass plays an essential role in the global carbon cycle, climate change mitigation and adaptation by reducing CO2 emissions. So, restoration and management of mangrove forests address SDG13 to mitigate climate change and increase climate resilience for local communities. However, little information is available about the effectiveness of mangrove sustainable management on mangrove change area and aboveground biomass (AGB). Here, we proposed a method for mapping, modeling, and assessing mangrove area and AGB in two Global Environment Facility (GEF) blue forests projects based on Sentinel-2 Level 1C imagery during their conservation lifetime. The SVR regression model was used to estimate AGB in Tahiry Honko project in Madagascar and the Abu Dhabi Blue Carbon Demonstration Project (Abu Dhabi Emirates), then optimized by genetic algorithm (GA) for feature selection. We used the root mean square error and coefficient of determination for accuracy assessment of the model. The results showed that mangrove forests and AGB declined in the Tahiry Honko project, while in the Abu Dhabi project increased after the conservation initiative was established. The results provide important information on the impact of mangrove conservation activities and contribute to the development of remote sensing applications for mapping and assessing mangrove forests in blue carbon initiatives.

TRACK 4
Climate change and energy

4a. Climate change: Effective response for energy, water and land use

Abstracts

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Analysis of Drought and Conflict in Amhara and Afar Regions: Implications to Household Livelihood and Food Security

Dr. Desalegn Ayal, Mr Jemale Munye
Addis Ababa University, Addis Ababa, Ethiopia

DR. DESALEGN AYAL

Abstract

The incidence and economic impact of natural and human-induced hazards have increased at the global level. Ethiopia is vulnerable to hydro-meteorological and human-induced hazards. This paper examines the interplay effect of drought and conflict on household livelihood and food security. For this report data collected using in-depth reports was substantiated using reports, published literature, and case studies. The result revealed that drought and conflict are the most disastrous features eroding the asset background of farmers and pastoralists in the Amhara and Afar regions. The recurring drought causes crop failure, shortage of water, and pasture and disease outbreaks. In the two regions, the war cost billions of dollars, physical injury, and loss of life. Pertinent cultivating and grazing areas become a battlefield, farmers and pastoralists displaced abandoning their mature crops ready for harvesting, and massive destruction of agricultural research institutions. The two mutually reinforcing hazards further worsen the food security situation of farmers and pastoralists. These hazards have exposed children, women, old people, people with disability, people with chronic illnesses, and marginalized communities to diseases that could otherwise be treated. Humanitarian and government assistance for food and medical supplies was not sufficient due to a lack of recognition of the crisis by donor and NGO communities. We argue that comprehensive short-term and long-term disaster risk management measures could help the victims to recover and live with the drought hazard. Likewise, local, national, and international stakeholders should address the root causes of the conflict and hence, build a culture of co-existence.

Keywords: drought, conflict, displacement, food security, resilience, livelihood

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Determinants of Companies' Commitment to Climate Change: Evidence Based on European Listed Companies

Chiara Xhindole, Lara Tarquinio
"G. d'Annunzio" University of Chieti-Pescara, Pescara, Italy

Abstract

Climate change is a highly topical issue of global relevance from an environmental, social, and economic perspective. Companies are increasingly required to report on their efforts to reduce the negative environmental impacts and promote mitigation strategies against climate change. In the Sustainable Development Goals Report of 2022, based on the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), the United Nations defines climate change as humanity's code red warning, emphasising the urgency to act to avoid further climate catastrophes and extreme weather events (SDGs, U. N., 2022). The main aim of this study is to assess the influence of different determining factors on companies' commitment towards climate change, focusing on those participating in the CDP questionnaire on climate program. The CDP scoring methodology evaluates the company's awareness of environmental issues, as well as the disclosure, the comprehensiveness of the content, management methods, and progress towards action taken on climate change (CDP, 2022b). Therefore, the CDP Integ Performance Score is employed to investigate the level of companies' commitment to climate change mitigation, adaptation, and transparency. A multiple linear regression analysis is performed on a sample of 3000 European companies collected from the Bloomberg Professional database for the financial year 2021. The results show that the CDP Integ Performance Score is positively related to the following determinants having, thus, a positive impact on companies' commitment to climate change: board size, emission disclosure, firm size, GRI compliance, CSR committee, women on board, and employees. By contrast, assurance and ROE are non-significant variables for our sample of companies. Furthermore, the performing of the multicollinearity test discards the existence of correlation problems between the independent variables of the model. This study contributes to the research available on this subject, and provides some suggestions for future research. Other drivers and determinants of climate change commitment can be identified and tested; the sample could be extended to non-European companies and a multiple-year period. Furthermore, qualitative research approaches, such as case studies, can be applied to integrate the results of the quantitative analysis. This paper is directly related to SDG 13 on Climate Action. The followings are the SDG targets and a brief indication of this study's contribution to the topic of the 29th ISDRS Conference.

a) SDG 13 + Target 13.2: this target can be applied to companies that are expected to protect the environment and mitigate climate change integrating those issues into their strategies and practices. SDG 13 + Target 13.3: Companies can implement actions to mitigate their environmental impacts and improve their mitigation and adaptation towards climate change.

b) Climate Action is a global environmental problem and challenges for businesses and society. The proposed paper contributes to the progress towards the achievement of SDG 13 as this study shows the main determinants affecting the commitment and transparency of companies towards climate change. Therefore, it is directly linked to the assessment of the planet as part of the 5Ps requiring the protection of the environment and taking action on climate change.

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DIRECT PARTICIPATION IN NON-STATE ACTORS WATER MANAGEMENT INSTITUTION TO FULFILL THE TARGET OF CLEAN WATER FOR ALL PEOPLE

Mr Daru Adianto, Mr Syahriza Alkohir Anggoro, Mr Dewa Krisna Prasada

Universitas Brawijaya, Malang, Indonesia

MR DARU ADIANTO

MR SYAHRIZA ALKOHIR ANGGORO

MR DEWA KRISNA PRASADA

Abstract

The water management institution as an entity that involves many parties in the process of making policies. This institution have authority but its authority is limited to recommendations. In addition, institutions such as the Forum DAS (watershed forum) in Indonesia place the institution as a channel for the aspirations of the parties, especially non-state actors. Existing regulations also provide space for the recognition of customary institutions to regulate themselves and the management of water resources in their territories as long as they do not conflict with national interests. This paper explores the organization of water resources management carried out by non-state actors in this case SUBAK and the potential for development in the management and management of water resources which guarantees the delivery of clean water for human life through multi-stakeholder partnerships. SUBAK as an irrigation management organization provides lessons learned on how water management is carried out with broader authority than other water resources management forums. In addition to its authority, SUBAK also consists of all parties directly affected by the management and utilization of water resources in its territory. Representative approach and the domination of experts and the government in making decisions on the management of water resources often eliminate the interests of those who need water resources. This considered by conditions where too many peoples must be involved in making decisions on the utilization of water resources, in addition to the inability of various parties to present their interests based on adequate scientific data. SUBAK has an organization in certain segments and has tiered procedures for resolving problems that occur between SUBAK institutions. Leveling is done to maintain genuine participation as a contrast to a representative approach. In addition, the SUBAK organization can develop a financing system within each organization with partnerships built by each organization. (SDGs 17.3) We believe that a direct participation approach such as that held in the SUBAK organization can open wider opportunities for the fulfillment of clean water as it becomes target universal and equitable access to safe and affordable drinking water for ALL (SDGS. 6.1).

Keyword: water management, participation, clean water, Indigeous people right

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Preliminary study-Conceptual framework of Green Premium for Green Certified Building in Malaysia.

Sr Zamharira Sulaiman, Sr Dr Elia Syarafina Abdul Shakur, Dr Lim Boon Keong, Sr Dr Chin Hon Choong, Ir Ts Dr Yap Boon Hui
Universiti Tunku Abdul Rahman, Kajang, Malaysia

Abstract

Green building receives increasing attention worldwide as a mitigation strategy to climate change. In Malaysia, green building index is the most popular green building certification system with other such as Green RE certification, MyCREST and MyGHI. Additional compliance premium/cost is expected for building owners and developers to opt for green building certification However, the development of green buildings in Malaysia is very slow because of the increment of compliance costs. Contrary, there are studies proven that the increment cost is insignificant especially, for those lower-grade of green building status and the cost is even lesser if compared to a conventional building. These contradict findings have invited doubts and confusion among building owners and developers. It may demotivate the interest of building owners and developers to opt for green certification if the costs remained uncertain and inaccurate. In this paper, we identify the elements of Green Cost Premium and cost components for Green Certified Building, and to develop the framework of Green Premium for Green Certified Building in Malaysia. Through the empirical analysis, the results prove that there are seven (7) elements of Green Cost Premium and eight (8) cost components of Life Cycle Cost. Therefore, this empirical study to discuss and meet the knowledge gap and focus on the building construction process. On this basic, we put forward relevant framework suggestions.

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Modeling CO2 cycle and evaluating the long-term effects of climate change in Lake

Dr. Eiji Komatsu
Meiji University, Tokyo, Japan. LERCS Inc., Yokohama, Japan

Abstract

Currently, many studies have understood that increasing CO2 concentrations significantly influence the carbon cycle and ecosystems of lakes. However, there are few research of quantitative evaluation for the effects of lakes' carbon cycle and ecosystems caused by increases in CO2 partial pressure (pCO2) in future climate scenarios using water quality model and the ecological model. In past studies the medium- and short-term change and transition and those mechanism of lake water quality and carbon cycle were analyzed using a lake ecological model combined with modeling of transport in watershed in representative lakes in lakes. In this study, a submodule of CO2 dynamics processes in a lake is developed, incorporating the numerical ecological model to evaluate the effect of long-term changes in atmospheric pCO2 on the carbon cycle and ecosystem in Lake in representative concentration pathway scenarios of IPCC high emission scenario; RCP6.0 and RCP 8.5. By combining the CO2 flux model between lake water and air, sediments modeled in the lake ecosystem, the transfer of inorganic carbon between lake water, the atmosphere, and sediments is possible. The CO2 flux between water and the atmosphere is estimated using difference between both partial pressures. The aqueous CO2 is estimated in consideration of inorganic equilibrium reactions (CO2/HCO3-/CO32-). pCO2 in water was estimated from the aqueous CO2 based on Henry's law. The CO2 flux between lake water and sediments is estimated by multiplying the CO2 concentration difference by the gas exchange coefficient. Thus, it is fund that this flux contributes to the carbon cycle in Lake. This study finally addresses the effects of long-term changes of atmospheric pCO2 on the carbon cycle, finally water quality, and ecosystem in Lake and watershed. This study finally addresses the effects of long-term changes of atmospheric pCO2 on the carbon cycle, water quality, and ecosystem in Lake, and propose the long-term sustainable management framework for Lake and watershed.

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Understanding the Dilemma and the Cross-Disciplinary Perspectives for University Energy Governance in Taiwan - A Case Study on National Taiwan University

PhD Student Dawei Wei-Jung HO[1], Professor Kuo-Tsang Huang[2]
[1]Department of Civil Engineering, National Taiwan University, Taipei, Taiwan. [2]Department of Bioenvironmental Systems Engineering, National Taiwan University, Taipei, Taiwan

PHD STUDENT DAWEI WEI-JUNG HO

PROFESSOR KUO-TSANG HUANG

Abstract

Campus energy saving is a crucial issue in Taiwan's energy transition under climate change. However, it is harder for universities to reduce energy consumption due to their complex building types, various user behaviors, and different electricity infrastructures. This study aims to disclose the dilemma of campus energy conservation and reflect on the embedded obstacles through a literature review and case study. This study uses perspectives from architecture, electricity engineering, and mechanical engineering to discuss how different specialties deal with energy-saving issues on campus, including their insights, limitation, blind spots, approaches, and derived problems. This study reviews the policies implemented by the government over the years, including the "Four-Saving Projects" and the "Sustainability Campus Plans," and synthesizes the measures taken to save energy and their limitations. Finally, this study proposes top-down and bottom-up strategies with the findings of two cases, the National Taiwan University General Library and the Department of Sociology and Social Work Building, discussing the aspects of institutional, technological, and stakeholder influence.

Keywords: Campus energy saving, Energy governance, Sustainable campus, Power demand control, Ice storage system, Citizen participation

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The Importance of the Water-Energy-Food Nexus in Energy and Sustainable Development

Ph.D. Gricelda Herrera-Franco[1], Ph.D. Harry Alberto Bollmann[2], Ph.D. Janaina Camile Pasqual Lofhagen[2], Ms. Lady Bravo-Montero[3], Mr. Jhon Caicedo-Potosí[3], Ph.D. Paúl Carrión-Mero[3,4]
[1]Santa Elena Peninsula State University, La Libertad, Ecuador. [2]Pontifícia Universidade Católica do Paraná, Curitiba, Brazil. [3]Centro de Investigación y Proyectos Aplicados a las Ciencias de la Tierra (CIPAT), ESPOL Polytechnic University, Guayaquil, Ecuador. [4]Facultad de Ingeniería en Ciencias de la Tierra, ESPOL Polytechnic University, Guayaquil, Ecuador

Abstract

The Water-Energy-Food (WEF) nexus is an integrative approach to analysis and management implemented over the last decades to strengthen the balance between socioeconomic growth and environmental concerns. Implementing the WEF nexus contributes to adapting to the effects of climate change by efficiently using resources that reduce greenhouse gases. The study aims to analyse the importance of the WEF nexus concerning energy developments through a literature review that includes bibliometric analysis to evaluate the nexus's evolution and establish strategies for sustainable development. The methodological framework comprises (i) the definition of the search and processing of information, (ii) an analysis of bibliometric results, and (iii) a literature review of scientific knowledge and its sustainable development strategies. The results verify that the WEF nexus appears in 100 scientific documents in Scopus and Web of Science publications, with applications for sustainable energy development analysis, and has a preponderance in the United States (22%), Germany (21%), China (20%), Malaysia (14%) and the United Kingdom (9%). The relationship of the WEF nexus with a focus on sustainable energy development was analysed between 2013 and 2022. In addition, this work enabled the establishment of strategies that balance economic growth, environmental protection, and a rationale for decision-makers in sustainable energy project proposals. The WEF nexus focusing on sustainable energy development enabled the establishment of strategies that balance economic growth, environmental impact, and a rationale for decision-makers in sustainable energy project proposals. This study links the following sustainable development goals (SDG): SDG #7 - affordable and clean energy, SDG #11 - sustainable cities and communities and SDG #13 - climate action, promoting energy sustainability by harnessing and developing renewable energy technologies such as solar, wind and hydro. Finally, this approach contributes to adaptability and resilience to climate change in different communities worldwide, evidencing research trends in research topics related to a circular economy, carbon footprint, green buildings, and urban sustainability.

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Legal Protection for Children Against Climate Change in the Asia-Pacific Region Apropos of Target 13.3 of the Sustainable Development Goals 2030 (SDG 2030)

DR NURUL HIDAYAT AB RAHMAN[1], ASSOCIATE PROFESSOR YANTI ROSLI[2]
[1]UKM, BANGI, Malaysia. [2]UKM, KUALA LUMPUR, Malaysia

Abstract

The impact of climate change on the environment can threaten children's right to safe and healthy development. Approximately one (1) billion children worldwide are exposed to significant environmental hazards, prompting the global community to work assiduously to protect the world from its consequences and prepare the next generation for them. This article seeks to elucidate children's rights to protection from climate-related hazards in the Asia-Pacific region and to highlight the effects of climate change on children's development rights. Further reference is made to Target 13.3 of SDG 2030, which aims to improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning as methods to combat climate change and its impacts. The article finds that climate change can affect children's social status, safety, and health conditions, stunting their life potential and violating their development rights. In conclusion, legal measures in the Asia-Pacific region protect children's rights to a safe, clean, healthy, and sustainable environment by promoting climate change education. The research concludes that these legal protections align with Target 13.3 but must be effectively implemented internationally and nationally. The work is founded on doctrinal legal research because it employs logic to evaluate specific statutory provisions and legal precedents. The data were obtained through library research and analyzed using the content analysis technique. The primary focus is to review related legal concepts, principles, and selected statutory materials. The paramount considerations are the child's best interests and the equality principle. The article concludes by proposing that the global community must continue safeguarding and preparing children for the climate change crisis, as enumerated in the 2030 Sustainable Development Goals, by increasing awareness, securing options, and encouraging participation, mainly through children's education.

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Affordable housing supported by the public funds — Lisbon case study

Filipa Pacheco[1], Dr João Joanaz de Melo[2]
[1]NOVA University Lisbon, Caparica, Portugal. [2]CENSE, NOVA University Lisbon, Caparica, Portugal

FILIPA PACHECO

DR JOÃO JOANAZ DE MELO

Abstract

The growth of the population and impacts from the expansion of urban areas affect the climate and essential ecosystems. This jeopardizes social cohesion.

Housing plays a crucial role in the quality of life for families. Adequate housing is essential for public health, comfort, and energy efficiency, besides a constitutional right. In Portugal more than 70% of families live in houses not complying with modern energy efficiency standards. Housing costs have been steadily rising in the country. For this combination of factors, housing requalification and affordable rents are in urgent demand in Portugal, especially in the fashionable city centres in cities like Lisbon and Oporto. The impact of urban areas on the environment depends both on the available infrastructure and on how we use it.

The current work aims to understand how the funds from the Recovery and Resilience Plan may contribute to develop affordable housing in Lisbon. The methodology comprehends an analysis of current regulations and practice, and the observation of a newly constructed municipal housing project with 128 apartments in Lisbon. Specific goals are (i) to understand how the residents' comfort is affected by the new infrastructure and residents' practice, and (ii) to identify strengths, shortcomings, and best solutions for future projects. Visits were made to vacant apartments and technical areas of the case-study building, and a survey to the residents was conducted. Key findings and recommendations are the following:

- Regarding the infrastructure: (i) the aim should be to support the highest number of families with cost-effective good quality construction (not the best technology at much higher cost); (ii) cost-benefit and life cycle assessment analysis should be performed at the design stage, comparing investment and operating costs for project alternatives; (iii) the use of thermal solar panels should be standard in new or major refitting of housing projects; (iv) a protected open-air clothe-drying space should be mandatory in housing projects, municipal and private; (v) integrated central heating is a good option and should be used when practical; (vi) the building energy certificates should distinguish clearly between energy efficiency and energy generation;

- Regarding the tenants in municipal housing: (i) energy literacy should be actively promoted, starting with guidance on how best to use household equipment; (ii) tenant relations must be close and transparent, with wide dissemination of affordable housing programs, careful review of applications and rents adapted to financial capacity of tenants; (iii) communication and satisfaction questionnaires should be routine.

Municipal affordable housing projects are important for the balance of the urban social environment and should also be used as pilots to improve housing in the city.

Keywords: urban areas, sustainable development, energy efficiency, affordable housing, Lisbon, Recovery and Resilience Plan, rehabilitation.

Poster

THE 29TH INTERNATIONAL SUSTAINABLE DEVELOPMENT RESEARCH SOCIETY Conference ISDRS

Direct Participation in Non-State Actors Water Management Institution to Fulfill the Target of Clean Water for All People

introduction

As one of the logical consequences of the anthropocene crisis, water scarcity has threatened the survival of all Earth species and created an imbalance in the planetary system. The impacts of this crisis have particularly been felt in the global South, where limited water supply is further exacerbated by private monopolies, environmental pollution, climate instability, and including the global health crisis caused by the Covid-19 pandemic, which has left nearly one billion people on Earth without access to adequate water and sanitation (Clark, 2019). For example, in 2020, the United Nations World Water Development Report stated that almost 6 billion people would suffer from water scarcity by 2050 as a result of increased water demand, uncontrolled consumption, population growth, and global warming (UNESCO, 2020). Such problems are more challenging in Indonesia as water has been politicized by the state and corporations, making it the most contested resource (Koeswahyono et al., 2022). Like many Southern countries, water governance in Indonesia is characterized by **strong non-state institutions** where cultural landscapes, geographical uniqueness, local knowledge, and traditional agriculture shape the relationship between humans and nature, including water allocation for productive agriculture and communities.
This study examines how traditional water governance is practiced to fulfill the right to water for communities. For this purpose, we conducted field research in Bali, where water sources (***klebutan***) in the Subak irrigation system are allocated for agricultural land and community needs. Due to its cultural and geographical uniqueness, the Subak irrigation system in Bali has been recognized by UNESCO as a world cultural heritage. Based on the field study of the Subak irrigation system, we argue that the Subak institution can serve as an institutional alternative that can address the challenges of clean water scarcity in line with Sustainable Development Goal 6.

Method

This field study employs a socio-legal approach to examine how the competition for water resources influences the formal and informal governance arrangements of water management within the context of legal pluralism. The study combines literature review and interviews with a number of Subak institution leaders (*pekaseh*) and farmers in two Subak locations, namely Subak Jatiluwih in Tabanan Regency and Subak Abian in Bangli Regency.

Finding & Discussion

BHAGAVAD GITA CHAPTER III VERSE 10 AS REFERENCE FOR WATER MANAGEMENT

Subak, which means 'one water flow' (*Sa* and *Yeh*), is a traditional irrigation management institution that has existed since the 8th century AD and is used in land management by the Hindu community in Bali. This institution is derived from the philosophy of the *Tri Hita Karana* traditional village, which is defined as the harmonious relationship between humans and God (*parahyangan*), humans and nature (*palemahan*), and human social relationships (*pawongan*), involving the regulation of religious and customary laws in a communal social space. Each Subak has a *Pura* (temple) and *Parhyangan* (sacred place) that are sanctified by the local community, expressing the relationship between individuals and the universe.

The management of Subak is based on local customary rules (*awig-awig*) and the holy scripture *Bhagavad Gita* Chapter 3 *Sloka* 10 as a guideline for human behavior boundaries. For example, one of the principles in awig-awig is "*paras-paros Sarpanaya, segilik segulik selunglung sebayantaka,*" which means that in any condition, every individual must help one another. This principle emphasizes that Subak governance is based on a spirit of mutual assistance among Subak members (*krama subak*) in cultivation and including the equitable distribution of water. The Subak system allows members to manage water autonomously while simultaneously maintaining spiritual, social, and environmental balance.

Subak Jatiluwih

In Subak Jatiluwih, Tabanan Regency, the Subak institution is specifically used to supply water for productive agricultural land, particularly for wet crops such as red rice (*oryza nivara*). This is based on local customary rules that separate water sources for agricultural and non-agricultural activities. Due to its specific allocation, membership in the Jatiluwih Subak consists only of land-owning farmers.

Subak Abian

The organization of Subak Abian differs from the wet farming type found in Jatiluwih. In Subak Abian, Bangli Regency, membership in the Subak involves various elements such as farmers, village institutions, the general community, and religious leaders. The diversity of Subak Abian's membership has its advantages as the Subak institution can develop strategic alliances with government entities to advance their own interests. For example, the Subak institution can form alliances with state institutions to obtain financial assistance that can be used to build irrigation channels, pumps, tanker trucks, and even water pipelining for the community.

The main challenges faced by Subak Jatiluwih and Abian are ensuring water availability amidst the threats of tourism industry expansion and land conversion, which in turn narrows down the water catchment areas. To address the threat of land conversion, the Subak institution has developed written agreements in the form of *awig-awig* that bind their members. These agreements prohibit Subak members from selling productive agricultural land for non-agricultural purposes. These *awig-awig* serve as the basis for regulating hydro-spatial allocation, ensuring the sustainability of Subak's water sources in order to guarantee the fulfillment of the right to water.

CONCLUSION

The Subak institution in Bali and its accompanying cultural landscape provide a useful case study for understanding how alternative water institutions reproduce water governance centered around the relationship between humans and the spiritual, social, and natural dimensions. Although water allocation in Subak depends on its intended purpose, the system has proven effective in ensuring water resilience for agricultural and community needs. The Subak institutional form can be one of the alternative institutions that can address the challenges of clean water scarcity in line with Sustainable Development Goal 6.

Dewa Krisna Prasada, Daru Adianto, Syahriza A. Anggoro, University of Brawijaya, ISDRS2023-POSTER

TRACK 4
Climate change and energy

4b. Affordable and clean energy

Abstracts

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Controversial role of household solid fuels in sustainable energy transition: the case of Central and Eastern European countries

Éva Kármán-Tamus[1], Dr. Tamás Pálvölgyi[1], Dr. Tekla Szép[2]
[1]Budapest University of Technology and Economics, Budapest, Hungary. [2]University of Miskolc, Miskolc, Hungary

Abstract

While sustainable energy transition and the decoupling of economic growth and energy use are both desirable objectives in the European Union, there are several barriers that slow down their course. Some of these barriers are contradictions and conflicts in energy and climate policy, others are the economic implications of the COVID-19 pandemic and the war in Ukraine. Affordable energy services are interlinked by sustainable and just energy transition, mainly by households' energy efficiency performance and dependence on heating fuels. Our main research objective is to measure the changes in the household energy mix (i.e. electricity, natural gas, solid fuels, district heating) with special regards to solid fuels and natural gas. The nexus of energy affordability and social security policies are significant in Central Easter Europe, therefore we selected six EU Member States in the area for further assessment, which have similar cultural backgrounds and socio-economic structures.

The use of conventional biomass is closely linked to energy poverty, which is no longer a problem only for the lowest income deciles but also for the middle class, as a result of the energy crisis of 2021-2022. To achieve sustainable energy transition, the use of modern renewables should be prioritized instead of traditional fuels to avoid the biomass trap. To quantify the energy affordability of the assessed CEE countries, we determine an indicator that characterizes households' expenditures in fuel-specific dimensions. The Share of Household Energy Expenditure (SHEE) is a households' energy-related welfare index, introduced as a ratio of household energy expenditures and their incomes.

Our results show that while there are no significant, long-lasting trends in the structure of household energy consumption, characteristic tendencies and spatial differences can be observed in the shares of household energy expenditure (SHEE index) for natural gas and solid fuels. The results confirm the dual trap of domestic heating as a significant barrier to a sustainable energy transition and social justice in the Central and Eastern European countries between 2006 and 2020. The priority of getting out of the dual fuel trap is to reduce household heating energy demands by prioritizing energy efficiency and deep renovations. National and municipal level policies supporting a sustainable energy transition should respond to this situation.

We attribute great importance to apply science-based results in policy making, therefore our research intends to assist policymakers in the sustainable development of national energy policies by presenting quantifiable results and policy recommendations. Our study especially relates to SDG7 and SDG13, which aims to ensure universal access to affordable, reliable and modern energy services and increase energy efficiency globally, while combating global climate change.

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The use of smart apps to promote energy saving: End-users' response and behavioural change in Hong Kong

Mr Hin Shun Thomas Lam
Hong Kong Baptist University, Hong Kong, China

Abstract

It is noticeable that existing government- and power company-led decarbonisation measures will not be enough to meet the 1.50C Paris Agreement target and avoid disastrous climate impacts. More and more cities are shifting their attention away from top-down approaches to engaging households and communities. The Department of Geography (GEOG) of Hong Kong Baptist University (HKBU) has started a large-scale four-year Research Impact Fund (RIF) project about smart low-carbon communities involving 600 households (2021-2024), which aims to motivate energy-saving awareness and behavioural change via bottom-up approaches. The smart apps can monitor real-time electricity consumption, provide energy-saving notifications and deliver incentive rewards for residential electricity end-users. It also acts as a communicative agent to generate, collect and interpret large-scale datasets. We aim to achieve an annual average of 10% electricity consumption reduction for households after the app-based behavioural change intervention (HKBU, 2021). This study is part of the RIF project, aiming to adopt an interdisciplinary multi-methods approach to examine the end-users' response and behavioural change under app-based intervention in Hong Kong. My MPhil research study is a case community of Sai Kung involving 100 households to participate. Meanwhile, Hong Kong is a significant case for studying the role of households in smart energy transitions because of its dense urban environment and smart city transformation (HKSAR, 2020). Sai Kung is a significant community due to its climate resilience capability, diverse housing types and strong community bonding. We propose to recruit 20 households and 100 households to join the Sai Kung pilot study and Smart Energy Envisioning (SEE) project respectively. Interdisciplinary multi-methods with 4 main sources of data, including (i) real-time electricity consumption data derived from smart sensors and smart apps, (ii) household electricity bills, (iii) households pre- and post-interviews and (iv) household sharing workshop would be collected to investigate the energy usage patterns and behavioural change. This study is novel in several aspects. Firstly, we will utilise big data analytics (BDA) and the rich, heterogeneous datasets of smart apps, electricity bills and household interviews to predict energy behavioural patterns. It thus empowers end users' to deliberate electricity consumption routines and energy-saving practices, ultimately demonstrating a community-based approach contributing towards the decarbonisation of Hong Kong. Secondly, we will test the app-based interventions in different housing types, which include village housing, private housing, and public housing in the Sai Kung Community. Our comparative perspective focus on different housing types will make a significant contribution, enabling us to map the variety of different forms of smart low-carbon households in our case community Sai Kung. Thirdly, we would test the end-users' progression in terms of the levels of engagement under app-based intervention in the Sai Kung Pilot Study and SEE Project and assess the smart human-technology interaction. The research outcomes would advance the research frontier of human-centred approaches to using BDA to promote urban low-carbon transitions through and with communities. It also provides useful implications for smart city transformation and decarbonisation measures.

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Energy harvesting technologies: a review of environmental assessment methods

Dr. Teresa Maria Gulotta, Prof. Roberta Salomone, Prof. Patrizia Primerano, Prof. Giuseppe Saija
University of Messina, Messina, Italy

Abstract

In 2019, the International Energy Agency forecasted that global energy consumption would increase by 53% in 2030. Electric energy has been recognised as one that could be affected by the highest growth because it is one of the main driving forces of global economic development. Therefore, the major challenge is finding a reliable and adequate power supply to meet these growing demands that could pressure the energy infrastructures tremendously in future. In this context, one of the aims of the MUR-PNRR project "Innovation Ecosystem - Sicilian MicronanoTech Research And Innovation Center - SAMOTHRACE" (ECS00000022), partially funded by the EU (NextGeneration EU), is to identify and develop innovative and sustainable technologies to harvest energy from the surrounding environment. In fact, these could be promising technologies that can convert the potential energy embodied in different sources into power. The harvesting sources could be classified into two main groups: i) natural and ii) artificial sources. The first refers to sources readily available from the environment (such as sunlight, wind, and geothermal heat), while the second includes the sources generated from human or system activities (such as radiofrequency, vibration, etc.). Although these technologies' theoretical principles have been widely studied, their effective environmental sustainability during their life cycle should still be investigated. Therefore, this paper aims to analyse and classify the existing technologies that are part of the macro group of energy harvesting systems through a systematic literature review, focusing on how their potential environmental impacts have been evaluated. The articles are selected using keywords such as 'energy harvesting' and 'environmental assessment methods'. Then, data on the type of technology investigated and source harvested, the type of study conducted, and the method applied for evaluating environmental sustainability are extracted from the full text. The preliminary results show that high interest exists in this research area. However, only 19 articles (that include both keywords in the title, abstract and keywords) applied environmental assessment methods to energy harvesting technologies, including methods such as life cycle assessment (LCA), footprint-based methods (carbon, water, material and ecological footprint), energy/exergy-based analysis, material/substance/chemical-based analysis and multi-criteria analysis. Regardless, it is worth noting that most of these studies are often focused on evaluating the environmental feasibility of these technologies only through the use of carbon and energy indicators during the use phase, ignoring the impacts linked to the manufacturing and end-of-life phases of these technologies as well as resources depletion indicators. Although this preliminary study sheds light on the methods used to evaluate the environmental sustainability of these emerging energy harvesting devices and their relative gaps, it also identifies additional technological and methodological features that should be investigated in future studies.

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Social Life Cycle Assessment of a Unitized Regenerative Fuel Cell stack: a preliminary analysis

Dr. Teresa Maria Gulotta[1], Prof. Roberta Salomone[1], Dr. Giovanni Mondello[1], Prof. Giuseppe Saija[1], Prof. Francesco Lanuzza[1], Dr. Nicola Briguglio[2]

[1]University of Messina, Messina, Italy. [2]Consiglio Nazionale delle Ricerche Istituto di Tecnologie Avanzate per l'Energia "Nicola Giordano", Messina, Italy

Abstract

To ensure the transition towards the secure and affordable production of energy and reach the Green Deal targets of decarbonised energy systems, developing innovative technologies to harvest, convert, and store energy is crucial. In this context, the European Commission planned several funds for the R&D of hydrogen technologies to improve energy security and sustainability. Among them, the Polymer Exchange Membrane Unitized Regenerative Fuel Cell (PEM-URFC) is an emerging technology that can convert the surplus of renewable electric energy into hydrogen and reconvert it when required, working in both fuel cell and electrolyser modes. This device could provide different benefits, such as reducing costs, resources and pollution of energy systems, but it could also generate several environmental and societal concerns generally associated with using Critical and Scarce Raw Materials. Therefore, their effective environmental, economic, and social impacts should be evaluated before commercialisation and installation. However, among them, the social impacts of these technologies are generally less evaluated, although they are essential to reaching sustainable development goals. Considering this gap, the aim of this study is to assess the social performance of manufacturing a 1/3 kW PEM-URFC stack (the core component of a PEM-URFC) with the scope of evaluating which processes could generate the most critical social concerns. This is reached by applying the Social Life Cycle Assessment (SLCA) method, which allows the estimation of potential negative and positive social impacts in a life-cycle perspective, thus avoiding the burden-shifting of impacts. A cradle-to-gate approach is applied, considering the manufacturing of the stack (Tier 1), the manufacturing of the stack components (Tier 2), and the raw materials extraction (Tier 3). The PEM-URFC stack is modelled using Simapro software, and the inventory is modelled using both primary and secondary data. The primary data refers to the quantification of materials included in the prototype PEM-URFC stack developed in the context of the "ELETTRORIGENERA" project (PO FESR SICILIA 2014-2020 AVVISO 1.1.5 - PROGETTO ELETTRORIGENERA N. 08ME2899200216). The secondary data refers to production processes selected from the Product Social Impact Life Cycle Assessment (PSILCA) database. For this preliminary analysis, Italy is set as the manufacturing country in Tier 1 and Tier 2, while the countries that supply raw materials are assumed as the largest country provider for a specific material (Tier 3). For the latter case, an allocation per mass productivity is applied when multiple countries are involved in the extraction process. When using the PSILCA database, primary data are converted from mass and energy units into USD. This study assumes that the USD for a unit of materials and energy are the average global price (Tier 3) and the average national one (Tier 1 and 2). Finally, the social impacts are calculated using the PSILCA Hotspot Analysis method. The expected results will shed light on the social performance of the stack, identifying the components/processes responsible for the highest social impacts and the most relevant stakeholders and impact categories involved in the potential production of PEM-URFC stacks.

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INVESTIGATING RESOURCES ASSESSMENT METHODOLOGIES: A SYSTEMATIC REVIEW

Emal Ahmad Hussainzad[1], Nor Zalina Harun[2], Mohd Johari Mohd Yusof[3], Fraidoon Karimi[1]
[1]Al-Beroni University, Kapisa, Afghanistan. [2]University Kebangsaan Malaysia, Selangor, Malaysia. [3]Universiti Putra Malaysia, Selangor, Malaysia

Abstract

The term "renewable energy resources" refers to natural resources that renew at a rate faster than they are used up. Examples of such resources include sunlight and wind, which are continuously replenished. Various methods have been explored to investigate these renewable energy sources, but there has not been a comprehensive list of these methods available for easy reference. Therefore, this study aims to provide a list of assessment methods for solar, wind, geothermal, bioenergy, hydropower, marine, and hydrokinetic renewable energy sources. A systematic literature review method was used to investigate the objectives. We searched ScienceDirect for keywords like: "solar resource assessment methodologies" OR "solar energy resource assessment", "wind resource assessment methodologies" OR "wind energy resource assessment", "geothermal resource assessment methodologies" OR "geothermal energy resource assessment", "bioenergy resource assessment methodologies" OR "bioenergy resource assessment", "hydropower resource assessment methodologies" OR "hydropower assessment", and "marine and hydrokinetic resource assessment methodologies" OR "marine and hydrokinetic". After screening, 85 of 366 renewable energy papers were deemed eligible. The results suggest that solar, wind and geothermal energy resources could be studied using both GIS and non-GIS methods. Bioenergy and hydropower could usually be studied with GIS and remote sensing. While marine and hydrokinetic energy resources could be assessed using non-GIS methods. The methodologies listed in the current study could save time and resources for those investigating renewable energy resources. The paper's theme relates to SDGs 7, 12, and 15, which pertain to the sustainable use of resources, renewable energy, and land resources. By focusing on renewable energy resources and their assessments, the paper can highlight specific SDG targets, namely 7.a, 12.1, 12.2, 12.a, and 15.a. The paper's contribution aligns with the Conference theme of assessing the 5Ps of SDGs, particularly the "planet" and "prosperity" dimensions, by providing insights into sustainable energy use and land resources. Additionally, the assessment methodologies presented in the paper can be useful for stakeholders implementing Agenda 2030 in ensuring that renewable energy resources are used and managed sustainably.

Keywords: Assessment, Geographic Information System, method, methodology, renewable energy resources

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Exploring energy poverty and thermal comfort in upper secondary students: a case study of Lisbon, Portugal

Ms. Inês Valente[1], Dr. João Pedro Gouveia[2]
[1]NOVA School of Science and Technology, NOVA University Lisbon, Caparica, Portugal. [2]CENSE - Center for Environmental and Sustainability Research & CHANGE - Global Change and Sustainability Institute, NOVA School of Science and Technology, NOVA University Lisbon, Caparica, Portugal

Abstract

Energy poverty is a growing multidimensional concern worldwide, with children and young people among the groups, particularly vulnerable. This vulnerability is often associated with negative impacts on their physical and mental health. Despite this population group spending a significant amount of time in both their houses and school buildings, there has been little research on the dual vulnerability to inadequate thermal comfort conditions in these two environments. In this work, the chosen case study is Portugal, top-ranked as one the EU countries with higher levels of energy poverty vulnerability and where the exposure to inadequate thermal comfort in school buildings varies due to disparities in renovation efforts: while some schools have undergone renovations to improve thermal comfort, others have not. This work aims to assess upper secondary school (ages 15-18) students´ perception of energy poverty at home and thermal comfort inside classrooms. The study employed two complementary components: 1) surveys of students regarding their dwellings´ conditions and thermal comfort at home, classroom thermal comfort, and their coping strategies to deal with thermal discomfort and 2) Interviews and surveys with other stakeholders, such as teachers and parents, to understand their perception of this issue. The results from renovated and non-renovated schools will be compared to determine the impact of renovation on students' thermal comfort. The data collected will be used to propose solutions to tackle energy poverty and mitigate any observed inequalities in non-renovated schools. These solutions will consider the specific characteristics of the study location and incorporate student perspectives in developing proposed improvements. This study provides valuable insights into the issue of energy poverty among young people and suggests the potential for expanding the definition of energy poverty beyond the residential sector. In other words, the factors contributing to energy poverty in the residential sector, such as low energy performance, high energy prices, and external pressure to limit spending on heating and cooling, may also be observed in other sectors, including education.

This study is directly aligned with several Sustainable Development Goals (SDGs), including SDG 3 (Good Health and Well-being), as the proposed measures promote the health and well-being of students by addressing energy poverty and lack of thermal comfort. It also supports SDG 4 (Quality Education), specifically target 4.1, by contributing to the eradication of inequalities in upper secondary education and ensuring access to quality education for all. Additionally, the study supports SDG 7 (Affordable and Clean Energy), targets 7.1 and 7.3, by identifying a vulnerable group to energy poverty and promoting access to modern energy services and improved energy efficiency in both the residential and education sectors. As such, this study represents a valuable contribution to the conference "*Half-way through Agenda 2030: Assessing the 5Ps of SDGs (people, planet, prosperity, peace and partnership)*" through its approach to addressing energy poverty and highlighting an underexplored area of inequality in education.

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The role of Renewable Energy Communities in achieving SDG7 targets: an experimental assessment methodology for the italian inner areas

Arch. Ph.D. Giuseppe Mangano, Professor Consuelo Nava
ABITAlab, Department of Architecture and Territory, Mediterranean University of Reggio Calabria, Reggio Calabria, Italy

Abstract

The transition towards renewable energy sources is crucial in achieving the UN Agenda2030 Sustainable Development Goals (SDGs) and the carbon neutrality of cities and territories. By pursuing this goal, the Renewable Energy Communities (RECs) have emerged as a promising model for sustainable energy production and consumption and they have the potential to contribute significantly in achieving SDG7, which aims to ensure access to “affordable, reliable, sustainable, and modern energy for all”. RECs are defined as locally-based organizations that enable citizens, small businesses and local authorities to participate actively in the development, production, and distribution of renewable energy. The goal of RECs is to increase the share of renewable energy in the overall energy mix, while promoting social and environmental sustainability and community empowerment, especially in territories that suffer phenomena of depopulation, distance from primary services and energy poverty, such as the inner areas. In this article, we propose an experimental methodology to assess the positive impact of RECs in the inner areas through the SDG7, focusing on the help of clean and emerging technologies to achieve that. Assessing the performance of RECs is important to ensure their effectiveness in reducing greenhouse gas emissions and contributing to carbon neutrality; it involves the evaluation of their impact on energy generation, distribution, consumption and storage, as well as their contribution to social and economic development, environmental protection and climate change mitigation; - the alignment with the targets of SDG7; it will be based on the implementation of relevant indicators such as the percentage of renewable energy production and consumption, the share of households with access to electricity from renewable sources, energy efficiency and affordability. The methodology consists of several steps. The first step is to identify the RECs being assessed with a case study approach. The second step is to define, collect and compare data with the baseline values for the SDG7 targets and indicators. The baseline values may be obtained from national or international databases, or from previous assessments. The third step should enlight the strengths and weaknesses of the investigated RECs in inner areas in achieving the SDG7 targets and provide recommendations for improvement, also from a technological point of view. In fact, the results at this step aim to discuss the role of the most widely used renewable technologies, but also the potential of the emerging technologies in monitoring, managing and regulating the energy fluxes and the capability to cover additional targets in the future. This paper is related to the SDG7, targets 7.1, 7.2, 7.3, 7.a and to the strategic "objective and choices" for the areas “Planet”, “People” and “Prosperity” in Agenda 2030 and in the italian National Sustainable Development Strategy. The contribute also highlight the linkages between the SDG7 and other SDGs, such as SDG13 on "climate action" and SDG11 on "sustainable cities and communities".

The authors partecipate in the Ministerial Table for Sustainable Development and G.Mangano is a Researcher at dArTe UniRC with a "Green-NOP" Research grant on the project of Renewable Energy Communities in the Inner Areas.

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Navigating the Dutch Energy Transition

Ivo Beenakker, Dr Linda Carton, Prof Hans Kranenburg, van, Dr Sietske Veenman
Radboud University, Nijmegen, Netherlands

Abstract

The phase out of fossil energy and the phase in of renewables are necessary to achieve the goal to become CO2neutral in 2050 in the Netherlands. Despite attempts to phase out fossil energy and to phase in renewables by developing and adopting policy instruments and creating events, they experience significant delays. The aim of this study is to gain a better understanding of the effectiveness of particular policy instruments and focusing events contributing to the energy transition. Using the Dutch energy transition as a case, this study provides a chronological overview on the development of the energy transition due to policy adoption and focusing events. The results show that the top-down phase out of fossil energy can cause significant delays, because actors lose information about the transition dynamics, experience unexpected opposition, or lack the legibility of social innovation. Simultaneously, the bottom-up adoption of policy instruments and shock events can accelerate transformative change because actors can mobilize and place renewable energy dominant on the political agenda. As top-down phase out policies can delay the energy transition (Hebinck et al., 2022), future research could explore how bottom-up policy instruments can phase out of fossil energy and phase in renewables.

Full Papers

Energy harvesting technologies: a review of environmental assessment methods

Teresa Maria Gulotta[1*], Roberta Salomone[2], Patrizia Primerano[1], Giuseppe Saija[2]

[1] University of Messina, Department of Engineering, Contrada di Dio, 98158, Messina, IT

[2] University of Messina, Department of Economics, Via dei Verdi, 98122, Messina, IT

[*] Corresponding author's e-mail address: teresamaria.gulotta@unime.it

Abstract. Energy harvesting technologies (EHTs) are gaining attention to meet the increasing demand for electric energy by harnessing alternative surrounding energy sources for powering small electric and electronic devices. This paper presents a systematic literature review to analyse and classify existing EHTs and the methods and metrics used for evaluating their potential environmental impacts. Two samples of articles were selected using keywords like 'energy harvesting' and 'environmental assessment methods' for conducting first an investigative analysis and then a systematic one. The findings reveal that, out of the selected articles, only 27 applied environmental assessment methods to EHTs, including life cycle assessment (LCA), footprint-based methods, energy/exergy-based analysis, and multi-criteria analysis. However, most studies focused on evaluating environmental feasibility during the use phase, neglecting manufacturing and end-of-life impacts. To ensure comprehensive evaluation, the assessment scope should include all life cycle phases. This would provide a holistic understanding of environmental impacts. By considering the complete life cycle, strategies and guidelines can be developed to mitigate the environmental footprint of EHTs. Further research and interdisciplinary collaboration are needed to address these gaps and maximize the environmental benefits of energy harvesting technologies.

1. Introduction

With the increasing demand for Internet of Things sensors and small electric and electronic equipment (EEE), the requirement for external power supply has also grown significantly. However, relying on batteries for power poses several challenges, such as the need for recharging and replacing, as well as concerns regarding size, weight, and the environmental impact of disposable batteries. Hence, finding an alternative solution to overcome these power limitations has become highly desirable (Pareja Aparicio et al., 2016). In this context, energy harvesters, also known as energy scavengers, have emerged as a promising technology that researchers have been exploring to enhance energy infrastructure's reliability, stability, and flexibility while reducing reliance on fossil fuels and greenhouse gas emissions. These technologies involve capturing and converting ambient or wasted energy from various sources (such as solar power, thermal energy, wind energy, salinity gradients, and kinetic energy) into electrical energy to power low-power systems (Hamilton, 2012). The harvesting sources could be classified into two main groups: i) natural and ii) artificial. The first refers to sources readily available from the environment (such as sunlight, wind, and geothermal heat), while the second includes the sources generated from human or system activities (such as radiofrequency, vibration, motion, etc.) (Mishu et al., 2020). Although energy harvesting technologies (EHTs) can function as large-scale renewable energy generators like wind turbines or photovoltaic panels, they typically generate much less energy, ranging from tens of microwatts to a few watts. Indeed, the purpose of EHTs is to offer an alternative to or supplement batteries by harnessing residual energy from natural, human, or object activities and converting it back into electrical energy (Beeby *et al*., 2013; Priya and Inman, 2009).

The academic literature extensively covers the technological and theoretical aspects of available energy harvesting devices, such as solar-powered devices, piezoelectric lighters, and self-powered wireless sensors (such as Priya and Inman, 2009; Hamilton, 2012; Kiziroglou and Yeatman, 2012a; Mishu *et al.*,

2020). However, it is crucial to thoroughly evaluate their potential environmental impacts to determine the sustainability of the proposed technology and its effects on ecosystems and human well-being throughout its life cycle.

In this context, this paper comprehensively explores, through a systematic literature review, the research trends in EHTs, including the classification of energy sources and conversion effects, as well as the main aspects evaluated. Additionally, it seeks to analyze the environmental assessment methods and metrics employed in the literature from a life cycle perspective, highlighting potential challenges and identifying research gaps.

The paper is structured in 5 sections. After the introduction, in which the context and aim of the research are reported, section 2 outlines the materials and methods used to develop a systematic protocol for investigating energy harvesting systems and environmental assessment methods. Section 3 presents the results and discussion, focusing on presenting the research trends, synthesizing bibliometric findings, and pointing out the main methodological features for evaluating the environmental impacts of EHTs, addressing major challenges, and providing recommendations. Furthermore, the last section remarks on the conclusion and future research perspectives.

2. Materials and methods

By employing a systematic literature review, this study aims to provide a robust and objective assessment to achieve the following goals:

1. investigate the research area of EHTs and provide a classification of these technologies;
2. identify the methods used to assess the environmental feasibility of EHTs.

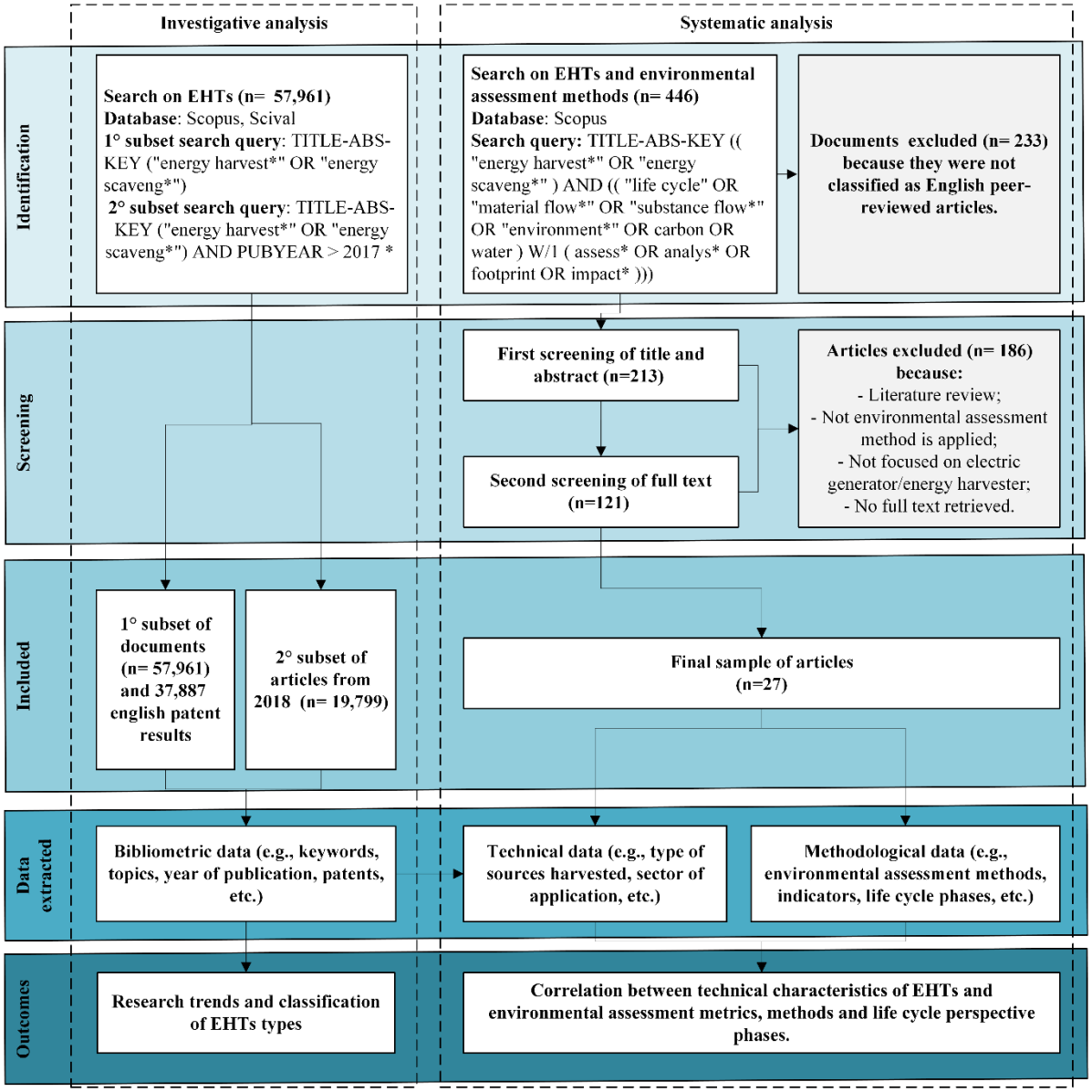
The systematic literature review is selected because this method can provide a rigorous and comprehensive analysis of the existing research on EHTs. A systematic approach ensures that all relevant studies are identified, selected, and critically evaluated based on predefined inclusion and exclusion criteria, minimizing bias and enhancing the findings' reliability and validity (Page et al., 2021). Moreover, it allows for the synthesis and comparison of multiple studies, enabling the identification of common research trends, knowledge gaps, and emerging themes. This section details the applied systematic review methodology, describing the developed search strategy and data extracted from the selected articles.

2.1. Search strategy

To identify relevant scientific literature, two search queries were carefully developed in line with the objectives of this study and executed in Scopus (consulted in June 2023).

The initial search query focused on terms related to 'energy harvest*' and 'energy scaveng*', searched within the titles, abstracts, and keywords fields of articles. As depicted in Figure 1, this initial search yielded over 50,000 documents and over 35,000 patents. To narrow down the sample to recent publications and to be used in SciVal, only articles published within the last 6 years (from 2018 to the present) were considered, resulting in a reduced sample size of approximately 20,000 articles. Both these subsets of articles are analysed to address the first objective of this systematic review, which involves evaluating research trends, identifying the main subject area, and classifying EHTs.

Figure 16. Schematic representation of scoping and systematic review protocol



*AND LIMIT-TO ((DOCTYPE , "ar") AND (LANGUAGE , "English"))

Subsequently, to address the study's second objective, the sample was refined to 446 documents by incorporating keywords related to environmental assessment methods (such as life cycle assessment, footprint-based methods, etc.) into the search query (no automation filter is applied). Considering the potential variations in the spelling of environmental assessment methods, a degree of flexibility was introduced in the search query using the Scopus Boolean operator "within" (W/n), which allows the identification of phrases in which the specified keywords are within a specified number of terms. Following this, a double screening process was conducted to include only English peer-reviewed articles that applied an environmental assessment method to analyse EHTs for power generation (eligibility criteria). Ultimately, 27 articles met the mentioned earlier criteria and were included in the review.

2.2. Data collection and analysis of outcomes

The two samples undergo different types of data collection and analysis. The first two subsets of the sample primarily focus on bibliometric data, including publication years, subject areas, keywords, and topics. The analysis of this data provides insights into researchers' interests in the field and the main technological aspects being evaluated (e.g., engineering, chemical reaction, materials science, etc.). The first subset of

articles is analysed using the Scopus platform, while the second subset is analysed through SciVal. Additionally, based on the keywords and topics of the studies, a classification of the main technological aspects is provided.

On the other hand, the second sample involves analysing the full texts of articles in addition to bibliometric data. This allows for extracting more information about the types of technologies studied, the environmental analysis conducted, and any potential gaps and concerns identified by the authors. These data are collected and managed using MS Excel software, enabling the identification of potential correlations between methods, metrics, life cycle phases, and technologies.

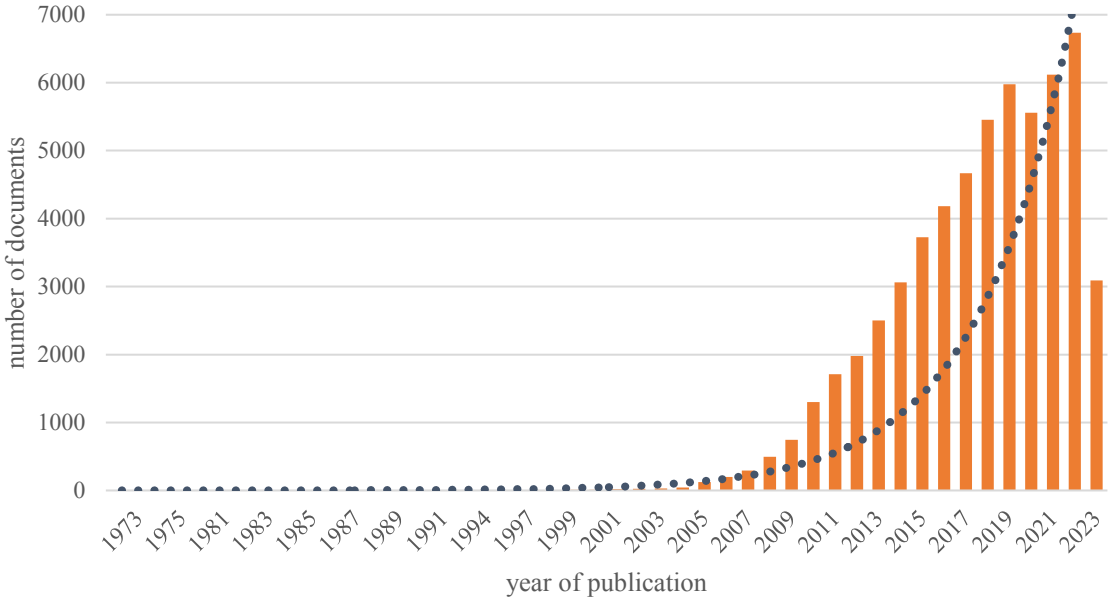
3. **Results and Discussion**

3.1. Research area trends

The analysis of the investigative sample, as depicted in Figure 2, reveals a significant interest in EHTs that can be traced back to 1966. This interest was initially sparked by the pioneering work of Philips, Baugh, and Young, as evidenced by their articles (Phillips and Baugh, 1966; Phillips and Young, 1966). These articles focused on evaluating the mechanism of intermolecular energy transfer within specific materials.

Subsequently, after 2005, there has been a remarkable surge in interest in this field, and approximately 57% of the analysed sample (32,935 documents) were published within the last six years, specifically from 2018 to the present. These findings align with the pressing global need to identify more stable energy technologies and reduce global reliance on fossil fuels, a need that gained prominence during the energy crisis of the early 1970s.

Figure 17. Histograms chart the distribution of published papers on EHTs for years



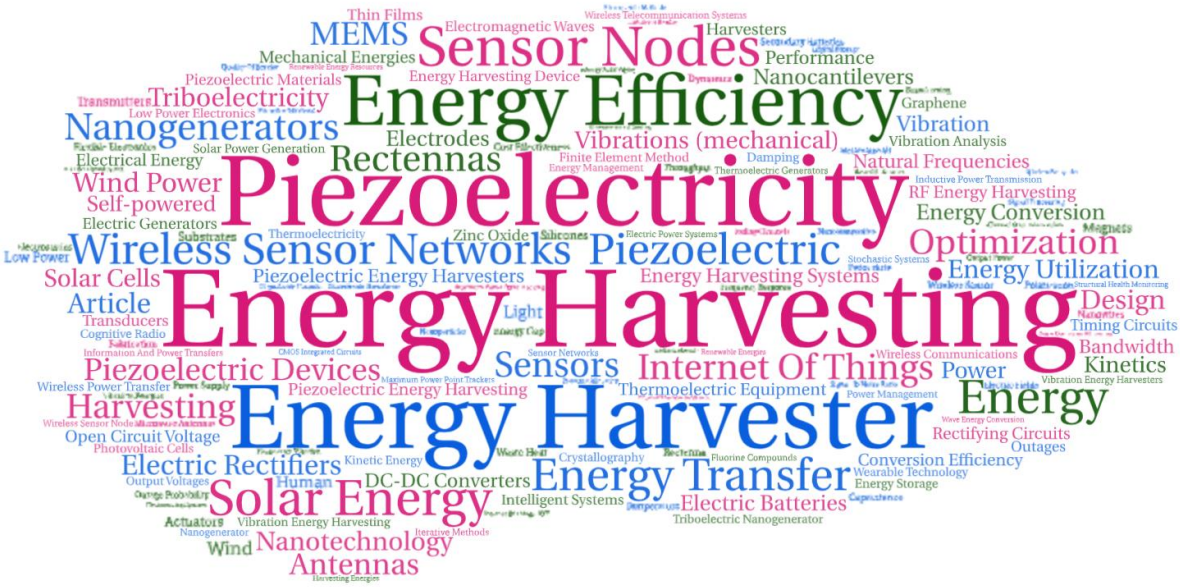
A keyword frequency analysis was conducted to gain insights into the extensively investigated EHTs. Keywords serve as indicators of the research focus in an article, and analysing their frequency helps identify changes in research hotspots throughout the development of a field (Li et al., 2020).

For this analysis, all keywords, as made for publication years, were extracted from the sample of 50,000 documents and obtained from the Scopus database using the "export filter count" function.

As depicted in Figure 3, the main keywords used in the sample are primarily associated with energy-harvesting generators and energy harvesters. The other keywords encompass various energy harvesting techniques (e.g., piezoelectricity, radio frequencies, triboelectricity, etc.) and related technological devices in which they are commonly employed (e.g., wireless devices, sensor nodes or networks, and more). The

keyword analysis further highlights the significant interest within the academic community in evaluating and optimizing energy conversion processes and efficiency, focusing on design and materials development.

Figure 18. Keyphrase frequency in the first subset of documents (source data from Scopus)



To gain insights into the predominant research aspects investigated in the field of EHTs and identify future trends, the SciVal platform was used. The second subset of the first sample of documents, comprising peer-reviewed articles published in English over the last six years (2018 to the present), was analysed. The results are presented in Figure 4, which includes the following graphs and table:

a) wheel graph: this graph illustrates the logical relationships between different subject areas and topics covered in the analysed documents. It provides a visual representation of the interconnections between various research areas within the field of EHTs, using the number of published documents as an indicator of magnitude;

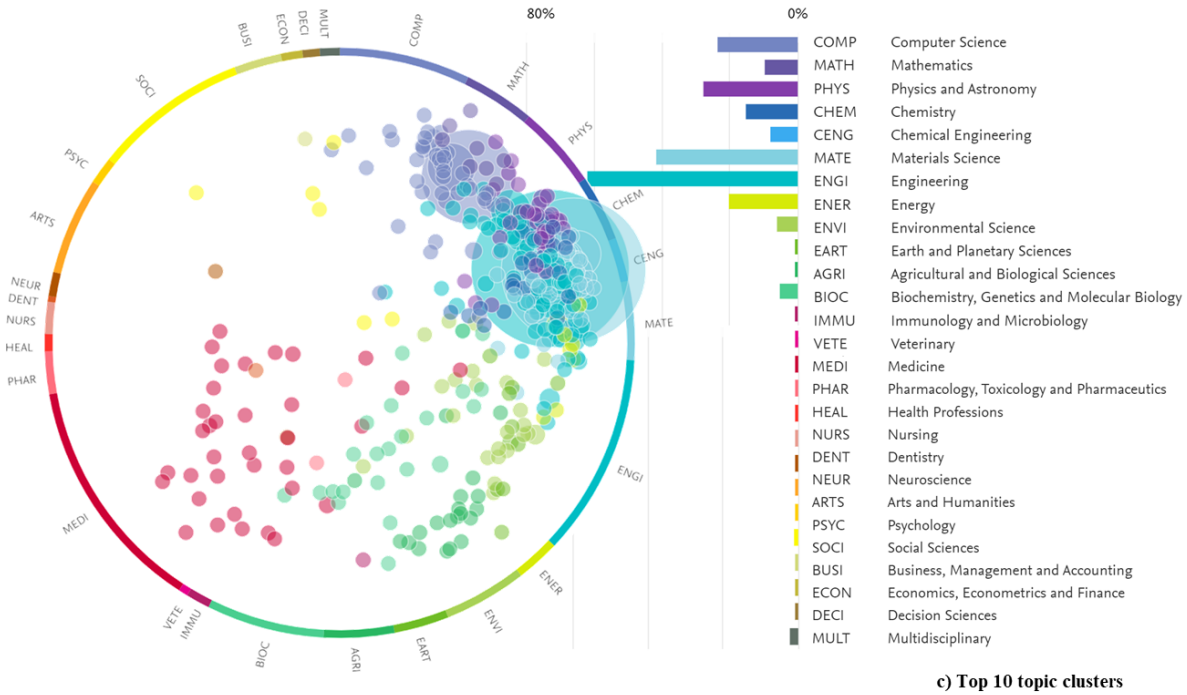
b) publication share by subject area: this graph highlights the distribution of publications across different subject areas. It is important to note that individual journals can often cover multiple subject areas, which may impact the percentage values assigned to each category accounting for more articles than the sample;

c) top ten topic clusters: this table presents the top ten topic clusters that emerged from the analysis of the sample. These clusters represent the most prevalent research themes and areas of focus within the field of EHTs.

Together, these visualizations provide a comprehensive overview of the subject areas, topic clusters, and publication distribution within the field. They offer valuable insights into the research landscape and shed light on the relative emphasis placed on different areas of study.

Figure 19. A comprehensive overview of the subject areas, topic clusters, and publication distribution within the field of energy harvesting technologies (sources: SciVal and Scopus platforms)

a) Wheel graph of topic cluster and subject area



b) Publication share by subject Area

c) Top 10 topic clusters

Topic Cluster	Scholarly Output	Pub. share	Pub. Share growth
Energy Harvesting; Harvesters; Piezoelectricity	3852	41%	32%
Photocatalysis; Photocatalysts; Solar Cells	3491	2%	72%
Cognitive Radio; MIMO Systems; Orthogonal Frequency Division Multiplexing	2126	2%	-14%
Wireless Sensor Networks; Sensor Nodes; Routing Protocols	872	1%	-12%
Ferroelectricity; Dielectric Properties; Ferroelectric Materials	845	3%	49%
Antennas; Slot Antennas; Microwave Antennas	662	1%	39%
Plasmons; Metamaterials; Surface Plasmon Resonance	619	1%	30%
Thermoelectricity; Thermoelectric Equipment; Thermal Conductivity	598	4%	27%
Graphene; Carbon Nanotubes; Nanotubes	567	0%	53%

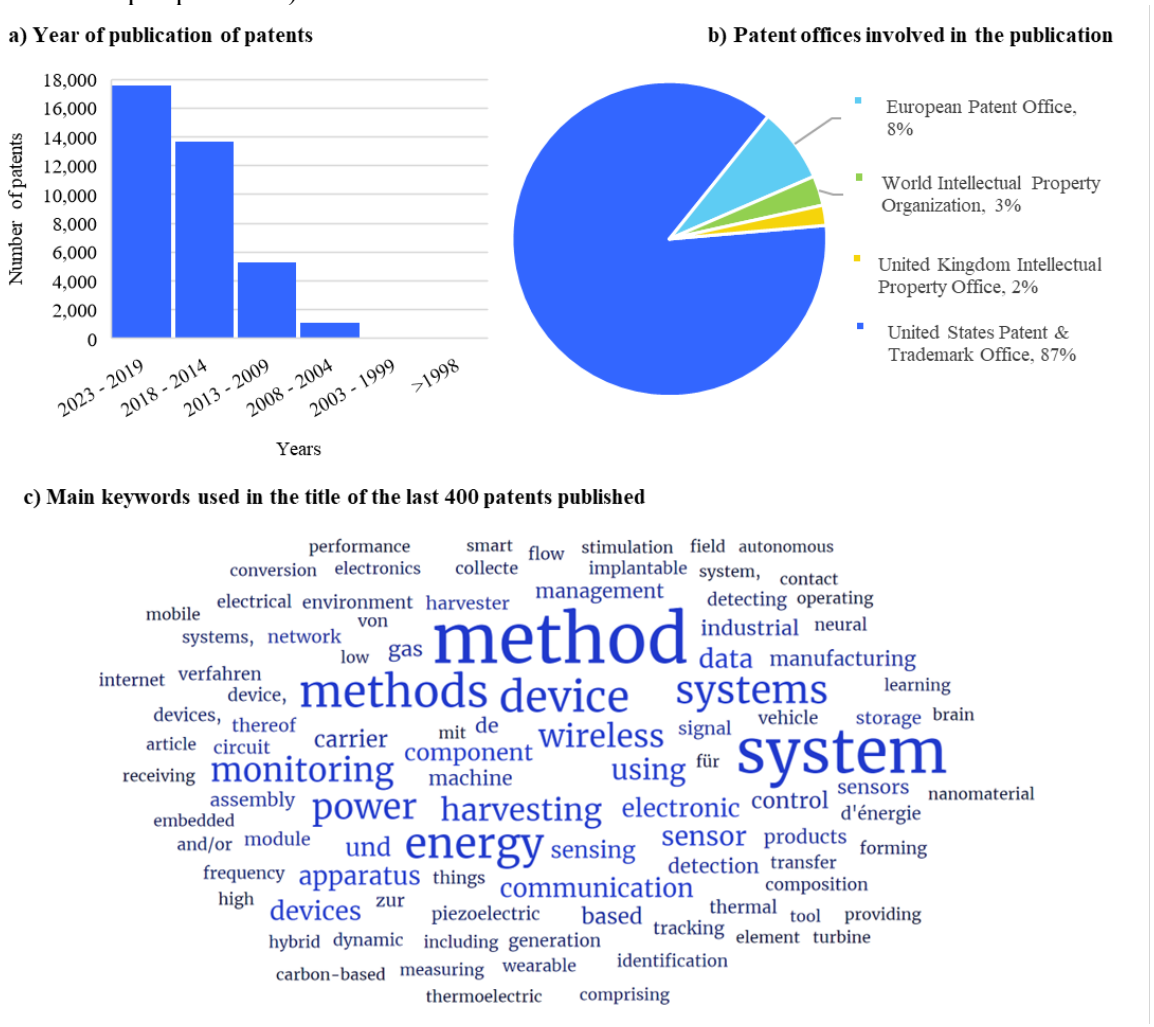
The analysis shows that the initial focus of EHTs research area is primarily on developing new and innovative materials for these technologies. Additionally, there is a significant emphasis on controlling and monitoring these materials to maximize energy performance. This trend indicates a strong interest in searching for chemical and engineering processes/products with specific electrical properties to enhance energy harvesting capabilities, as also highlighted by keywords frequency in Figure 3.

Engineering-related categories emerge as the most prominent in EHTs research, demonstrating the central role of engineering principles and techniques in advancing these technologies.

Furthermore, subject areas such as chemistry, materials science, and computer science rank as the second most relevant areas, underscoring their importance in supporting the development and optimization of these systems. On the other hand, categories such as social sciences, medicine, and environmental sciences currently appear less popular in EHTs research. This is likely due to the experimental nature of many EHTs, which currently limits the exploration of potential socio-economic and environmental consequences. However, as EHTs mature and move towards practical implementation, more attention is expected to be paid to studying the broader impacts of these technologies on all pillars of sustainability similar to what has already happened with energy technologies globally (Owusu and Asumadu-Sarkodie, 2016).

Figure 5.a data unquestionably supports the findings, as evidenced by the patents submitted during the specified years. Most of them have been published in the last five years (about 87%). Intriguingly, the United States Patents and Trademark Office has published most of these patents, accounting for approximately 87% of the total patents shown in Figure 5.b. It is significant to mention that the European Patent Office also holds a share of at least 8% of the patents.

Figure 20. A comprehensive overview of a) the patents publication distribution within the field of energy harvesting technologies, b) patents offices involved, and c) main keywords used in titles of main 400 (sources: Scopus platforms)



Upon analysing the frequencies of keywords used in the titles of the last 400 patents (Figure 5.c), it becomes evident that most of them are related to the advancements in techniques and methods for harvesting energy for electronic devices. The primary focus lies on wireless sensors, thermal storage, and piezoelectric materials. These developments possess immense potential to revolutionize the field of energy harvesting and drastically enhance the efficiency of electronic devices.

3.2. EHTs technology classification

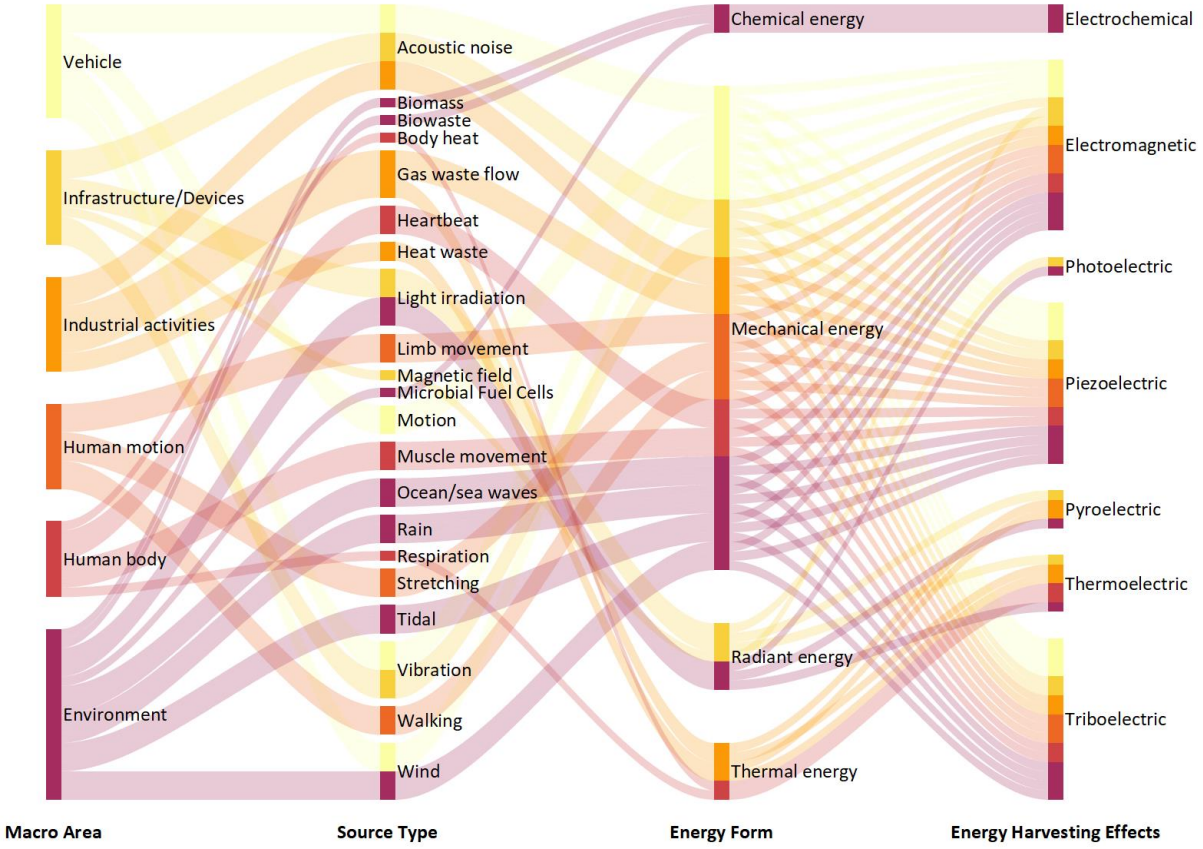
Over the years, the concepts and technical aspects related to energy harvesting (EH) have been extensively investigated. As highlighted in the previous section, the EHTs encompass various advancements, techniques, and sources with the potential for further application in various areas, from self-powered implantable medical electronics (Jiang et al., 2020) to sensors or small electronic devices (Mishu et al., 2020). Indeed, the wide range of technological advancements in EHTs opens opportunities for harnessing different energy sources and combining them innately to meet specific application requirements.

To facilitate a better understanding of the key technological aspects of EH, a proposed classification is presented in Figure 6, highlighting the potential logical connections among techniques and sources. This classification framework consists of four main categories: macro area of harvested sources, types of energy sources, forms of harvested energy, types of energy harvesting effects for energy conversion.

The terms used in each category are derived from literature studies and supplemented with information obtained from sources such as Priya and Inman (2009); Hamilton (2012); Kiziroglou and Yeatman (2012); Ryu, Yoon and Kim (2019); Jiang *et al.*, (2020); Mishu *et al.*(2020) as well as the information extracted from SciVal and Scopus databases (e.g., keywords, topics, etc.).

This classification framework serves as a valuable tool for organizing and categorizing the diverse aspects of EH, allowing researchers to better identify and explore the main technological dimensions within the field.

Figure 6. Potential classification of energy harvesting technologies and potential logical connections among categories



By examining Figure 6, it can be observed the wide variety of sources that can be harvested from the surrounding environment, including light, radiofrequency, and motion. These sources can originate from different macro areas such as the natural environment (e.g., wind, solar irradiation), the human body (e.g., blood pressure, enzymatic reaction, movement), or industrial processes (e.g., waste heat from machines).

Furthermore, it is worth noting that the same type of energy can be provided by different macro areas. For instance, wind flow or light irradiation can occur naturally or artificially, such as through climatic effects and train motion or the emission of photons by the sun and lamps. Additionally, different electric properties of materials and technologies can be exploited (referred to as methods) to harvest the same types of energy forms. For example, thermal energy can be converted into electric energy using thermo- or pyro-electric effects, while mechanical energy can be harnessed through tribo- or piezoelectric or electromagnetic effects, and so on. In addition, the conversion principles can be applied to various types of harvested energy and, in some cases, EHTs could be developed merging more than one conversion principle. The latter systems are called hybrid energy harvesting devices (Mishu et al., 2020).

However, the applications and usage conditions of different technologies may vary based on the characteristics of the materials and specific application requirements. Indeed, based on their main scope of application, Prauzek *et al.* (2018) identified three main categories of energy harvesting systems: 1)

autonomous harvesting systems, 2) autonomous hybrid harvesting systems, and 3) battery-supplemented harvesting systems.

The first category refers to systems that can operate solely on energy obtained from ambient sources, eliminating the need for batteries. These systems depend on the availability of the energy source and are not affected by storage inefficiencies. In contrast, the second category involves systems that incorporate a secondary battery or ultracapacitor as an energy reservoir. These systems can harvest energy to power both the devices and energy storage, offering the potential for extended operational lifetime. On the other hand, the last category involves batteries serving as the primary energy source, with the harvesting device playing a secondary role. The primary objective of these systems is to minimize battery energy usage and increase the system's lifespan by reducing the frequency of external recharging or battery replacement.

These classifications provide valuable insights into different approaches and considerations for designing energy harvesting systems based on their operational characteristics and energy management strategies. Additionally, they help identify differences in modelling environmental assessment approaches, further enhancing the understanding of the broader implications and sustainability aspects of energy harvesting technologies.

3.3. Environmental assessment methods in EHTs

The utilization of "environmental assessment" keywords in search queries led to a significant reduction in academic research outcomes, decreasing to 400 documents initially and further down to 213 peer-reviewed articles. However, many of these articles merely defined the evaluated technology as environmentally friendly devices or refer to the reduction of environmental impacts, without employing any environmental assessment metrics to evaluate their potential sustainability.

In contrast, the final sample, comprising 27 articles, clearly describes the use of a specific environmental assessment method. These articles were all published after 2016, possibly due to the European Commission's release of the "Clean Energy for Europeans packages" proposal in that year. This proposal encouraged member states and researchers to identify energy technologies capable of reducing greenhouse gas emissions (European Commission, 2016), thereby amplifying the focus on environmental aspects and decarbonization of energy sector.

Table 1 presents a synthesis of the assessed EHTs in the sample, categorized according to the previously mentioned classification. The predominant focus of the reviewed papers lies on technologies capable of harnessing energy derived from natural phenomena such as solar radiation, wind flow, and the salinity gradient of the ocean. In particular, within the realm of energy harvesting methods, 55% of the sample examined solar cell devices (photoelectric) for capturing both indoor and outdoor light radiation. Additionally, some of these studies explored the potential of hybrid technologies that incorporate multiple energy sources (e.g., solar photovoltaic panels integrated with vertical axis wind turbine (Valencia et al., 2022b)).This emphasis on solar cell devices can be attributed to their advanced level of maturity, as they have been extensively used for generating electricity from renewable sources in recent years. Moreover, their scalability makes them suitable for various applications. Conversely, technologies capable of harvesting waste energy flow (e.g., heat wasted by industrial activities) receive comparatively less attention from an environmental perspective.

Table 13. Types of energy harvesting technologies evaluated into the final sample

Macro area	Energy sources	Types	Energy-Harvesting effects	n.	References
Environment	Chemical	Salinity gradient	Electrochemical	1	(Wojtarowski et al., 2021)

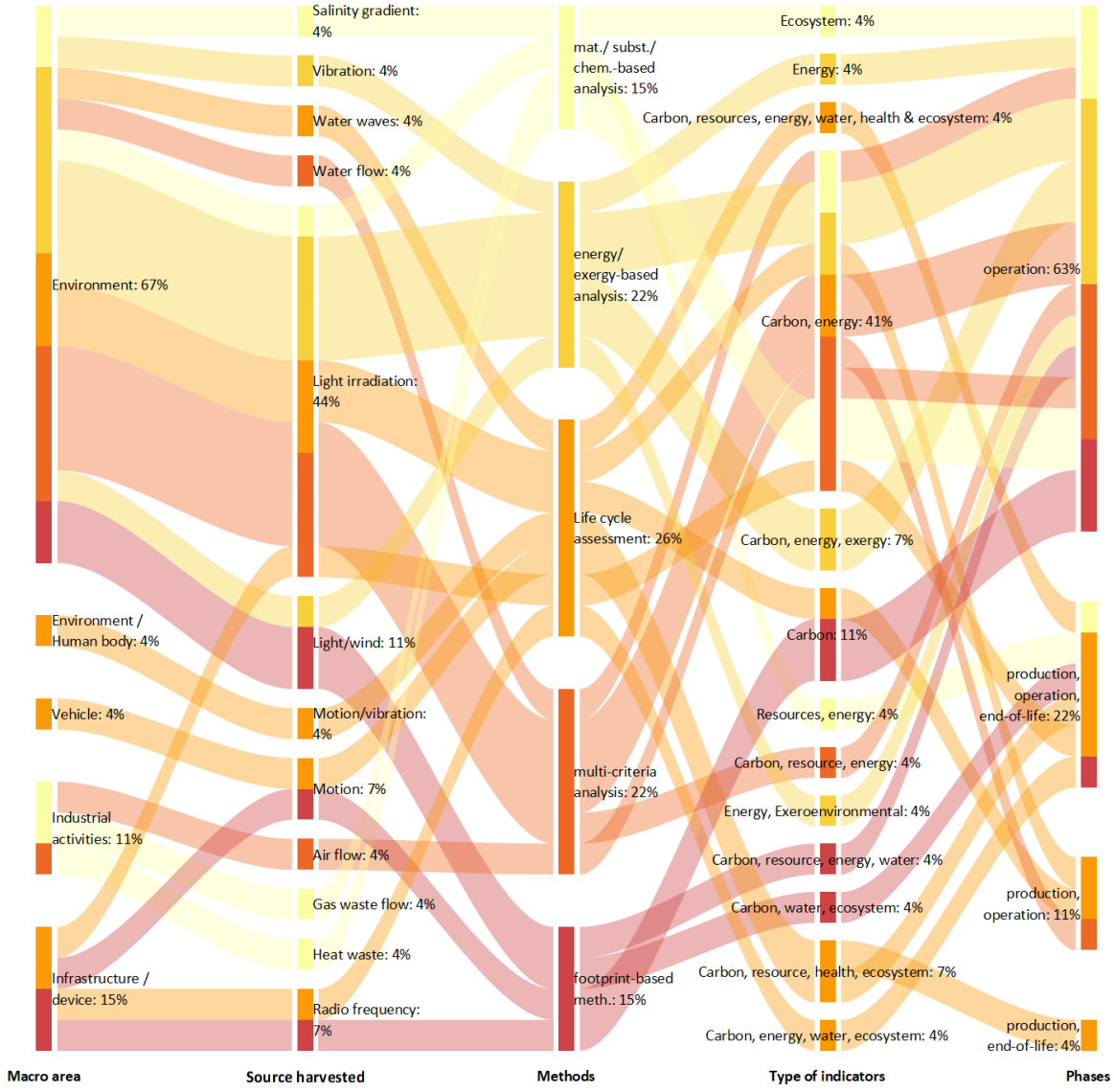
	Mechanical	Vibration	Piezoelectric	1	(Rejdali et al., 2022)
		Water waves	Triboelectric	1	(Xu et al., 2023)
		Water flow	Electromechanical	1	(Stefanizzi et al., 2023)
	Radiant	Light irradiation	Photoelectric	10	(Baldini et al., 2023; Farangi et al., 2020; Gholami et al., 2019; Hamed Banirazi Motlagh et al., 2023; Hossain et al., 2020; Huang et al., 2017; Jahid et al., 2020; Nikzad and Mehregan, 2022; Soares and Wang, 2023; Zheng and Zhou, 2023)
			Photoelectric/ thermoelectric	1	(Bany Mousa et al., 2019)
	Radiant/ mechanical	Light/wind	Photoelectric/ electromechanical	3	(Esfandi et al., 2020; Valencia et al., 2022a, 2022b)
Environment / Human body	Mechanical	Motion/ vibration	Triboelectric	1	(Ahmed et al., 2017)
Vehicle	Mechanical	Motion	Piezoelectric	1	(Hazeri and Mulligan, 2022)
Industrial activities	Thermal	Airflow	Thermoelectric	1	(Oh et al., 2021)
		Gas waste flow	Thermoelectric	1	(Leszczynski and Grybos, 2020)
		Heat waste	Thermoelectric	1	(Kumar et al., 2019)
Infrastructure / device	Mechanical	Motion	Electromechanical	1	(Hassouna et al., 2021)
	Radiant	Radiofrequency	Electromagnetic	2	(Gonzalez et al., 2023; Mahapatra et al., 2017)
		Light irradiation	Photoelectric	1	(Välimäki et al., 2020)
Total				**27**	

Furthermore, it is important to note that the evaluation of energy technologies employs various environmental assessment methods. These methods include life cycle assessment (LCA) (26%), multi-criteria analysis (22%), energy/exergy-based analysis (22%), material/substance/chemical-based analysis (15%), and footprint-based methods (carbon, water, material, and ecological footprint) (15%) (Figure 7).

However, it is noteworthy that most studies primarily focus on assessing the environmental feasibility of these technologies based on carbon and energy metrics (41%) during the operational phase. Only a small number of papers (5) consider the complete life cycle of the technology, including aspects such as end-of-life considerations and recyclability.

Impact categories linked to toxicity, acidification, and resource depletion still appear neglected, even if these impacts could be crucial to be assessed when evaluating technologies and processes involving some specific material or chemical reaction generally included in EHTs. Indeed, these impacts were calculated only in two articles of the reviewed sample, in which LCA was applied to electromechanical energy harvesters accounting for production and end-of-life phases (Ahmed et al., 2017; Hazeri and Mulligan, 2022). Additionally, when resources and energy indicators are proposed, the amount of waste generated throughout the technology's life cycle is used as a performance indicator (Baldini et al., 2023).

Figure 7. Relations among macro area and source harvested by EHTs, environmental metrics (types of indicators) and life cycle phases (Phases) with the environmental assessment methods (methods)



4. **Conclusion**

This paper proposes a systematic literature review to investigate the research interest in energy harvesting technologies and identify the methods generally used to evaluate their environmental sustainability. Energy harvesting technologies offer a viable alternative to traditional power sources, enabling electrical energy generation from ambient or wasted energy sources. However, it is crucial to assess their environmental implications to ensure long-term sustainability.

The paper highlights the exponential growth of literature on energy harvesting within the last decade, particularly focusing on energy harvesting concepts and technical aspects. However, there is a lack of studies evaluating these technologies' environmental sustainability methods. Existing research primarily analyses energy performance, neglecting the importance of materials used in energy harvesting devices and their impact on environmental sustainability.

While this preliminary systematic review identifies literature gaps and establishes a technological classification, it also points out certain methodological limitations that need further investigation in future studies. For instance, using only the keywords "energy harvester" and “energy scavenger” may exclude articles that did not explicitly identify their technology as energy harvesting or scavenging devices. To

address this, additional terms related to different energy harvesting methods or sources should be introduced, maybe referring to materials specifically used to harvest and convert energy.

Furthermore, future studies should analyse the inventory data and methodological choices employed in environmental assessment models. This would help evaluate the general academic consensus and criticisms in specific fields. These findings could then be utilized to develop guidelines for applying life cycle thinking approaches and other environmental assessment methods for energy harvesting technologies. The collected information on patents submitted in the recent years could be also used to developed more reliable inventory data for future environmental studies, extracting details on production processes and materials on different devices.

To maximize the potential benefits of energy harvesting technologies and address the identified challenges, interdisciplinary collaboration is essential. This paper calls for researchers from various disciplines to collaborate and work together to overcome the barriers and promote the sustainable development of energy harvesting technologies. Doing so can ensure a better understanding of their environmental implications and unlock their full potential in wide variety of fields of application.

Acknowledgement

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Investigating resources assessment methodologies: A systematic review

Emal Ahmad Hussainzad[1], Nor Zalina Harun[2], Mohd Johari Mohd Yusof[3] and Fraidoon Karimi[4]

[1] Department of Horticulture, Faculty of Agriculture, Al-Beroni University, Kapisa, Afghanistan
[2] Institute of The Malay World and Civilisation, University Kebangsaan Malaysia, 43600 UKM Bangi
[3] Department of Landscape Architecture, Faculty of Design and Architecture, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia
[4] Department of Horticulture, Faculty of Agriculture, Al-Beroni University, Kapisa, Afghanistan

[1] Corresponding author's e-mail address (emal_ahmad2011@yahoo.com)

Abstract. This study delivers a scrupulous inventory of methodologies for the evaluation of renewable energy resources, a domain that spans solar, wind, geothermal, bioenergy, hydropower, and marine and hydrokinetic energy. Informed by a systematic review, we dissected 366 papers from ScienceDirect, selecting 85 for comprehensive analysis. We uncovered that studies of solar, wind, and geothermal resources are typically investigated by both Geographic Information System (GIS) and non-GIS techniques. Alternatively, methodologies used for bioenergy and hydropower predominantly utilise GIS coupled with remote sensing. Interestingly, the exploration of marine and hydrokinetic energy resources seems to lean towards non-GIS methodologies such as analytical and numerical models, and mathematical large-eddy simulation (LES). This scholarly compilation creates an efficient compass for researchers in renewable energy and fosters a renewed commitment to sustainable energy utilisation, aligning seamlessly with the Sustainable Development Goals 7, 12, and 15. Beyond the confines of academia, this study underscores the real-world implications of these methodologies, shedding light on their importance for stakeholders working towards the implementation of Agenda 2030 and the pursuit of sustainable renewable energy resource management.

1. Introduction

Renewable energy resources are characterized as natural assets that regenerate at a pace that outstrips their rate of consumption. Prototypical examples of such perpetually renewed sources include sunlight and wind. Renewable energy sources can be classified as solar, wind, geothermal, bioenergy, hydropower, and marine and hydrokinetic resources (Zohuri, 2017). These energy resources are deemed abundant, environmentally friendly, cost-efficient, and omnipresent (UN, 2022). Alrikabi (2014) emphasizes the multifaceted benefits of these resources - promoting a clean environment, providing employment opportunities, bolstering economic growth, and enhancing energy security. Conversely, reliance on non-renewable energy resources appears to adversely influence these vital aspects.

Subsequent segments will encompass a literature review elucidating each renewable energy resource type, followed by sections detailing the employed methodology, results and discussion, and conclusion.

2. Literature Reviews

Among the myriad renewable energies, solar energy holds a prominent position, harnessed from the sun to generate electricity for domestic and commercial uses (Mofijur et al., 2019). Solar energy stands out due to its considerable potential compared to geothermal and biomass energy, enabling the capture of heat and generation of electricity. Theoretically, solar energy could fulfil global energy demands if appropriately harnessed and distributed. The leading countries in solar energy generation include China, Germany, Japan, the United States, and Italy (Kabir et al., 2018). China is leading the solar revolution with its staggering solar photovoltaic capacity reaching approximately 254.355 GW in 2021, which accounted for around one-third

of the global total (International Renewable Energy Agency, 2022). Germany, despite its relatively less sunlit geography, impressively ranks among the leading countries, boasting a solar capacity of 58 GW in 2021 (Enerdata, 2023). Japan, another strong contender, has made substantial strides in solar power utilization, with its capacity reaching 78.4 GW in 2021 (IEA PVPS, 2022). In the United States, solar power generation capacity witnessed a sharp increase, reaching 65.8 GW in 2022, bolstered by favorable policy initiatives (U.S. Energy Information Administration, 2022). Italy, while smaller in comparison, has made significant advances with a solar capacity of 21.6 GW in 2021 (GSE, 2022). Collectively, these countries have made impressive strides towards leveraging the immense potential of solar energy. The assessment and exploration of solar energy resources have drawn upon a variety of methodologies, spanning from Geographic Information System (GIS) analysis to remote sensing techniques and others (Uyan, 2013). These strategies provide an understanding of the geographical distribution, potential, and limitations of solar energy harnessing. However, a considerable gap persists in the literature concerning a comprehensive review or catalogue of these varying methodologies applied to solar energy assessment.

Wind energy is another abundant, clean, and renewable energy source, a result of Earth's rotation, surface irregularities, and differential atmospheric heating by the sun. The energy is captured by wind turbines converting kinetic energy into usable electricity (Rayyan Fazal and Kamran, 2021). Predominant wind energy producers include China, the United States of America (USA), Germany, Spain, and India (Aziz et al., 2017). Specifically, China held the pole position in wind power capacity, reaching approximately 328.48 GW in 2021, accounting for nearly one-third of the global wind energy capacity (Statista, 2022). The USA followed with a wind power capacity of around 126.1 GW, demonstrating a commitment to renewable energy (U.S. Energy Information Administration, 2021). Germany, despite its smaller size, registered a substantial wind power capacity of about 65.8 GW in 2021 (Fraunhofer Institute for Solar Energy Systems, 2021). Spain held a capacity of around 28.4 GW, making significant contributions to the European wind energy landscape (Red Eléctrica de España, 2022). Lastly, India, with its considerable wind potential, reached a wind power capacity of around 40 GW (Ministry of New and Renewable Energy, 2022). Each of these countries contributes substantially to the global wind energy landscape, setting precedents for others to follow. Various methodologies, such as Geographic Information System (GIS) mapping (Hoogwijk et al., 2004), Synthetic Aperture Radar (SAR) (Adams et al., 2011), and numerical simulation with mesoscale models (Monforti et al., 2014), have been instrumental in assessing and optimizing wind energy resources. Despite the abundance of methodologies, it is noteworthy that a comprehensive review delineating all these techniques specifically for wind energy assessment appears to be absent in the existing literature.

Geothermal energy, derived from the earth's core, is utilized to rotate turbines, producing electricity (Rybach, 2010). Within the sphere of geothermal energy production, two nations distinctly emerge as leaders: the United States and Indonesia. In the United States, the figures from 2020 suggest a leading global position in the production of geothermal electricity, approximately accounting for a production quantum of 16.7 billion kilowatt-hours (U.S. Energy Information Administration [EIA], 2020). Across the Pacific, Indonesia, displaying a considerable leap in the implementation of geothermal technology, boasted the second highest globally installed geothermal capacity, an appreciable 2,130 MW, as the curtains were drawn on 2020 (International Renewable Energy Agency [IRENA], 2021). The investigation of geothermal energy resources has utilized several methodologies, including numerical simulation with mesoscale models (Axelsson, 2010), surface thermal flux (Malcolm et al., 2011), and total well flow methods (Muffler, 1979). Despite the variety of these methodologies, there appears to be a noticeable gap in the literature with regards to a consolidated review that collates and categorizes these various methodologies specific to the geothermal energy assessment.

Bioenergy, another renewable source, is derived from biological materials and converted into fuels, heat, and electricity (Fiorese et al., 2013). Illustratively, the United States and Brazil lead the global stage in the production of bioenergy energy. For instance, in 2020, the United States was able to generate a substantial 4.96 quadrillion British thermal units (Btu) of energy derived solely from biomass. This feat further cements its status as one of the primary bioenergy producers worldwide (U.S. Energy Information Administration [EIA], 2020). Concurrently, Brazil, acknowledged for its adeptness in bioenergy production - especially ethanol - recorded an impressive output of approximately 31.6 billion liters of ethanol derived from sugarcane in 2019 (Renewable Fuels Association, 2020). The assessment of bioenergy resources employs various methodologies, ranging from GIS-based methods (Thompson et al., 2009) to decline curve analysis (Way et al., 2020). These approaches help to evaluate the geographical distribution, potential, and limitations of bioenergy production. Despite the

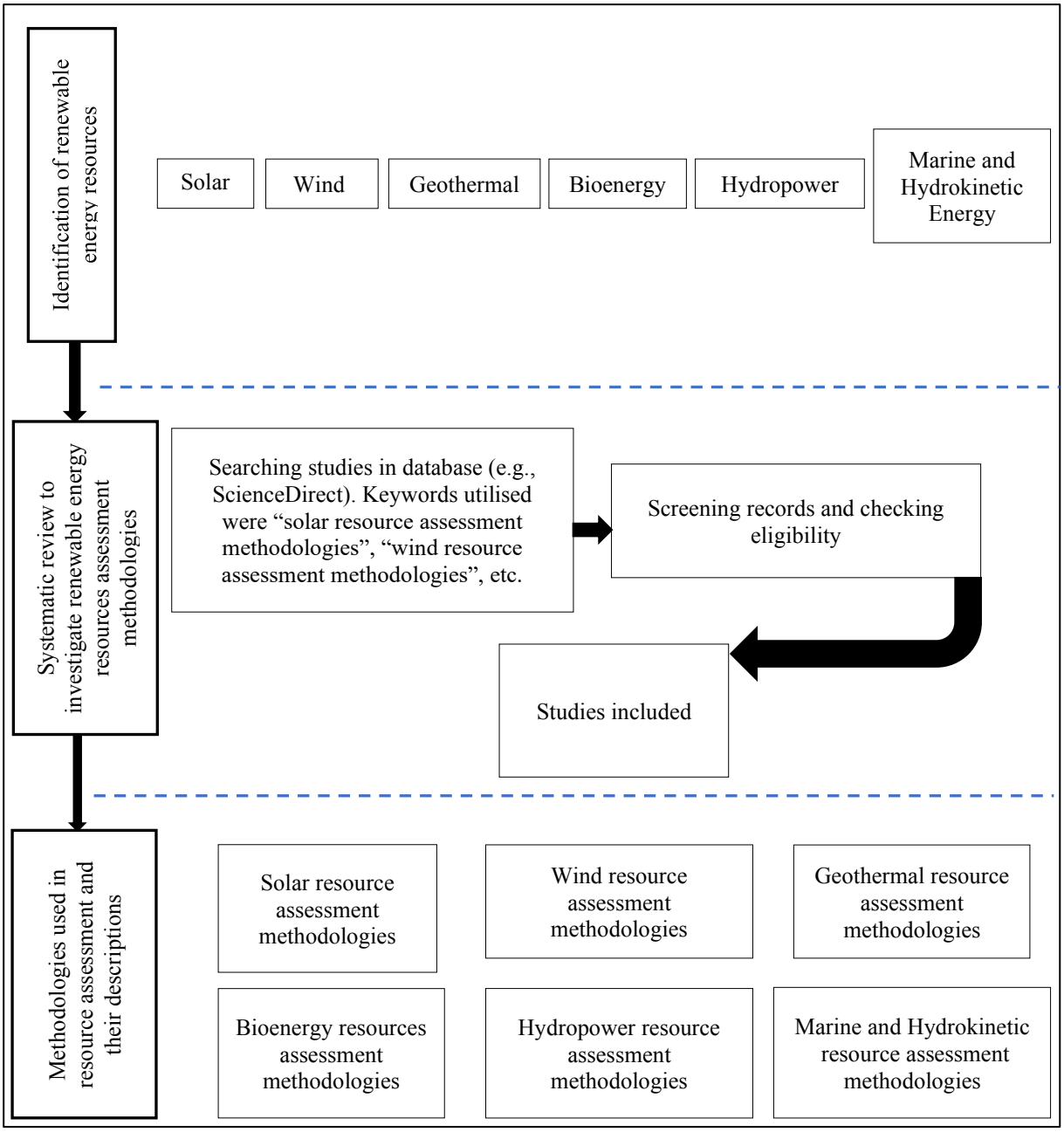
variety of these methodologies, there is a significant gap in the literature regarding a comprehensive compilation and categorization of these different methodologies specifically for bioenergy resource assessment.

Hydropower, a mature and extensive source, exploits the flow of water to generate energy (Yang, 2019). Lastly, marine and hydrokinetic energy harnesses the natural movement of water bodies, such as waves, tides, and currents, providing an abundant source (Copping, 2018). The methodlogies used to investigate these renewable energy resources are also dispersed.

Resource assessment methodologies serve as invaluable tools to understand and address issues related to these energy sources. These methods, including Geographic Information System (GIS)-based analysis, remote sensing, Synthetic Aperture Radar (SAR), numerical simulation with mesoscale models, surface thermal flux, total well flow, planar fracture method, decline curve analysis, and many others (Martins, 2020; Kozai, Ohsawa, and Hasager, 2008; Purba et al., 2021) remain dispersed and are yet to be catalogued comprehensively.

To remedy this, the current study aims to compile these assessment methodologies, separating them into GIS-based and non-GIS-based categories, further highlighting those applicable to multiple resources. This will serve as an indispensable guide for researchers investigating renewable energy resources. A systematic literature review is employed to identify and describe the methodologies for assessing each energy resource. The review targets to delineate the methods applied to solar, wind, geothermal, bioenergy, hydropower, and marine energy resources. The conceptual framework for this review is illustrated in Figure 1.

Figure 1. Resource assessment investigation framework



3. Methodology

In order to analyze the case studies, a systematic literature review (SLR) was implemented. PRISMA 2009 was used to describe the sources and identify, screen, and verify the articles' eligibility (Moher et al., 2009). The methodology will be outlined fully in the sections that follow.

3.1. *Guideline* used

The study was directed by PRISMA 2009 to define the research question, set the inclusion and exclusion criteria for the evaluated papers, and assess the relevant publications. To clarify, PRISMA 2009 can aid in screening publications and provides information on their eligibility and ineligibility (Pati and Lorusso, 2018). Therefore, the current study utilized a dependable strategy to review papers on resource evaluation methodologies.

3.2. Selection of Database and search strategies

The review was carried out with the assistance of the ScienceDirect journal database. The bibliographic database ScienceDirect contains more than 16 million articles spread across 2500 different journals. For the sake of this investigation, the ScienceDirect database, which addresses a diverse range of topics about environmental science and energy, is of particular value. The database uses peer review, meaning the information they contain may be relied upon (Owen et al., 2022).

3.3. Systematic Literature Review (SLR) process

The SLR was accomplished primarily through three steps: item identification, screening, and eligibility evaluation (Figure 2). ScienceDirect was the database utilized to search for relevant publications. In this database, specialized terms related to resource assessment methodologies were searched. "solar resource assessment methodologies" OR "solar energy resource assessment", "wind resource assessment methodologies" OR "wind energy resource assessment", "geothermal resource assessment methodologies" OR "geothermal energy resource assessment", "bioenergy resource assessment methodologies" OR "bioenergy resource assessment", "hydropower resource assessment methodologies" OR "hydropower assessment", and "marine and hydrokinetic resource assessment methodologies" OR "marine and hydrokinetic" were among the keywords that were searched. These keywords were selected in response to the stated research objectives in the introduction. Each of these terms underwent a separate search, followed by the three-step procedure of identification, screening, and eligibility verification. These investigations were conducted on May 15, 2022.

"solar resource assessment methodologies" OR "solar energy resource assessment" retrieved 50 articles, while "wind resource assessment methodologies" OR "wind energy resource assessment" retrieved 222, "geothermal resource assessment methodologies" OR "geothermal energy resource assessment" retrieved 9, "bioenergy resource assessment methodologies" OR "bioenergy resource assessment" retrieved 8, "hydropower resource assessment methodologies" OR "hydropower assessment" retrieved 38, and "marine and hydrokinetic resource assessment methodologies" OR "marine and hydrokinetic" retrieved 39. The inclusion and exclusion of articles for each of these categories were determined by the Table 1 criteria. The exclusion criteria were as follow: book chapters, books, and conference proceedings; papers authored in languages other than English; and articles that did not focus on or reference any of the indicated renewable energy resources assessment methods in their title, abstract, or keywords. The contents of the previously screened articles were reviewed again, and those irrelevant or off-topic were deleted. Table 2 presents the overall number of papers extracted from the ScienceDirect database and the qualifying items for each renewable energy type after screening and eligibility check.

Figure 2. The flow to select relevant articles for each type of renewable energy resource assessment methodology

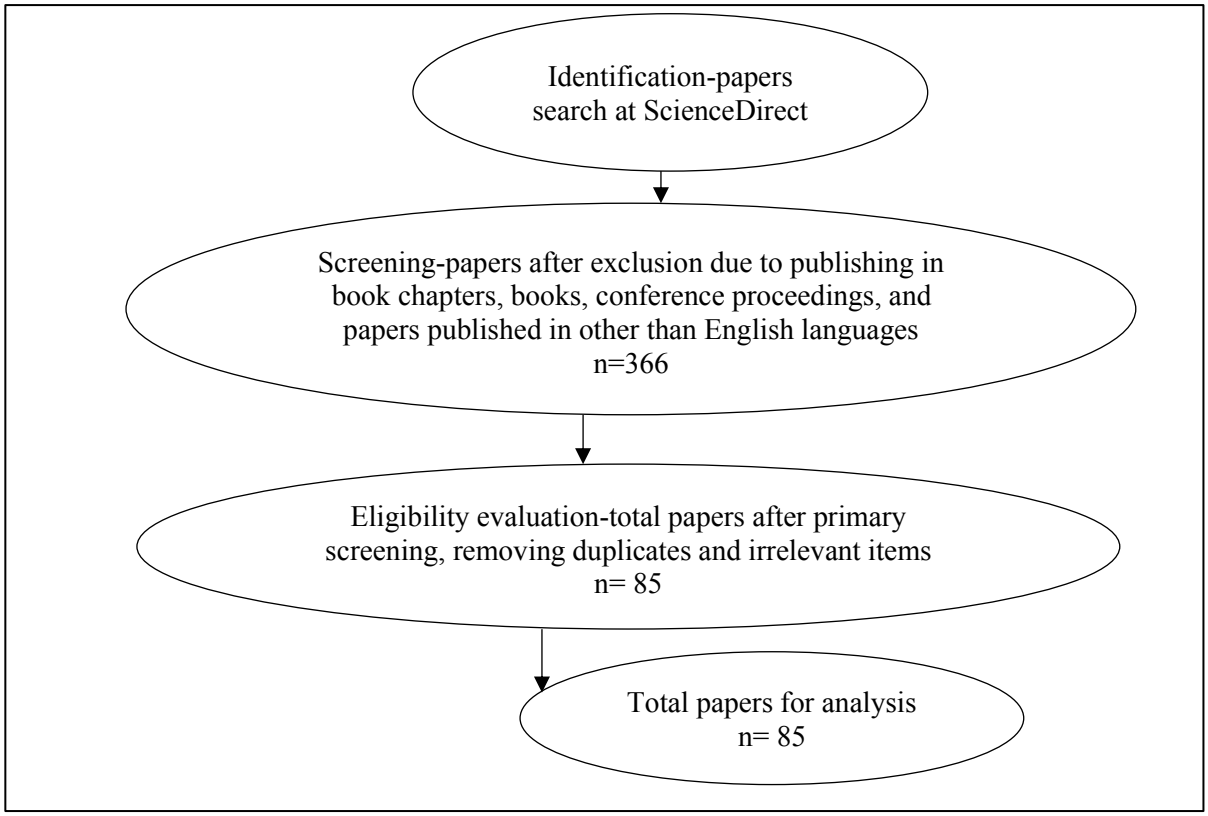


Table 1. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Publication timeline	Any	Not excluded any
Document type	Peer-reviewed papers	Book chapters, books, conference proceedings
Language	English	Other than English
Nature of study	Focused on renewable energy and mentioned a method of assessment	Not focused on renewable energy and has not mentioned any method to assess any of the energies
Study area	Energy and renewable energy-related	Not related to energy and renewable energy

Table 2. Total number of eligible papers for each type of renewable energy

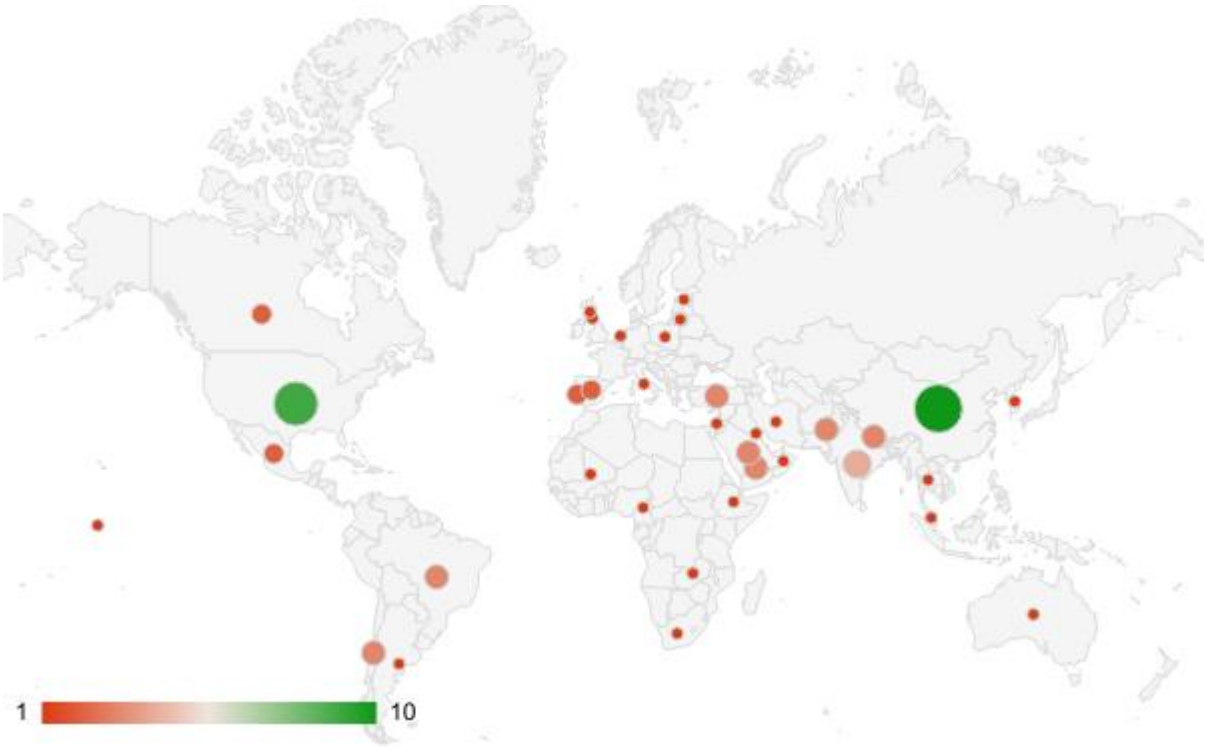
Criteria	Papers-ScienceDirect	Eligible papers-ScienceDirect
Solar resource assessment methodologies Keyword: "solar resource assessment methodologies" OR "solar energy resource assessment"	50	27
Wind resource assessment methodologies Keyword: "wind resource assessment methodologies" OR "wind energy resource assessment"	222	36
Geothermal resource assessment methodologies Keyword: "geothermal resource assessment methodologies" OR "geothermal energy resource assessment"	9	4

Bioenergy resource assessment methodologies Keyword: "bioenergy resource assessment methodologies" OR "bioenergy resource assessment"	8	5
Hydropower resource assessment methodologies Keyword: "hydropower resource assessment methodologies" OR "hydropower assessment"	38	8
Marine and hydrokinetic resource assessment methodologies Keyword: "marine and hydrokinetic resource assessment methodologies" OR "marine and hydrokinetic"	39	5

4. Results and Discussion

Publications were evaluated based on whether or not they outlined a procedure for assessing renewable energy sources. The search conducted in the ScienceDirect database resulted in the retrieval of 366 papers. After screening and eligibility check, a total of 85 records were delivered to the final review. The trend showed that China (n=10) and USA (n=9) are the leading countries conducting research on renewable energy resources and discussing their methodologies (Figure 3). Owen et al. (2022) further verified the substantial research capabilities of these two nations in the field of environment and other pertinent subjects. In the following sections, the outcomes of the database search and their significance will be discussed.

Figure 3. Geographical distribution of the selected papers. (4 other studies were global in scope, while 8 studies did not specify any particular region and were methodology-based)



4.1. Solar resource assessment methodologies

A total of 50 papers (review and research) on solar resource assessment approaches were extracted from the ScienceDirect database. The subject area of the search was especially relevant to energy. The articles published in various journals were dispersed over almost two decades, from 2002 to 2022. Most articles (n=39) were research pieces, while the remainder (n=11) were review papers. Miranda and Garcia-Carpintero (2018) stated that research papers are published more frequently than review articles. However, the impact

and citations of review publications are often more significant. Table 3 displays the distribution of these publications according to the journals in which they were published.

After initial screening, duplicate checking, and other pertinent inspections, the number of relevant articles reached 27. The rejected articles either did not focus on renewable energy resources or did not specify any research technique. Most articles discussed the study's approach to investigating solar resources. In addition to the method they employed, they described and evaluated alternative inquiry strategies used in prior studies or potential ways that could be implemented. Escobar et al. (2014), for instance, employed a GIS and remote sensing-based methodology (satellite estimation model). In contrast, they also emphasized the possible but costly ground measurement method for solar energy. The methods of solar resource assessment extracted from the research and review articles (RA) were distinguished (Table 4).

Solar resource assessment methods were primarily classified into GIS and remote sensing-based and non-GIS-based methods. The first group included methods such as satellite-based estimation model, satellite image and data processing and analysis, raw data analysis using GIS, GIS-based calculations, Spatio-temporal assessments using satellite images, direct normal irradiance analysis, GIS-based multicriteria decision-making technique, potential assessment using GIS, and other GIS and observation data-based assessment methodologies. The non-GIS-based solar resource assessment methodologies were ground measurement, direct measurement, global horizontal irradiance analysis, Engerer model and Monte-Carlo simulation, weather research and forecasting model, assessment using radiometers, and others.

Most solar resource testing techniques have recently been based on GIS and remote sensing. This increment could be the result of technological advancements in recent years. The direct solar resource measurement is more accurate than satellite images and model-based measurements. However, GIS and remote sensing assessments are more straightforward and save time (Mahmud et al., 2014). Occasionally, combining two techniques and data, such as station-based data and data derived from satellite observations, results in a single output that can be used to evaluate solar resources (Yang and Gueymard, 2019).

Table 3. Journal distribution of the retrieved papers for solar energy

Journal	No. of papers
Renewable and Sustainable Energy Reviews	12
Renewable Energy	10
Solar Energy	9
Energy Procedia	7
Applied Energy	3
International Journal of Hydrogen Energy	3
Global Energy Interconnection	3
Energy for Sustainable Development	1
Sustainable Energy Technologies and Assessments	1

Table 4. Solar resource assessment methodologies

Papers-Authors	Country	GIS and remote sensing-based methodology	Non-GIS based methodology
Escobar et al., 2014	Chile	Satellite-based estimation model	Ground measurement technique
Mahmud et al., 2014	Ethiopia	.	Direct measurement
Ortega et al., 2010	Chile	Satellite image processing	Ground measurement
Tahir and Asim, 2018 (RA)	Pakistan	Satellite data analysis	Surface measured data analysis
Hernández-Escobedo et al., 2015 (RA)	Mexico	Raw data analysis using GIS	.
Tang et al., 2021	Global	GIS calculation	Big data analysis
Charabi and Gastli, 2012	Global	Spatio-temporal assessment using satellite images	.
Du et al., 2022	China	Satellite data analysis	Accurate global horizontal irradiance (GHI) measurement
Schillings et al., 2004a	Arabian Peninsula	Analysis of direct normal irradiance from satellite data	Ground measurement
Viana et al., 2011	Brazil	Satellite-based solar irradiation data analysis	.
Huang et al., 2018	China	GIS analysis with Multi-Criteria Decision Making (MCDM) technique	.
Kim et al., 2019	Korean Peninsula	.	Engerer model and Monte-Carlo simulation to derive direct normal irradiance
Sigal et al., 2014	Argentina	Potential assessment using GIS	.
Islam et al., 2019	Malaysia	Solar resource assessment using NASA data	.
Liu et al., 2022	USA	.	Weather Research and Forecasting (WRF)-Solar model
Eckman and Stackhouse, 2012	Global	Space-based earth observations	.
Esteves et al., 2015	Brazil	Digital high-resolution solar radiation database analysis	.

Zawilska and Brooks, 2011	South Africa	Nasa satellite data analysis	Ground-based measurements
Dasari et al., 2019	Arabian Peninsula	High-resolution spatial and temporal data analysis	.
Yadav et al., 2015 (RA)	India	.	Rapid miner in ANN models
Qin et al., 2021	Australia	geostationary satellite data analysis	.
Abreu et al., 2018	Portugal	.	Long-term statistical analysis and typical weather data generation
Yang and Gueymard, 2019	USA	Satellite observation data (Gaussian processes)	Station-specific data (Gaussian processes)
Schillings et al., 2004b	Arabian Peninsula	Satellite data processing method	.
Valdés-Barrón et al., 2014	Mexico	Satellite data anlaysis	Assessment using radiometers
Nygaard et al., 2010	Mali	Satellite remote sensing data analysis	Mesoscale modeling
Ramírez-Sagner et al., 2017	Chile	GIS data analysis	.

4.2. Wind resource assessment methodologies

The search yielded over two hundred and twenty-two items (n=222), demonstrating that wind resource exploration has a lengthy history. In addition, the number of journals carrying these publications increased dramatically (n=25) (Table 5). China is one of the countries that has invested much in renewable energy research, notably wind (Li et al., 2021). The studies are more prevalent in Asian countries than in Europe and the United States, which may be due to the vast availability of wind resources in these regions (Dent, 2013).

After screening and eligibility verification, 36 papers were found qualified for the inquiry of wind resource assessment methods. Wind resource evaluation and solar energy assessment utilize similar approaches at some points, like Weather Research and Forecasting (WRF). Wind satellite data analysis, Google Earth data analysis, topography analysis, Multi-camera Particle Image Velocimetry (PIV), and others were identified as GIS-based techniques for assessing wind resources through a systematic review (Table 6). Non-GIS techniques included polynomial regression model, numerical weather prediction (NWP) models, ground measurement, periodic statistics analysis, WAsP analysis, artificial intelligence algorithms and numerical methods, among others. Comparatively, fewer studies utilized GIS and remote sensing-based assessment methodologies than non-GIS methods.

Table 5: Journal distribution of the retrieved papers for wind energy

Journal	No. of papers
Renewable and Sustainable Energy Reviews	50
Renewable Energy	42

Energy	19
Applied Energy	18
Energy Procedia	18
Journal of Wind Engineering and Industrial Aerodynamics	14
Solar Energy	3
Energy and Buildings	10
Energy Conversion and Management	9
International Journal of Hydrogen Energy	4
Building and Environment	3
Journal of Cleaner Production	3
Energy Reports	3
Global Energy Interconnection	3
Electric Power Systems Research	2
Refocus	2
Renewable Energy Focus	2
International Journal of Electrical Power & Energy Systems	1
Applied Thermal Engineering	1
Energy Economics	1
Resources, Conservation and Recycling	1
Energy for Sustainable Development	1
Sustainable Energy Technologies and Assessments	1
Journal of Energy Storage	1
Energy Conversion and Management: X	1

Table 6. Wind resource assessment methodologies

Papers-Authors	Country	GIS and remote sensing-based methodology	Non-GIS based methodology
Wang et al., 2021	China	.	Polynomial regression model
Aukitino et al., 2017	Kiribati	Wind satellite data analysis	WAsP analysis

Kazet et al., 2016	Cameroon	Google earth data analysis	Weibull parameter analysis
Kucukali and Dinçkal, 2014 (RA)	Turkey	.	Turbulence analysis, statistical analysis, Weibull parameter analysis
Charabi et al., 2011 (RA)	Oman	satellite data analysis	Numerical weather prediction (NWP) models, ground measurement
Alawaji et al., 1996	Soudi Arabia	.	Periodical statistics analysis
Migoya et al., 2007	Spain	Topography analysis	WAsP analysis, ground measurement, statistical analysis
Al-Abbadi, 2005	Saudi Arabia	.	Wind speed, direction, power density, and energy analysis
Alawaji, 1996	Saudi Arabia	.	Periodical statistics analysis, wind speed and direction analysis
Al-Yahyai et al., 2010 (RA)	General	.	Numerical Weather Prediction (NWP) models
Saluja and Douglas, 1996	Scotland	.	WAsP analysis
Li et al., 2021	China	Observation analysis	.
Wang et al., 2018	China	.	Artificial intelligence algorithms and numeral methods in estimating Weibull parameters
Tian et al., 2019	General	.	Numerical analysis
Zhang et al., 2015 (RA)	General	.	Numerical Weather Prediction (NWP) models
Jiang et al., 2017	China	.	Numerical methods and metaheuristic optimization algorithms
Blocken et al., 2015	Spain	.	Computational Fluid Dynamics (CFD) simulations
Tabrizi et al., 2014	General	.	Computational Fluid Dynamics (CFD) modeling method

Kilpatrick et al., 2021	General	Multi-camera Particle Image Velocimetry (PIV)	.
Marčiukaitis et al., 2008	Lithuania	.	Local measurement, Numerical Weather Prediction (NWP) models, WAsP analysis, CFD
Alkhalidi et al., 2019	Kuwait	.	Weibull parameter statistical analysis
Simões and Estanqueiro, 2016	Portugal	.	Mesoscale modelling, Urban Digital Terrain Model (U-DTM)
Meij et al., 2016 (RA)	Palastine	.	Weather Research and Forecasting (WRF), Numerical weather prediction (NWP) models
Öner et al., 2013 (RA)	Turkey	.	Wind power density prediction method, WAsP analysis
Tang et al., 2019	General	.	CFD
Dvorak et al., 2010	USA	High-resolution bathymetry analysis	Mesoscale modelling
Liang et al., 2022	China	Modeling spatiotemporal patterns	.
Allen et al., 2017	Great Britain	Observation analysis	NWP models
Xu et al., 2020	China	Satellite image analysis	.
Laudari et al., 2018	Nepal	Dedicated mast	Microscale modeling,
Neupane et al., 2022	Nepal	Geospatial analysis	.
Ranthodsang et al., 2020	Thailand	.	Feasibility analysis
Li et al., 2022	China	.	Wind speed prediction model
Khan and Tariq, 2018	Pakistan	SODAR and meteorological mast	.
Cong et al., 2022	China	.	Wind power time series simulation model, Markov algorithm
Crippa et al., 2021	Saudi Arabia	Temporal model based on observation data analysis	.

Chandel et al., 2014	India	.	Wind Energy Pattern Factor (WEPF) method

4.3. Geothermal resource assessment methodologies

Geothermal energy is one of the most environmentally-friendly forms of energy available. When generating electricity, geothermal energy emits fewer greenhouse gases than other renewable and non-renewable energy sources (Kömürcü and Akpinar, 2009). USA, Sweden, China, Iceland and Turkey are among the top five countries with installed geothermal energy capacity (Erdogdu, 2009).

The number of papers retrieved from the specific journals (n=9) is shown in Table 7. These figures show how little attention researchers pay to this type of energy. Most of the studies found were from previous decades (Table 8). The scarcity of studies on geothermal energy resource evaluation could be due to the limited inventive space that this resource affords for extraction and assessment. Surface thermal flux, volume, planar fracture, and magmatic heat budget are the four approaches for evaluating geothermal energy resources. The most efficient and well-known method of evaluation is the volume (Muffler and Cataldi, 1978). GIS and remote sensing are used to investigate geothermal energy for geological surveys; the rest are non-GIS methods (Economides and Acre, 1984).

Table 7. Journal distribution of the retrieved papers for geothermal energy

Journal	No. of papers
Geothermics	4
Renewable and Sustainable Energy Reviews	2
Renewable Energy	1
Journal of Volcanology and Geothermal Research	1
Tectonophysics	1

Table 8. Geothermal resource assessment methodologies

Papers-Authors	Country	GIS and remote sensing-based methodology	Non-GIS based methodology
Cataldi et al., 1978	Italy	.	Volume method
Şahin and Yazici, 2012	Turkey	.	artificial neural network (ANN), adaptive neuro-fuzzy (ANFIS) methods
Economides and Acre, 1984	USA	Engineering and geologic surveys and analysis	.
Muffler and Cataldi, 1978	General	.	Surface thermal flux, volume, planar fracture, magmatic heat budget

4.4. *Bioenergy resource assessment methodologies*

Bioenergy is also one of the renewable energy sources and majors that received less attention or investigated less (Table 9). Since bioenergy comes from living organisms such as specific plants, their extension and

potential for producing energy could be easily mapped out by geographic analysis tools and methods. Therefore, many reviewed articles have used GIS-related methods and tools (Table 10) (Yousefi et al., 2017).

Table 9. Journal distribution of the retrieved papers for bioenergy

Journal	No. of papers
Renewable and Sustainable Energy Reviews	5
Applied Energy	1
Renewable Energy	1
Sustainable Energy Technologies and Assessments	1

Table 10. Bioenergy resource assessment methodologies

Papers-Authors	Country	GIS and remote sensing-based methodology	Non-GIS based methodology
Shane et al., 2016	Zambia	Spatial distribution analysis using QGIS	.
Calvert, 2011	Canada	Geography analysis/Geomatics and bioenergy feasibility assessment	.
Batidzirai et al., 2012	Netherland	Spatial analysis of high-resolution datasets and land availability modelling	.
Yousefi et al., 2017	Iran	GIS-based spatial analysis of statistical and geographical data	.
Zyadin et al., 2018	Poland	GIS land use land cover analysis	.

4.5. Hydropower resource assessment methodologies

Among the retrieved publications from the database (n=38) (Table 11), eight were eligible for use in the current section. The methods utilized to assess hydropower resources were GIS and remote sensing-based. The usage of GIS and remote sensing data in assessing this energy resource could be due to the abundance of water sources and their extension, making it difficult to be accessible and analyzed in any other way (Table 12). GIS and hydrological modelling, Virtual hydropower assessment, digital elevation model using GIS, and others are examples of hydropower resource assessment methods (Kusre et al., 2010; Zaidi and Khan, 2018; Tamm and Tamm, 2020).

Table 11. Journal distribution of the retrieved papers for hydropower energy

Journal	No. of papers

Renewable and Sustainable Energy Reviews	8
Renewable Energy	7
Energy	4
Journal of Hydrology	3
Sustainable Energy Technologies and Assessments	3
Applied Energy	2
Journal of Cleaner Production	2
Energy Policy	1
Advances in Water Resources	1
Cold Regions Science and Technology	1
Global and Planetary Change	1
Global Environmental Change	1
Atmospheric Research	1
Ecological Indicators	1
Water Resources and Economics	1
Climate Services	1

Table 12. Hydropower resource assessment methodologies

Papers-Authors	Country	GIS and remote sensing-based methodology	Non-GIS based methodology
Tamm and Tamm, 2020	Estonia	Virtual hydropower assessment (VHA) using GIS	.
Kusre et al., 2010	India	GIS and hydrological modelling	.
Manawko and Kasiviswanathan, 2022	Global	Run-of-river-based hydropower potential	.
Zaidi and Khan, 2018 (RA)	Pakistan	GIS and digital elevation models	.
Mosier et al., 2016	USA	Hydropower potential assessment tool (HPAT), Global climate models (GCMs)	.

Cyr et al., 2011	Canada	Synthetic hydro model (SHN) created from digital elevation models (DEM)	.
Dudhani et al., 2006	India	Remote sensing data analysis	.
Singh and Nachtnebel, 2016 (RA)	Nepal	Analytical hierarchical process (AHP)	.

4.6. Marine and hydrokinetic resource assessment methodologies

Five of the 39 papers that were retrieved discussed assessment methodologies for marine and hydrokinetic resources (Table 13). In contrast to hydropower, most of these methods for investigating marine and hydrokinetic energy consisted of modeling and numerical analysis to determine the resource potential (Table 14). None of the studies used GIS and remote sensing methods. It should be noted that most studies were conducted in the United States, and this geographical distribution of studies demonstrates the importance of producing this type of energy in the United States (Yang et al., 2013; Yang et al., 2017; Fontaine et al., 2020).

Table 13. Journal distribution of the retrieved papers for marine and hydrokinetic energy

Journal	No. of papers
Renewable Energy	16
Renewable and Sustainable Energy Reviews	9
Renewable Energy Focus	3
Energy	2
Energy Conversion and Management	2
Sustainable Energy Technologies and Assessments	2
Nano Energy	1
International Journal of Marine Energy	1
Energy Research & Social Science	1
Energy Reports	1
Joule	1

Table 14. Marine and hydrokinetic energy assessment methodologies

Papers-Authors	Country	GIS and remote sensing-based methodology	Non-GIS based methodology
Fontaine et al., 2020	USA	.	Analytical and numerical models
Yang et al., 2017	USA	.	Mathematical large-eddy simulation (LES)

Yang et al., 2013	USA	.	The three-dimensional coastal ocean model
Armandei and Fernandes, 2016	Brazil	.	Preliminary unit turbine model based on buffeting
Guerra and Thomson, 2019	USA	.	Numerical models

5. Conclusion

The systematic review of renewable energy resources found that GIS, remote sensing, and non-GIS-based approaches are available to investigate the resources. Solar, wind and geothermal energy resources could be both explored by the two described types of approaches. However, the review found that bioenergy and hydropower could only be explored by applicable GIS and remote sensing techniques. On the other hand, marine and hydrokinetic energy resources could only be studied using non-GIS methods.

Researchers, government agencies, and non-governmental organizations may use the outcomes of this systematic review to examine renewable energy resources using the most appropriate methodology. It might save time and assist users in comparing strategies and selecting the best one to implement based on their available resources. Thus, the recent study could prevent the wasting of numerous resources. Additional research is required to explore and evaluate resource assessment approaches in different research databases. In addition, they can employ other review techniques to discover more resource assessment procedures.

This academic collection provides a useful guide for renewable energy researchers and emphasizes the necessity of sustainable energy usage, aligning with the Sustainable Development Goals 7, 12, and 15. The study emphasizes the practical implications of these methodologies, emphasizing their significance for stakeholders dedicated to implementing Agenda 2030 and achieving sustainable renewable energy resource management.

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The role of Renewable Energy Communities in achieving SDG7 targets: an experimental assessment methodology for the italian inner areas

Giuseppe Mangano[1 4], Consuelo Nava[2]

[1] ABITAlab, Department of Architecture and Territory, Mediterranea University of Reggio Calabria, Via dell'Università n.24, 89124, Reggio Calabria
[2] ABITAlab, Department of Architecture and Territory, Mediterranea University of Reggio Calabria, Via dell'Università n.24, 89124, Reggio Calabria

[4] Corresponding author's e-mail address: giuseppe.mangano@unirc.it

Abstract. The transition towards renewable energy sources is crucial in achieving the Agenda 2030 SDGs and the carbon neutrality of cities. The Renewable Energy Communities have emerged as a promising model for sustainable energy production and consumption and they have the potential to contribute significantly in achieving SDG7. In this article, we propose an experimental methodology to assess the positive impact of Renewable Energy Communities in the inner areas through the SDG7, focusing on the help of clean and emerging technologies to achieve that. Assessing the performance of RECs is important to ensure: their effectiveness in reducing greenhouse gas emissions and contributing to carbon neutrality; the alignment with SDG7. The methodology consists three steps: identifying the renewable energy community being assessed with a case study approach; defining, collecting, analysing and comparing data with the baseline values for the SDG7 targets and indicators. The third step should enlight the strengths and weaknesses of the investigated RECs, also from a technological point of view. The results at this step aim to discuss on the role of the most widely used renewable technologies, but also to assess the potential of the technologies in producing, consuming and storing the energy and their capability to achieve additional targets.

1. Introduction

The decarbonization processes required for the energy transition, with climate change scenarios to 2035, 2050 and 2085 [1] (IPCC, 2019), entrust the role of "energy communities" with an important and in any case "smart and open" task, due to the nature that "energy networks" themselves have of implementing "smart grid" models, where the concepts of consumption and production are internal to the same way in which energy systems and their technologies function in "multi-energy systems" and with high levels of storage and redistribution, making end-users active subjects [2].

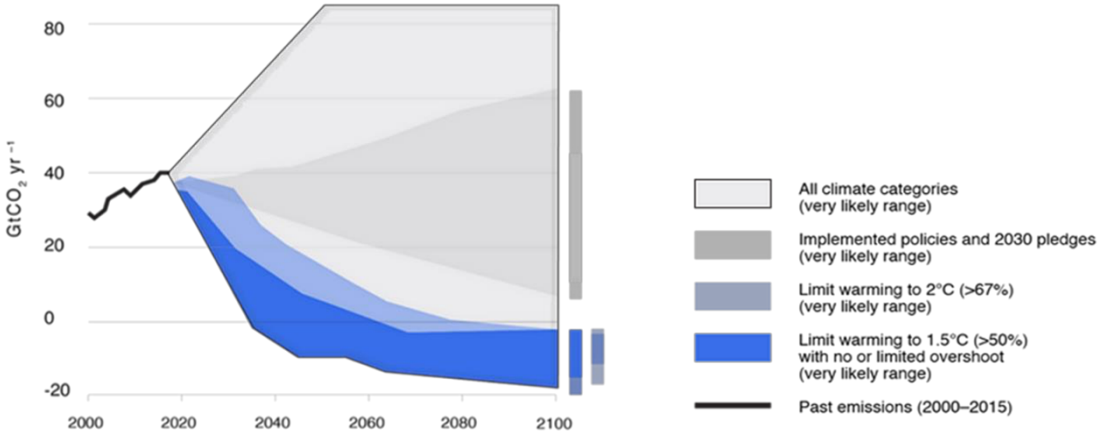
It advances a new approach, which shifts the very concept of decarbonization towards "net-zero" models and founds a new paradigm, which '(...) introduces new benefits for end-users, such as security of energy supply and affordability, while grid operators benefit from deferred grid reinforcement plans and increased diversification of energy supply. At the same time, this paradigm introduces new technical, economic and social challenges for grid operators, end-users and regulators, in particular due to the unreliability, intermittency and non-transferability of most RES' [3].

Energy communities derive many benefits from all energy system networks, but to date with greater incidence from RESs photovoltaic and wind, "it is estimated that by 2030, energy communities could own around 17% of installed wind capacity and 21% of solar capacity [4]. By 2050, nearly half of EU households are expected to be producing renewable energy' [5]. Energy communities and their networks will still remain connected to national energy systems and distribution infrastructures for a long time, but in islands and inland areas autonomous systems could realize innovative consumption, self-consumption and production patterns with advanced technologies. This would de facto change the structure of infrastructures, the spatial systems of inhabited contexts and their energy flow management models, acting within the broader circular models of sustainable resource use and management by users/citizens. In the design of sustainable cities, energy communities become one of the models to be pursued for 'net zero' cities, expressing in highly innovative transformation projects, new performative configurations and energy infrastructures perfectly integrated into the urban landscape, making all the environmental systems involved productive

In the regime of climate change scenarios, it is necessary to produce levels of quality "beyond performance" in order to aim for a "performative level"; this means working for scenarios of climate adaptation and/or mitigation and calling on the capacity of regenerative design to provide pathways that can be activated as responses to states of impact for emerging phenomena. Such an approach is based. also according to the latest IPCC reports (2013 to 2022), on the concepts of impact and vulnerability and thus risk, referring to the "global warming level" (GWL), described as "the increase in global mean near-surface air temperature relative to the pre-industrial period (properly the period prior to 1750, often approximated by conditions in the period 1850-1900)" [6].

The IPCC identifies as key risks for Europe, which are susceptible to their level of impact with reference to increased global warming (since the 1.5° of COP 25 has been largely compromised). Already with a 2° C rise in temperature, the risks become more serious and partly irreversible. The IPCC shows the path to be traced, with reference to past emission scenarios (from 2000) up to 2100, a period in which, in addition to the first challenges of 'climate neutrality' in 2030, 2050, the results of climate mitigation policies carried out in the productive sectors of industry, energy, residential, transport, tertiary, land consumption, etc. should be recorded (Fig.1).

Figure 1. IPCC 6th Assessment Report, Climate Change 2022: Mitigation of Climate Change



Under the climate change regime, even advanced hybrid building design processes must be conducted according to a new approach to innovation and sustainability. Therefore, in the field of frontier research, there is a need for applied experimentation in innovation-led design in transition scenarios, through the expression of more advanced spatial and functional configurations, contributing to the discussion on sustainability in its most radical version, with a building design that projects its goals beyond green and efficient performance, towards climate neutrality, going beyond the concept of “zero carbon” and through regenerative type systems of positive and hybrid response. It should be argued that, to address the design and management of hybrid buildings under climate change, regenerative type design is the most complex but also

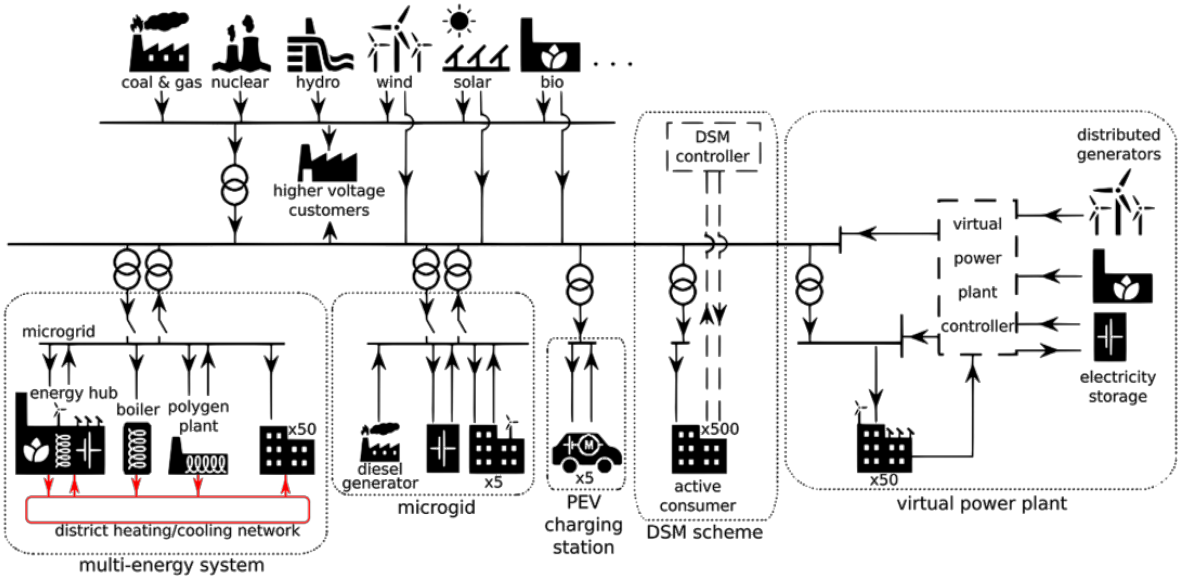
the most performing translation of advanced sustainable design. What is experimented to realize "the resilience of buildings in the built environment", in fact changes the very concept of the hybrid building, in the architecture of its possible forms and materials and context spaces, in its functions as an urban device, as an ecological and technological device, or even as a regenerative device for "living" or "carrying out activities" [7].

All regenerative systems are themselves 'hybrids', since in order to produce performance with a “positive/productive balance”, they must be able to function on both high levels of efficiency and effectiveness. Thus, for example, the passive-active behaviors of any technological system designed for a level of thermo-hygrometric wellbeing, is the result of the integration of the physical-environmental devices of the technical elements and the digital ones, of regulation and control of the natural/passive behaviors [8].

In this model of regenerative design, the innovative character emerges that F. Tucci [9] entrusts to the possible interaction between "Self-reliant approach (whose reference principles are: reflexivity, self-organization and inclusivity)", "Error-friendliness approach" (whose reference principles are: robustness, flexibility and adaptability) and "Dynamic-responsive approach" (whose reference principles are: integration, connectivity and responsiveness).

Real configurations of energy landscapes in smart grids (Fig.2), recognize energy communities and their distribution technologies with reference to the use of renewable resources, realized in a single urban energy system.

Figure 2. Emerging energy landscape on smart grid and urban energy system concepts. Source: Applied Energy, 2018

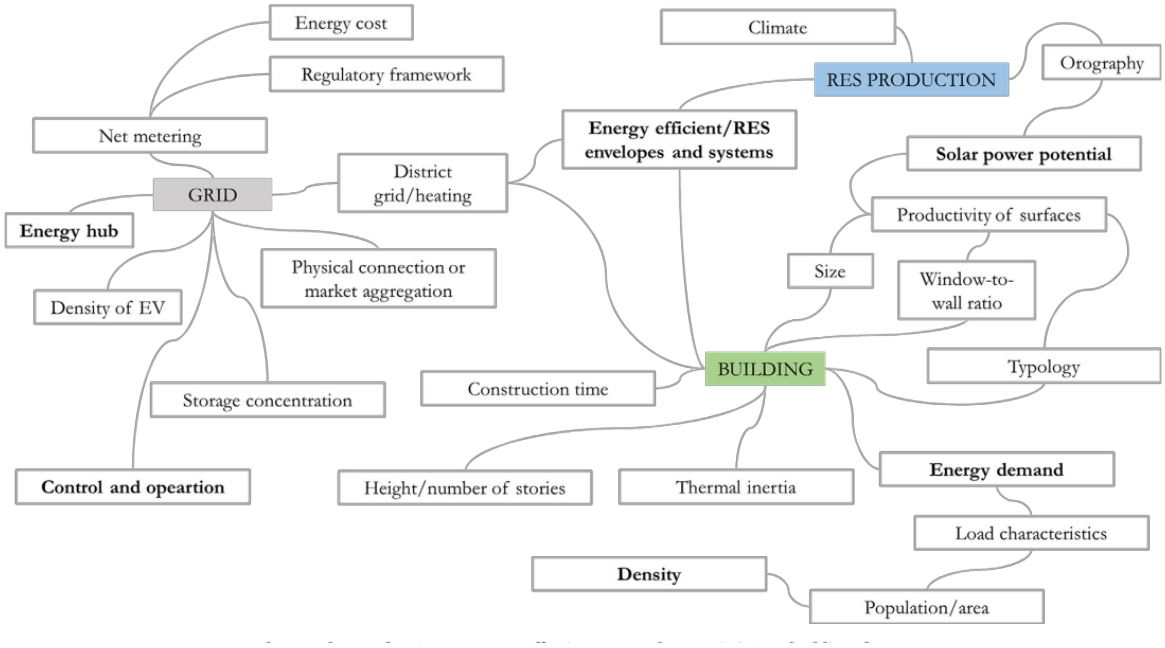


In these scenarios, where technologies powered by renewable energy sources are of relevant importance, the building takes on the definition of a 'building cluster'. "(...) The building cluster scale, also known as 'building block or neighborhood', represents an intermediate level between the individual building and the neighborhood or urban scale. It can be defined by several criteria, such as energy system, archetypes, location, building size, density (low, medium, high), function (residential, office, mixed), number of floors (low, high), year of construction, geographical boundary and so on.

Consequently, a building cluster is considered as a group of buildings systematically interconnected to the same energy infrastructure, so that a change in the energy performance of a single building affects both the energy infrastructure and the other buildings in the cluster. synergistically or disruptively' [10]. A true productive energy landscape (Fig.3), whose cluster efficiency is influenced by many factors, at different scales, that can be ascribed as "impact parameters"; these can be divided into four categories: geometry (form), construction (fabric), systems (equipment) and operation (program).

It is in this organizational dimension that policies and strategies referring to SDG7 (targets and indicators) and the role that innovative and emerging technologies play through the configuration of advanced energy communities can be implemented.

Figure 3. Outline of the main parameters influencing the energy characteristics of a building cluster. Source: Applied Energy, 2018



It is therefore necessary to redefine the inter-scalar relationship between functioning models and expected impacts, to define the quality of space in terms of functions and well-being, and thus to adopt a regenerative approach with high performances, for which sustainable design is not limited to the reduction of impacts, but produces positive environmental and social performance [11].

The research conducted by G. Mangano and C. Nava, as described in some of the results already produced and illustrated in the following paragraphs, moves from these premises and finds in the methodological investigation referred to the general thematic objectives the theoretical and applicative conditions for the two outputs sought: *output 1 - Sustainability Assessment - Monitoring of SDG7, related SDGs and technological performances - output 2 Sustainability Assessment - Prioritization of policies and public funds to create a REC.*

2. Literature Review

The United Nations' 2030 Agenda for Sustainable Development was adopted in September 2015. It is underpinned by 17 Sustainable Development Goals (SDGs) and 169 targets [12]. The adoption of the UN Agenda 2030 marked a significant milestone in international development, aiming to promote sustainable development, eliminate poverty, and address social, economic, and environmental issues worldwide. National policy-makers now face the challenge of implementing this indivisible agenda and achieving progress across the economic, social and environmental dimensions of sustainable development world-wide. As the process moves towards implementation, there is a need to address the scope and systemic nature of the 2030 Agenda and the urgency of the challenges.

This requires a wide range of tools and science-based analysis to navigate that complexity and to realize the ambition. In fact, to achieve the SDGs, a robust monitoring and assessment system is essential to track progress and identify areas that require urgent attention.

This review focuses on the content of monitoring and assessment methodologies for both global and national scales, aiming to highlight successful practices and potential challenges.

A comprehensive search was conducted across official reports, and publications from reputable organizations focused on sustainable development and academic databases.

At this stage, there are a number of recognized methodologies for monitoring and evaluating the achievement of the SDGs, which can be divided into two main categories, according to the 'scale of measurement': in this contribution, two reports on measurement and monitoring at the global scale and two reports on measurement and monitoring at the national/local scale are briefly referred to.

2.1 Measuring and monitoring progress in the implementation of the SDGs on a global scale

Each year, the United Nations publishes the "Sustainable Development Goals Report", which provides a comprehensive global assessment of progress in implementing the 2030 Agenda for Sustainable Development [13]. It uses the most up-to-date data and estimates to track progress towards the 17 Goals, including in-depth analyses of Goal-specific indicators, based on the global indicator framework for the SDGs, developed by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs). The Report highlights that a convergence of interconnected crises poses a significant threat to the success of the 2030 Agenda. These crises, such as the COVID-19 pandemic, climate change and conflict, have far-reaching impacts on various aspects of society, including food and nutrition, health, education, environment, energy poverty, peace and security, highlighting the severity and scope of these challenges. The Report identifies specific areas that require immediate attention to effectively address these problems.

While instruments such as the UN Report aim to provide an overview of all seventeen goals, it is interesting to highlight how several parastatal and private entities produce their own reports on specific SDGs. For the purpose of this contribution, we cite for example "The Energy Progress Report" [14], which is released annually by five major agencies responsible for monitoring the progress of SDG 7 and has emerged as the main global source of information on the achievement of SDG 7. This goal aims to ensure universal access to affordable, reliable, sustainable and modern energy for all. Agencies involved in producing the report include the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the United Nations Statistics Division (UNSD), the World Bank and the World Health Organization (WHO). This comprehensive report serves as a global synopsis for the international community, providing an overview of progress in areas such as energy access, energy efficiency, renewable energy, clean cooking and international cooperation in support of SDG 7. The report presents the most up-to-date statistics for energy access, energy efficiency, renewable energy, clean cooking and international cooperation. It presents the most up-to-date statistics for each of the indicators related to the goal. In addition, the report offers valuable policy insights, focusing on priority areas and actions needed to accelerate progress on SDG 7 and related Sustainable Development Goals (SDGs).

2.2 Measuring and monitoring progress in the implementation of the SDGs on a national scale

Similarly, at the national scale in Italy, the official monitoring of the progress of the achievement of the SDGs is entrusted by the Ministry of the Environment and Energy Security (MASE, formerly MATTM and MiTe) to the National Institute of Statistics (ISTAT), which each year publishes the "SDGs Report: Statistical Information for the 2030 Agenda in Italy" [15], with the aim of guiding users through the intricate system of statistical measures generated. In addition to tracking Italy's progress on the path to sustainable development,

the Report provides valuable thematic and analytical insights at both the regional and socio-demographic levels. Acknowledging the inherent complexity of sustainable development, the Report also presents an analysis of the interconnections between targets, sub-targets, indicators and statistical measures, included in a set of 55 national indicators, defined by the National Table for Sustainable Development. This ongoing effort fits with the progress in the production of statistical measures within the National Statistical System and the expansion of the 'mapping' of indicators proposed by the UN-IAEG-SDGs. For the purposes of investigating the territorialization of the 2030 Agenda at regional, metropolitan and municipal scales, it is also useful to mention the role played by the Alliance for Sustainable Development - AsviS, with its "ASviS Report. Italy and the Sustainable Development Goals" [16], which analyses the state of progress of our country with respect to the implementation of the 17 SDGs, on the basis of the evaluation of "composite indicators" (Istat, Ispra, UN, indicators of other bodies...) and illustrates an organic framework of proposals, pointing out the areas where action is needed to ensure the economic, social and environmental sustainability of territories.

2.3 Methodologies developed to support SDG7 in academic field

SDG 7 is a critical component of achieving all SDGs. The primary objective of SDG 7 is to ensure universal access to energy, particularly for disadvantaged populations, while simultaneously promoting a global shift towards utilizing low-carbon energy sources. Energy, which is the capacity to perform work, plays a fundamental role in transforming materials in economic activities to enhance the overall well-being of society.

Several studies in the scientific literature have highlighted the need to develop effective methodologies for monitoring and evaluating the achievement of the SDG7 targets, defined as (7.1) ensuring universal access to affordable, reliable and modern energy services, (7.2) increasing the share of renewable energy, (7.3) doubling the global rate of energy efficiency improvement, (7.a) strengthening international cooperation on clean energy research and technology, and (7.b) expanding infrastructure and developing technologies.

According to Matthew J. Burke and Rigo Melgar [17], the goals outlined in SDG7 strongly emphasize the use of technological solutions, particularly energy efficiency and renewable energy. The authors developed a methodology to compare how SDG7 places a significant emphasis on the adoption of advanced technologies to promote energy efficiency and renewable energy sources, while at the same time predicting a significant reduction in the correlation between economic growth and energy consumption. These goals combine the sustainable expansion of energy systems with an equitable distribution and effective allocation of energy resources and services, being more effective and beneficial if implemented as an integrated policy framework, rather than being treated as separate measures.

Andrea A. Eras-Almeida and Miguel A. Egido-Aguilera [18], emphasize the importance of achieving SDG7 particularly for the most vulnerable regions such as small islands and rural areas in developing countries. Both small islands and rural areas face numerous difficulties, including limited access to essential goods and services such as energy, isolation from markets, scarcity of human resources, difficulty in achieving economies of scale, and other obstacles to development. In their research work, they developed a methodology to study the role of off-grid energy systems for fragile contexts, based on an extensive literature review and the construction of a set of indicator tables to assess access to household electricity supply, overall renewable energy capacity, categorization of off-grid applications and consumption of hybrid business models in vulnerable contexts.

Maria Canepa, Adriano Magliocco and Nicola Pisani [19] developed an analytical platform that uses artificial intelligence, geo-referenced data and automated analysis to define the characteristics of urban contexts and identify parameters and solutions to respond to the effects of climate change in the urban environment, considering risk levels and settlement types. The methodology is based on a data-driven approach, starting with the choice of essential indicators for the metropolitan city of Genoa, taking into account development trajectories and key sectors (derived, for example, from SWOT analyses provided by the municipalities). This methodology makes it possible to identify trends associating validated indicators with different macro-level objectives, as the SDGs are correlated with KPIs that could describe different scenarios and be associated to define a trend.

The methodologies described above contribute to understand the connection existing between the need to associate performance indicators referable to the technologies employed, to the impacts from a socio-

economic point of view, especially in those fragile contexts such as inner areas (context investigated in the research proposal of this contribution), relating the Agenda 2030 sustainable development goals and their measurability through the indicators of specific targets, but also providing a method (descriptive, infographic, communicative, digital...) to return the results of these observations and thus give useful guidelines to the stakeholders in the energy, policy-makers, planner and designers and the communities themselves.

However, with regard to the contribution that new instruments, such as Renewable Energy Communities for fragile and peripheral territories such as inner areas, can make to the objectives of carbon neutrality, energy self-sufficiency and the fight against energy poverty, it may be useful to develop an original methodology, which 'forces' and highlights more the link between 'efficiency' indicators (linked to the technologies used) and 'effectiveness' indicators, linked to the socio-technical context and their positive impact on communities and places.

3. Materials and method

In this paragraph, the section 3.1 clarifies the general methodological approach referring to the development and construction of the SDG assessment framework (Fig.4), while the following sections (Sections 3.2) illustrate the application on case studies.

3.1 Methodological approach

The methodology adopted constitutes an experimental approach aimed at formulating an integrated assessment system, in order to validate the effectiveness of Renewable Energy Communities and their positive impact in addressing carbon neutrality and triggering regenerative processes (technological, environmental, economic, social). For the construction of the methodology, the study of the research contribution of C.H. Gebara and A. Laurent [20] was helpful.

The methodological framework consists of three interrelated macro-steps: *a) Methodological steps, b) Assessment framework, c) Output from the application.*

The first step (a) constitutes a literature review of existing indicators, both for SDG7 targets (effectiveness indicators) and for technologies for renewable energy production, distribution, storage, and consumption (efficiency indicators). At this "literature review of indicators" stage, all indicators referable to Goal 7 and RES technologies are considered. Criteria for selecting indicators are then established, thus generating an "integrated list of indicators," i.e., those that are really useful for the assessment of technological performance and impact performance (outcome), including from the socio-economic point of view. At this first step, in order of methodological process, two sets of recommended indicators for SDG7 (and its targets 7.1, 7.2, 7.3, 7.a and 7.b) and energy technologies, respectively "Socio- and techno-economic indicators" (Fig.5) and the "Performance indicators related to technology used" (Fig.6), can be defined in step b).

Figure 4. Construction of methodology framework. Source: elaboration by G.Mangano (2023)

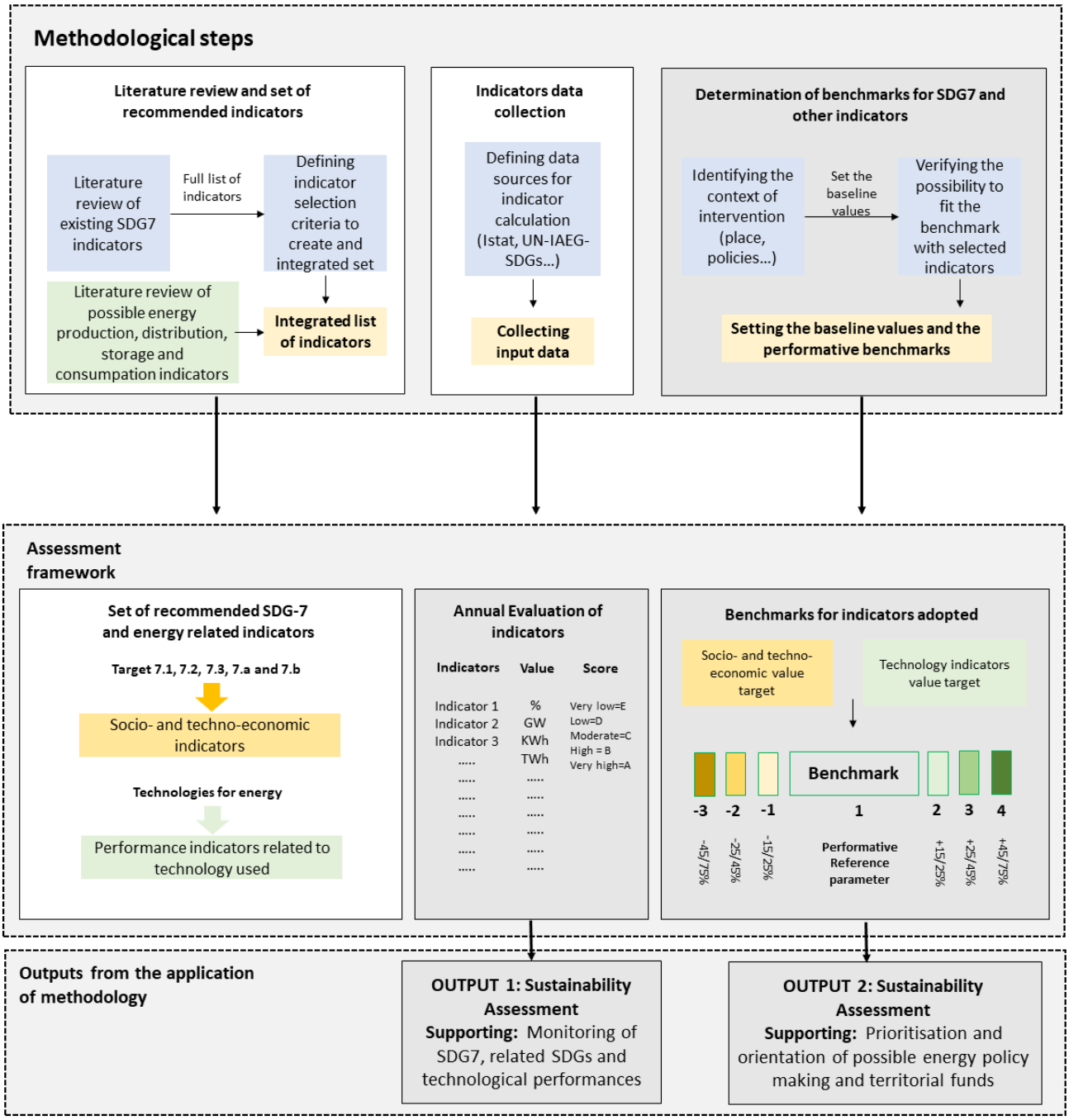


Figure 5. SDG7 targets and indicators considered. Source: elaboration by G.Mangano (2023)

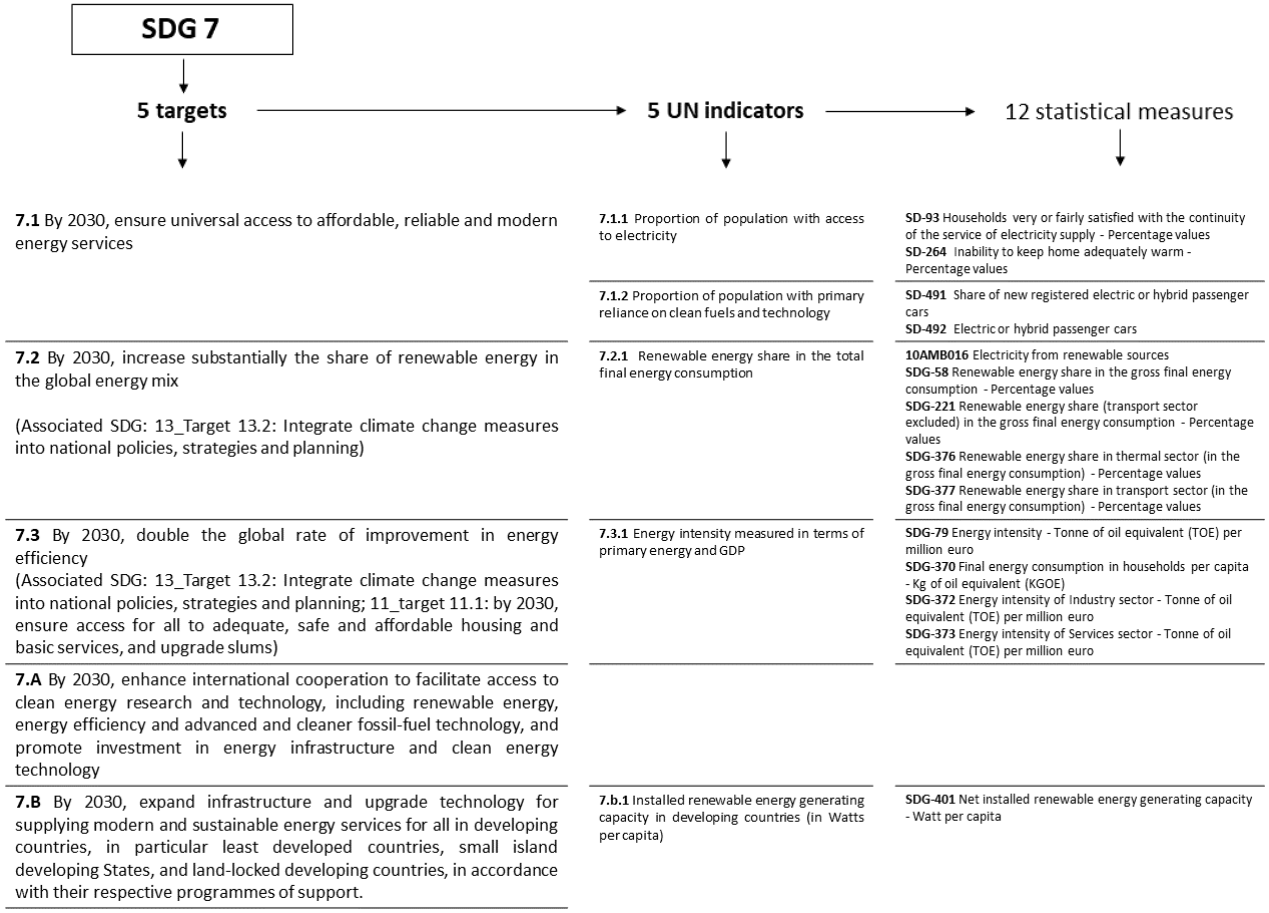
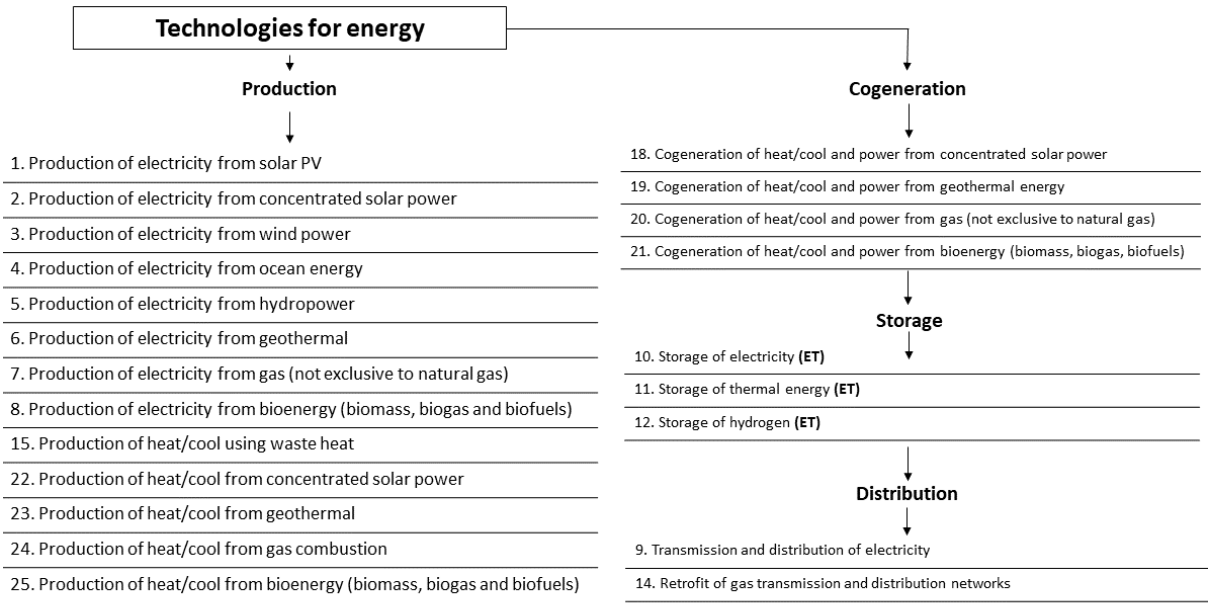


Figure 6. The 25 energy sectors classified by type. Source: adapted Mangano (2023) on EC (2020)



The source for the quantitative measurement of the indicators can be traced to the recognized systems and databases already used by the above-mentioned national and public institutes (Istat, UN-IAEG-SDGs, ISPRA), thus constituting an "input" data collection for the chosen indicators. The numerical evaluation of

these indicators takes place with "annual period" and will allow to populate each individual indicator both quantitatively (value on units, e.g. %, GW, KWh, etc...) and qualitatively by assigning a score relative to the relative weight that the individual indicator has on the whole set (Very low=E, Low=D, Moderate=C, High=B, Very high=A). The assessment process at the methodological level, concludes with the determination of benchmarks for the SDG7 indicators: at this stage, first of all, it turns out to be necessary to identify the context of intervention (place, policies, etc.), as each context may establish (from the point of view of the regulatory instruments in place, for example), different benchmarks; then, the basic benchmark values are set and the possibility of "populating" these benchmarks with the selected indicators is checked. This process becomes important for defining baseline values and performance benchmarks (e.g., expected installed PV power, amount of energy from PV, CO2 emission reduction relative to context, and so on..). The benchmarks for the adopted indicators will also constitute the "target values" for socio-technical and economic indicators and for technological indicators. In order to provide a comprehensive assessment of whether the benchmark is met (or not), a score is established for the level of contribution that the case study/project investigated are able to make to the specific indicator, according to a numeric scale, related to incremental or decreasing percentage of matching the indicator itself. The benchmark level is fixed as “1”, the incremental levels from 1 to 3, while decreasing from -1 to -3, according to scale of percentage.

The application of this assessment methodology, in the case of Renewable Energy Communities, allows for two outputs:

- *Output 1)* Sustainability Assessment for supporting monitoring of SDG7, related interconnected SDGs (e.g. SDG9, SDG11, SDG13) and technological performances. This output narrowly defines the contribution of RECs to the achievement of the SDG7 targets of Agenda2030 and the interconnected SDGs, among which certainly to be identified in the targets related to technological innovation, research, infrastructure and combating climate change. Each of the Sustainable Development Goals is inherently interconnected, forming a cohesive and interrelated set of global priorities and objectives. Recognizing the diverse spectrum of both favorable and unfavorable interactions between these SDGs is essential to fully harnessing their potential on a global scale. It ensures that advancements in certain areas do not come at the detriment of progress in other domains. The dynamics of these interactions, including their nature, strengths, and potential impacts, heavily rely on the specific context in which they are applied.
- *Output 2)* Sustainability Assessment for Supporting prioritization and orientation of possible energy policy making and territorial funds (RFF, ORP 21-27, Horizon Europe, etc.). The chosen policy options and strategies pursued play a critical role in shaping the outcomes and implications of these interactions.

3.2 Methodology application on three study cases

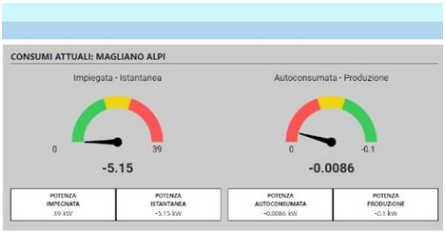
Below, we present the results of the application of the above methodology, in order to evaluate its effectiveness, on no.3 case studies in inner areas:

- no.2 national case studies for output 1, with the RECs "Energy City Hall", Magliano Alpi (Ita) and "Berchidda Energy 4.0" (Ita);
- no.1 local case study for output 2, with the ongoing experimentation for the activation of a Living Lab in the Grecanica Area, within the project-research Tech4You (see acknowledgements).

The case studies and applied assessment methodology are presented in the form of fact sheets with original information structure by the authors.

3.2.1 Study cases application for output 1- Sustainability Assessment - Monitoring of SDG7, related SDGs and technological performances

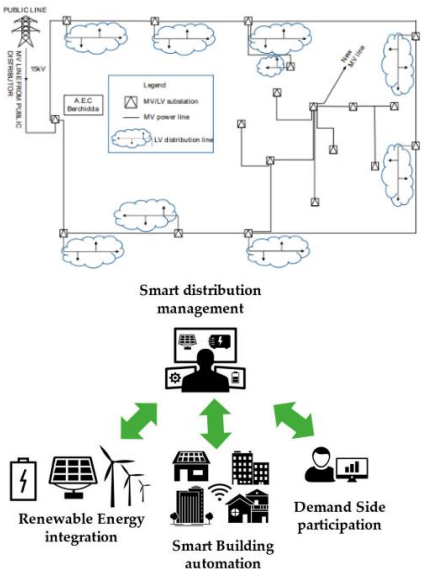
Case Study 1. REC "Energy City Hall" (Magliano Alpi, Cuneo, Ita)



IDENTIFICATION SECTION	
Location: Magliano Alpi (Cuneo, Italy)	
Year: 2020	
Population: 2166 inhabitants (up to date 31-12-2020)	
Management model: Energy Community made up of Municipality of Magliano Alpi, the Public Library, the gym, the school and n.4 residents	
TECHNOLOGY USED	
- 20Kwp photovoltaic plant on the roofs of the Town Hall - Connection PODs for energy sharing - Electric Vehicles (EV) recharging stations - IoT platform for real time energy management and monitoring (Energy4Com support)	
PERFORMATIVE INDICATORS	**Benchmark**
Energy Production: 24 MWh by photovoltaic system	1,5
Energy demand coverage: 7 households of which three municipal 3 households and 1 small handicraft enterprise	1,5
SOCIO-, TECHNO-ECONOMIC IMPACTS	
- Building retrofit	2
- Processes of local development	
- Local short supply chains with a strong cognitive and technological value	2 1
- Free services for residents (EV charge, energy sharing)	2

SDG7 – CONTRIBUTIONS ON INDICATORS	Score
7.1.1 Proportion of population with access to electricity	C
7.1.2 Proportion of population with primary reliance on clean fuels and technology	C
7.2.1 Renewable energy share in the total final energy consumption	C
7.3.1 Energy intensity measured in terms of primary energy and GDP	B
7.b.1 Installed renewable energy generating capacity in developing countries (in Watts per capita)	N.a.
Level of Contribution on other SDGs	
SDG9 C **SDG11** B **SDG13** B	
Figures above: PV plant and energy monitoring platform. Source: https://cermaglianoalpi.it	

Case Study 2. REC "Berchidda 4.0" (Magliano Alpi, Cuneo, Ita)



IDENTIFICATION SECTION	
Location: Berchidda (Sassari, Italy)	
Year: 2019	
Population: 2688 inhabitants (up to date 31-08-2020)	
Management model: Energy Community made up citizens, Sardegna Region, Department of Engineering and Electronic University of Cagliari	
TECHNOLOGY USED	
- 200 photovoltaic plants with >1500 kWp of power - Storage systems with a capacity of 50 kW/50kWh - Smart Home Systems (smart box) for energy monitoring	
PERFORMATIVE INDICATORS	**Benchmark**
Energy Production: - solar energy production of about 3 GWh/year	3
Energy demand coverage: Local self-consumption >50%	3
SOCIO-, TECHNO-ECONOMIC IMPACTS	

- Activation of 30 pilot projects on existing pv systems for self-consumption promotion and community engagement	2
- 620,000 € savings (-50% public cost of energy) and 30% energy bill reduction	3

SDG7 – CONTRIBUTIONS ON INDICATORS	Score
7.1.1 Proportion of population with access to electricity	B
7.1.2 Proportion of population with primary reliance on clean fuels and technology	B
7.2.1 Renewable energy share in the total final energy consumption	B
7.3.1 Energy intensity measured in terms of primary energy and GDP	B
7.b.1 Installed renewable energy generating capacity in developing countries (in Watts per capita)	N.a.
Level of Contribution on other SDGs	
SDG9 B **SDG11** B **SDG13** A	
Figures above: PV panels for REC on roofs and Smart distribution management of the local energy community resources. Source: web search	

3.2.2 Study cases application for output 2-Sustainability Assessment for Prioritisation of policies and public funds to create a REC

For output 2, we will use the illustrated methodology to guide choices in the pre-design phase of a Living Lab for the establishment of a REC. at the Municipality of Bova (Reggio Calabria, Ita), as part of Pilot Project 4.7.1 - "Open platform "phigital space" (physical and digital) of the type "user profiling" for the advanced and dynamic codesign of interventions on the built and ex novo" within the Tech4You research project.

Case Study 3. Experimentation in the Grecanica Area: Living Lab in Bova

IDENTIFICATION SECTION
Location: Bova (Metropolitan City of Reggio Calabria, Calabria, Italy)
Year: 2023-in progress
Population: 400 inhabitants (Istat data 2021)
Surface: 46,94 km^2
Population density_ 8,52 inhab./km^2

Altitude: 820 m a.s.l.

Inner Areas classification: F-Ultra Peripheral

Management model proposed: Living Lab for the activation of a Renewable Energy Community

TECHNOLOGY TO BE PROPOSED

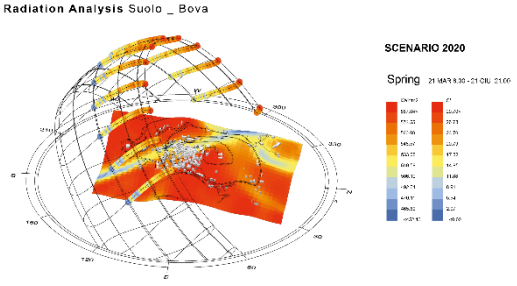
- Photovoltaic with innovative organic cells (high capacity)
- Eolic turbines
- Biomass

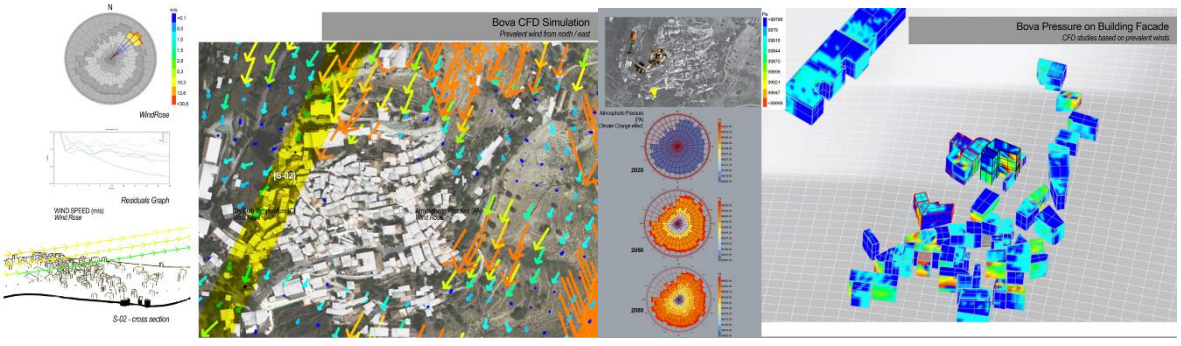
PERFORMATIVE INDICATORS	Benchmark
Production of electricity from solar PV	
Production of electricity from wind power	
Production of electricity from bioenergy (biomass)	n.a.
Storage of electricity	
Transmission and distribution of electricity	

SOCIO-TECHNO-ECONOMIC IMPACTS EXPECTED

- Processes of local development
- Free services for residents (EV charge, energy sharing)
- Process of community awareness on environmental safety
- Challenge of Energy Poverty for public goods
- Public Building retrofit

n.a.





SDG7 – CONTRIBUTIONS ON INDICATORS	Score
7.1.1 Proportion of population with access to electricity	N.a.
7.1.2 Proportion of population with primary reliance on clean fuels and technology	N.a.
7.2.1 Renewable energy share in the total final energy consumption	N.a.
7.3.1 Energy intensity measured in terms of primary energy and GDP	N.a.
7.b.1 Installed renewable energy generating capacity in developing countries (in Watts per capita)	N.a.
Level of Contribution on other SDGs	
SDG8, SDG9, SDG11, SDG13, SDG17	
Figures above: Mangano G., Draft Paper and ABITAlab elaboration for radiation, sunlight and windflow analisys (Grasshopers + Ladybug Tools), Action 8, M1, Activities 1 for Spoke 4, PP 4.7, Tech4You, PNRR, march 2023	

At this step, the aim is to understand whether such an assessment methodology is useful in guiding working trajectories for capturing public integrated spatial investments that may come from competitive opportunities or funding devices such as the EU Recovery Fund or RePower EU for instruments such as Energy Communities. The fact sheet below is therefore the result of the analytical study phase of those data useful for the construction of the set of indicators and analyses conducted by the ABITAlab research team on the scenarios and climatic and environmental factors, capable of being able to give indications on which renewable energy technologies to adopt.

4. Results and Discussion

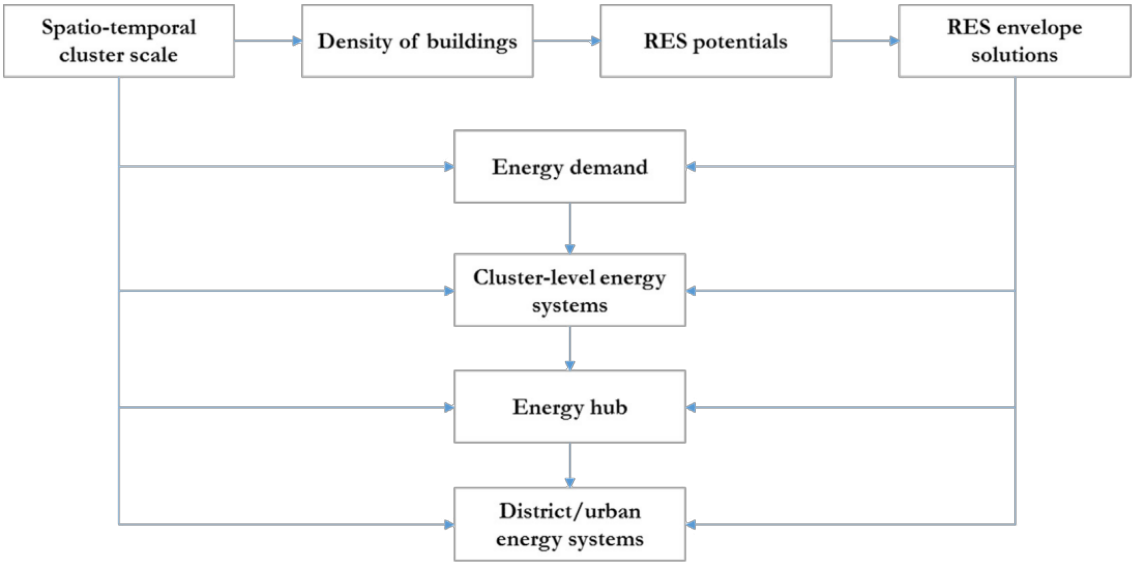
The discussion related to the results at this step, regard the performance effectiveness of energy technologies, suggesting to address the questions related to the time factor and the loss of performance of those technologies defined as "business as standard" in the medium and long term. In fact, following the methodological proposal of evaluating performance indicators of energy technologies, it is necessary to consider the evaluation of regenerative processes in the medium and long term related to technologies using renewable sources: the most popular ones, such as photovoltaics, have a performance in terms of energy production within 20 years. In deed for example, it is known that after 20 years, the efficiency of technologies raises the question of performance and thus, in turn, the ability to generate a positive impact. Nowadays

The most innovative RES solutions must be able to offer potential opportunities for energy savings and improvement of the environmental quality of the interior space, using those distribution technologies that can make the system adaptable and integrable, multi-operational, expandable, in order to combine the complementary beneficial aspects of active and passive technologies in the building envelope (Fig.7). In fact, the high-performance hybrid building with positive building requirements is realized, which will be referred to below. Solar energy and solar heat are usually energy generators for buildings, while energy-efficient solutions help to reduce energy use in the buildings themselves; they, as well as devices, technologies, spaces and infrastructures, become nodes of the energy HUBs of the smart grid. "(...) The energy hub is a node of the urban energy system as a whole, with multiple energy carriers in and out and typically consists of a more elaborate and complex internal arrangement of components. The benefits of this close integration are identified as increased reliability, load flexibility and efficiency gains through synergy effects, which are well suited to building clusters.

The energy hub is also seen as a practical way to offer more services through the sharing and interconnection of domestic devices, thus reducing the impact on carbon emissions. Thus, energy hub is not a single entity that contains all the necessary systems for energy transformation, conversion and storage, but a collection of individual energy consumers and producers distributed over an area (as reported on energy communities).

This allows the variable loads, systems and energy sources of multiple buildings to be taken into account in several alternative pathways" [10] [22].

Figure 7. Flow chart of the building cluster approach based on RES envelope solutions. Source: Applied Energy, 2018



It is therefore a matter of considering the performative contribution that can be made by so-called “emerging technologies”, defined as “[...] a set of technologies whose areas of development and application are still rapidly expanding, and their technical and value potential is still largely unrealised. Naturally, this leads to a vibrant innovation environment for these technologies” [21].

Among them, *energy storage technologies* are crucial for maintaining a high level of energy storage performance when systems are not in use. Indeed, new energy storage systems have started to be used by people in many sectors. Grid energy storage systems are needed to maximise the introduction of energy efficiency. The electrochemical energy storage system, known as the battery system, has enormous potential for grid energy storage. Energy storage methods can be used in various applications. Energy storage systems are grouped into five main categories: *mechanical, thermal, chemical, electrochemical and electrical energy storage.*

5. Future Trends

From this initial discussion, we can see how the terms of the issues related to production from renewable sources and the use of production technologies change, which, precisely because of their ability to respond "to changes in energy demand" (of other resource flows in general), must be much more open and responsive. Moreover, technologies as devices make all the parameters we have discussed, 'equipment' for production, exchange but also monitoring the efficiency and effectiveness of networks. The availability of processes and products from emerging technologies (sensors, virtuality, etc.), support this new dimension of control and operation, according to targets and performance levels dictated by the global and local demand for climate and hence carbon neutrality [22]. Also among the main aims of CERs is to establish new social innovation enterprises, in which citizens and small groups of producers, structures and knowledge centers participate, mediating and accelerating processes of participation and technology transfer. The sharing of the process and results of these activities transforms energy communities into "communities of place", where citizens can enjoy the co-benefits of their participation, and into "communities of interest", capable of sharing visions that go beyond the benefits themselves and that promote local development [23], also Distribution Technologies: from the cluster to the hybrid building through co-design and co-management practices of processes, projects and programs [2] [24].

Some considerations on future research scenarios can be made regarding the two outputs of the adopted methodology:

a) The methodology proves useful in understanding the progress of achieving the Sustainable Development Goals (SDG 7 and related) in order to understand the substantial contribution, including through technology push, of Renewable Energy Communities at the building and cluster scale (see output 1 of the methodology). In fact, each of the SDGs is inherently interconnected, forming a cohesive and interrelated set of global priorities and objectives. Recognizing the diverse spectrum of both favorable and unfavorable interactions between these SDGs is essential to fully harnessing their potential on a global scale. It ensures that advancements in certain areas do not come at the detriment of progress in other domains;

b) the methodology, in monitoring and verifying the traceability of sustainable development goals and the contribution of technologies in achieving carbon neutrality objectives, can provide interesting benchmarks to guide and prioritise integrated territorial investments for the creation of energy communities (RRF, Horizon Europe, etc.). The dynamics of these interactions, including their nature, strengths, and potential impacts, heavily rely on the specific context in which they are applied. The chosen policy options and strategies pursued play a critical role in shaping the outcomes and implications of these interactions. The underlying idea of this approach is that an analysis of interactions between various Sustainable Development Goal domains, informed by science, can greatly enhance decision-making effectiveness and ensure more coherent outcomes, as well as facilitate follow-up and monitoring of progress, which is currently lacking in the current practice.

Recognizing both potential trade-offs and synergistic relationships between different SDGs is of utmost importance in accomplishing lasting sustainable development results. The scoring methodology introduced here aims to foster a deeper science-policy dialogue regarding the significance of such interactions. It serves as a starting point for policymakers, stakeholders and researchers to establish their priorities and implementation strategies in public funds and policy-oriented projects (NRRP, Horizon Europe, ORP 2021-2027, RePower EU, Metro ONP). Furthermore, it encourages the engagement of the policy community in advancing knowledge in this field through continuous development and exploration. The impact of this methodology can certainly help guide action trajectories, which involve communities in decision-making and technology transfer processes, as illustrated in the case of feasibility studies for the start-up of the Living Lab in Bova, as a physical-digital space capable of triggering local development actions, which also leverage

sustainable development objectives and the need/objective of mitigating energy poverty and climate neutrality.

6. Acknowledgement

This contribution is partially supported by the ONP research project "Research and Innovation" 2014-2020, Action IV.6 "Research contracts on green issues", cod. G05, CUP C35F21001290002 and the research project Tech4You - PP 4.7.1 Open platform "phigital space" of the type "user profiling" for the advanced and dynamic codesign of interventions on the built and ex novo – Competitive academic research NGEU, MUR, PNRR - Spoke 4: Unibas, Unical, Unirc, CNR (2022-in progress), with the Scientific Responsibility of Consuelo Nava (dArTe UniRC).

Consuelo Nava is the author of the paragraph 'Introduction'. Giuseppe Mangano is author of the paragraphs "Literature Review" and "Materials and methods". C.Nava and G.Mangano are co-authors of the paragraphs "Results and Discussion" and "Future Trends".

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TRACK 4
Climate change and energy

4c. Climate, tourism and sustainable development

Abstracts

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Measuring the Carbon Footprint of a sample of accommodation facilities in Italy

Ioannis Arzoumanidis[1], Valentino Tascione[1], Luigi Ippoliti[1], Lara Fontanella[2], Luigia Petti[1], Andrea Raggi[1]
[1]Department of Economic Studies, University "G. d'Annunzio", Pescara, Italy. [2]Department of Legal and Social Sciences, University "G. d'Annunzio", Pescara, Italy

Abstract

Tourism is amongst the fastest growing economic sectors, with the number of international arrivals reaching 1.5 billion in 2019, an increase of almost 53% in the decade 2010-2019. Such a trend was abruptly interrupted by the COVID-19 pandemic, which has affected the entire planet. Indeed, according to the UNWTO, international tourist arrivals decreased by 73% for the year 2020 and by 72% for 2021 (when compared to 2019). However, in this sector an ever-growing attention has been paid to sustainability by various stakeholders over time, e.g., consumers or political decision-makers, as demonstrated also by the great number of financial incentives promoted to support sustainable initiatives. Such attention has been intensified also by the need to meet the United Nations Sustainable Development Goals (SDGs).

Currently, there are systems for labelling and measuring the environmental performance of services, but only few are based on a life cycle perspective; this represents a strong cognitive and communicative limitation of these tools. Online booking platforms have become one of the most common means of booking in the tourism sector, allowing managers to provide targeted information on their "offer package" and users to have an immediate and anticipated idea of the characteristics of the structure and related activities to their stay, and possibly personalise it. Information could be inserted within the platforms to guide the user in choosing ecological or "green" accommodation facilities.

This article explores the inclusion of Carbon Footprint (CF) as a possible life cycle-based indicator to be used in online booking platforms. It builds upon previous research of a literature review on life cycle-based sustainability and circularity indicators for the hospitality sector and addresses the CF of a selected sample of accommodation facilities in Italy. In order to do so, a non-probabilistic sampling strategy of the accommodations has been implemented for exploratory analysis, which is still ongoing. Each identified accommodation profile included its own characteristics and, therefore, peculiarities from a sustainability point of view. The sampled facilities were contacted for the necessary CF data collection and until now three of them agreed to collaborate. The three facilities were then assessed in terms of their CF, by using CF-specific software (CCaLC). The preliminary results so far highlighted the electricity consumption as one of the most impacting for the impact category of "climate change" as well as the necessity for measures towards promoting the importance of sustainability assessment amongst the accommodation facilities owners.

This article relates to the following SDG targets: 8.9, 12B, 13.3, 14.7 and the specific topic of the Conference as it aims at promoting the climate change (and sustainability) awareness not only for online booking platforms users (i.e., tourists) but also for accommodation facilities owners.

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Adapting Tourism Development to a Changing Climate: Impacts and Strategies.

Mrs Ashvini Ghatikar
Ramaiah University of Applied Science, Bengaluru, India

M R S A S H V I N I G H A T I K A R

Abstract

The tourism industry is highly dependent on natural resources and is therefore highly susceptible to the impacts of climate change. As climate change accelerates, it poses significant challenges to the tourism industry, affecting both natural and built environments. Therefore, it is essential to understand the impacts of climate change on tourism development and explore strategies to adapt to these impacts. This research paper examines the potential impacts of climate change on tourism development and offers strategies for adapting to these impacts. With the increasing awareness of climate change, it is necessary to understand how it affects tourism development in various areas. This study analyzes the potential impacts of climate change on tourism development, including changes in infrastructure, tourism activities, and visitor behaviour. Furthermore, this paper discusses various adaptation strategies that can be implemented to manage the impacts of climate change on tourism development. The findings emphasize the importance of sustainable tourism practices and highlight the need for effective strategies to mitigate the negative impacts of climate change on tourism development. This study concludes with recommendations for policymakers and tourism stakeholders on how to adapt and prepare for the future of tourism in the context of a changing climate. Overall, this paper provides valuable insights into the implications of climate change on tourism development and offers practical strategies to ensure sustainable tourism practices.

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Utilizing synoptic scale climate data within sustainable tourism development

Associate Professor David Perkins, Mr Susan Phuyal
Missouri State University, Springfield, USA

ASSOCIATE PROFESSOR DAVID PERKINS

Abstract

Tourism has great potential to be used as a tool towards achieving sustainable development. As seen in many communities, the appropriate implementation of sustainable tourism methods helps to establish local economic viability in concert with attentive treatment of both social and environmental systems. Maintaining such environmental and social integrity within a location is often the basis by which tourism demand is generated—drawing tourists from across the world. In light of environmental change within the Anthropocene, and in particular, climate change, special attention needs to be made when assessing both the long-term viability of a tourist destination and the social characteristics stemming from human interaction with local ecology. In this paper, I specifically address the use of climate information within Nepal where tourism in the Himalayas is driven by the human-nature interface and the unique culture which has developed in this alpine environment.

In doing so, I highlight how focusing on a synoptic scale climatological analysis can provide valuable information within a sustainable tourism development context. Proper utilization of weather and climate data at varying scales are of utmost importance for understanding development implications. For example, within tourism, long-term climate/change data can aid in decisions regarding infrastructure improvement and destination branding; shorter-term weather data can assist in forecasting tourist demand and allocating accessory resources. That said, literature has established that tourists operate in 'realms' of understood climatic comfort that might be readily described through synoptic-scale atmospheric phenomena. Here, I use geographically-calibrated synoptic scale climate descriptors such as 'humid cool' and 'warm humid' conditions. Data is obtained from the Spatial Synoptic Classification (SSC, v3) and the Gridded Weather Typing Classification (GWTC-2) and helps describe local climate and climate change.

Reviewing weather types like these helps provide a more complete picture of the interface changing climatic conditions might have within the context of tourists' interpretations of a location's weather and climate. In this particular research, I focus more on human (tourist) perceptions than actual environmental outcomes. While environmental systems are finely tuned, and perturbations such as one degree of temperature change can have devastating impacts, tourists react more to overall impressions of weather and climate conditions and are less personally attuned to such anomalies—particularly in shorter-term contexts. Analyzing weather and climate data within a tourist-centric synoptic-scale context provides a new and exciting perspective to more fully understand the weather, climate, and tourism nexus.

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Exploring the accesses to Serra da Estrela

Sofia Gouveia[1], Dr. João Joanaz de Melo[2], Eng. António Galvão[2]
[1]NOVA University Lisbon, Caparica, Portugal. [2]CENSE, NOVA University Lisbon, Caparica, Portugal

Abstract

Mountains are geographic and climatic barriers capable of isolating regions. For centuries, humans sought to access or overcome these barriers, building access and communication routes, for commercial reasons or, in modern times, for recreation and leisure.

Serra da Estrela is a granite mountain, a part of the central mountain range crossing the Iberian Peninsula, and is the highest point in mainland Portugal. The Serra da Estrela Natural Park is a protected area classified under the EU Natura 2000 Network. It holds unique natural resources and values.

Despite its great beauty and tourist potential, access to Serra da Estrela is insufficient. There is a road right to the top of the mountain (an uncommon feature in other mountain regions). However, due to the lack of public transport, car is the only practicable transport in the area, creating significant pollution, pressure in natural sensitive areas, and traffic congestion in all seasons; and additional problems in Winter, when roads at higher altitude pose significant risks or are cut due to heavy snowfall. This problems have been confirmed by online research and the results of a questionnaire given to visitors.

The main objective of this work was to study the problem of accessibility in Serra da Estrela and to contribute to its improvement. Methods included the research of similar cases at an international level, analysis of online visitation data, local population and visitor surveys, and interviews with municipalities and civic organizations.

Several initiatives were reviewed to improve accessibility to Serra da Estrela. The common principle was not to open new roads, but to allow better access and experiences to visitors, with less environmental impacts. The initiatives that were considered more viable in the short run were: the creation of a public bus shuttle network, combined with traffic restrictions and tolls on road access to sensitive areas; and the use of pack animals to support visitation. Other projects which merit further study include the creation of a funicular to bypass the most congested roads, and a mountain railway along the beautiful Zêzere river valley.

This study generated significant interest with local organizations and authorities, and is expected to help promote a more sustainable development in the region.

Keywords: accessibility in mountain regions; sustainable tourism

Full Papers

Measuring the Carbon Footprint of a sample of accommodation facilities in Italy

Ioannis Arzoumanidis[1,*], Valentino Tascione[1], Luigi Ippoliti[1], Lara Fontanella[2], Luigia Petti[1] and Andrea Raggi[1]

[1] Department of Economic Studies, University "G. d'Annunzio", Viale Pindaro 42, 65127, Pescara, Italy
[2] Department of Legal and Social Sciences, University "G. d'Annunzio", Viale Pindaro 42, 65127, Pescara, Italy

[*] Corresponding author: i.arzoumanidis@unich.it

Abstract. Tourism is amongst the fastest growing economic sectors, with the number of international arrivals increasing by almost 53% in the decade 2010-2019, a trend which was interrupted by the COVID-19 pandemic: international tourist arrivals decreased significantly in 2020-2021. However, in this sector an ever-growing attention has been paid to sustainability by various stakeholders over time, which has been intensified also by the need to meet the United Nations Sustainable Development Goals. Online booking platforms have become one of the most common means of booking and reliable and concise information within them could guide the user in choosing more environmentally friendly or "green" accommodation facilities. This article explores the inclusion of Carbon Footprint (CF) as a possible life cycle-based indicator to be used in online booking platforms by addressing the CF of a selected sample of accommodation facilities in Italy. For this purpose, a non-probabilistic sampling strategy has been implemented for exploratory analysis. Each identified accommodation included its own peculiarities from a sustainability viewpoint. Three of them agreed to collaborate and were then assessed in terms of their CF, by using CF-specific software. The results so far highlighted the energy consumption as one of the most impacting aspects.

1. Introduction

Tourism is amongst the fastest growing economic sectors, with the number of international arrivals reaching 1.5 billion in 2019, an increase of almost 53% in the decade 2010-2019 (Statista, 2022). Such a trend was abruptly interrupted by the COVID-19 pandemic, which has affected the entire planet. Indeed, according to the UNWTO, international tourist arrivals decreased by 73% for the year 2020 and by 72% for 2021 (when compared to 2019) (UNWTO, 2023). However, in this sector an ever-growing attention has been paid to sustainability by various stakeholders over time, e.g., consumers or political decision-makers, as demonstrated also by the great number of financial incentives promoted to support sustainable initiatives (Arzoumanidis et al., 2021; Italian Ministry of Tourism, 2023). Such attention has been intensified also by the need to meet the United Nations Sustainable Development Goals (SDGs) (United Nations, 2016).

Currently, there are systems for labelling and measuring the environmental performance of services, but only few are based on a life cycle perspective (Arzoumanidis et al., 2021); this represents a strong cognitive and communicative limitation of these tools. Online booking platforms have become one of the most common means of booking in the tourism sector (Arzoumanidis et al., 2022), allowing managers to provide targeted information on their "offer package" and users to have an immediate and anticipated idea of the characteristics of the facility and activities related to their stay, and possibly personalise their stay. Objective and concise information could be inserted within the platforms to guide the user in choosing more environmentally friendly or "green" accommodation facilities (Chaw and Tang, 2019; Arzoumanidis et al., 2022).

This article explores the inclusion of Carbon Footprint (CF) as a possible life cycle-based indicator to be used in online booking platforms. It builds upon previous research of a literature review on life cycle-based sustainability and circularity indicators for the hospitality sector (Arzoumanidis et al., 2021; Arzoumanidis

et al., 2022) and addresses the CF of a selected sample of accommodation facilities in Abruzzo, Italy. For this purpose, a non-probabilistic sampling strategy has been implemented for exploratory analysis (Galloway, 2005), which is still ongoing. Each identified accommodation profile included its own characteristics and, therefore, peculiarities from a sustainability point of view. The sampled facilities were contacted for the necessary CF data collection and until now three of them have agreed to collaborate. The overnight staying at the three facilities was then assessed in terms of their CF, by using CF-specific software (CCaLC) (Manchester University, 2023).

The article is structured as follows: in Section 2, the literature review basis is briefly presented; in Section 3, the procedure of the selection of the sample is described; then, the studies of the three tourism facilities are described in terms of the methods used and analysis performed; the results of the studies are presented and discussed in Section 4; finally, in Section 5 some conclusions are drawn and future development possibilities are outlined.

2. Literature Review

The previously published literature review (Arzoumanidis et al., 2021) explored the use of life cycle-based sustainability and circularity-related indicators for the hospitality sector. The results discerned sustainability indicators from the life cycle-based and the circularity indicators in the sense that the sustainability ones also included socio-economic and sociocultural aspects. These indicators have been suggested by international organisations/frameworks and have been examined thoroughly by the scientific community for the tourism industry, but they were not specifically addressed for the hospitality subsector. Life cycle-based sustainability indicators for the tourism industry in general were also little tackled, which was also valid for the hospitality subsector (ibid.). Amongst the indicators, carbon footprint/climate change was largely mentioned to be used as a life cycle-based sustainability indicator for tourism/hospitality, either alone (as a proxy) or amongst other indicators (ibid.). For this reason, this article focusses on examining CF as a possible life cycle-based indicator to be used in online booking platforms for the hospitality sector. Other Life Cycle Assessment indicators included acidification and nutrient enrichment/eutrophication. On the other hand, the circular tourism literature was found to mostly focus on practices rather than their evaluation, with the most commonly mentioned circularity indicators being recycling rate and waste-related indicators. Finally, the literature proposed that an impact assessment of hotel services could be performed following a circularity strategy, e.g., durable vs. single-use (ibid.).

3. Methodology

3.1. Selecting a sample of accommodation facilities

The selection of the sample of accommodation facilities was performed by implementing a non-probabilistic sampling strategy for exploratory analysis (Galloway, 2005), which is still ongoing. Such a process started with a census of all types of facilities (e.g., guesthouses, vacation rentals, Bed & Breakfasts, hotels, country houses, hostels, shelters, residences and farmhouses) in order to have the complete picture on the tourist offer (Abruzzo turismo, 2023).

Following a qualitative and numerical assessment of the facilities and based on the overarching objective of the project, the field of research was limited to B&Bs, farmhouses and (three- to five-star) hotels.

The selection of the municipalities, in which the facilities to be contacted were selected, was performed whilst trying not to concentrate facilities in specific areas whilst leaving out others.

For the choice of municipalities, the initial condition was that they fall within areas of high cultural heritage value (Italian National Institute of Statistics, 2023), which was prerequisite of the overarching project. These were defined as (Italian National Institute of Statistics, 2023): municipalities characterised by the presence of at least one UNESCO site, and/or a village certified by the Association "*I Borghi più belli d'Italia*" ("the most beautiful villages in Italy" – Bacilieri, 2022), and/or Orange Flags of the Italian Touring Club (Italian Touring Club, 2023), and/or that are part of a National Park, and/or that has been Capital of Culture, and/or with at least 10,000 visitors per year to a state or non-state museum, monument or archaeological site as of 2018.

In the next step, the statistical sampling method was used to identify the facilities within those municipalities of a high cultural heritage value. The regional territory was divided into four altitude ranges

through stratification: plains/hills (0-350 m above sea-level), foothills (350-600 m above sea-level) and mountains (stratified in turn into 600-1000 m above sea-level and over 1000 m above sea-level).
Within these strata, a total of 6 municipalities were selected, in which 12 facilities to be chosen (a minimum statistical sample that can be considered acceptable).

In stratum I, the Municipality of Pescara was chosen, given that it is the most representative municipality of the hotel supply in the stratum but also in the region. Pescara was considered important in terms of magnitude of tourist flows as well as being the regional barycentre from a tourism point of view. The city is also characterised by the presence of tourism-related infrastructure, such as large train station and an airport, which is located 7 km away from the city centre.

In stratum II, the municipality of Sulmona, which is part of the Majella Park, is a UNESCO Geopark. It is a city of about 23000 inhabitants and rich in cultural attractions.

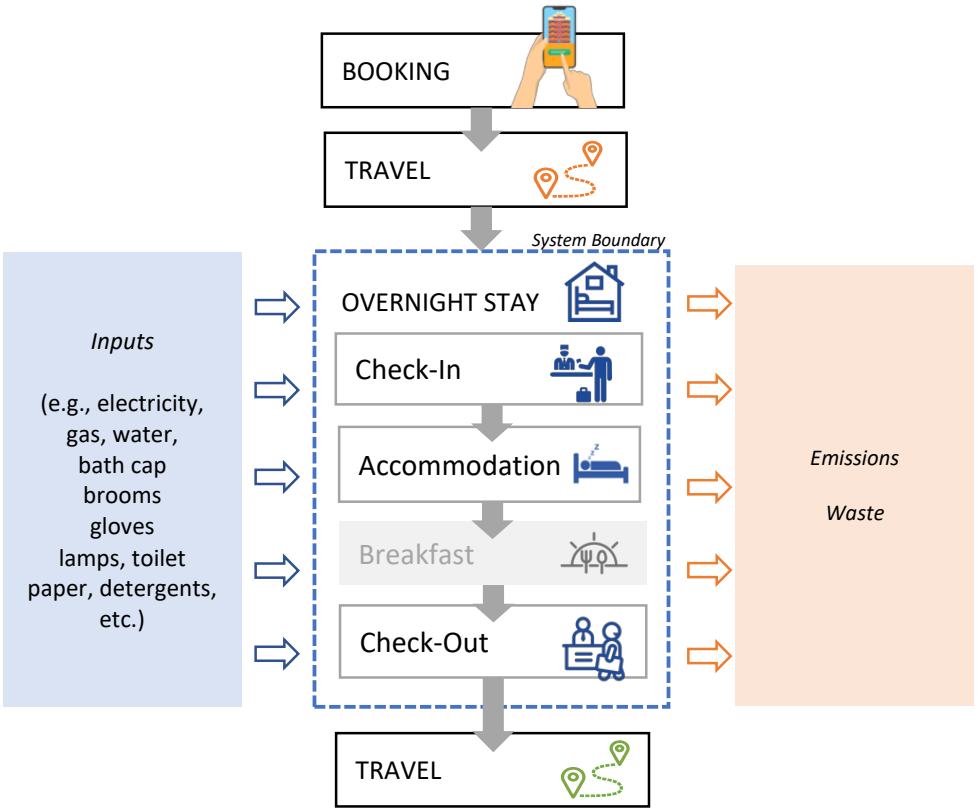
Two municipalities were selected in stratum III: Villetta Barrea and L'Aquila. The former is an important tourist destination located within the "Abruzzo, Lazio and Molise" National Park. On the other hand, L'Aquila is the regional capital. A high number of accommodation facilities (the highest in Abruzzo) and a wide range of cultural offerings are located in this city.
Two municipalities were also chosen in stratum IV, both of which are part of "*I Borghi più belli d'Italia*" ("The most beautiful villages in Italy") designation. The first was Santo Stefano di Sessanio, a town that is part of the "*Gran Sasso and Monti della Laga*" National Park, characterised by the presence of a luxurious *Albergo Diffuso* hotel. The second place was Scanno, which has acquired the Touring Club's Orange Flag and is part of the "Abruzzo, Lazio and Molise" National Park, hosting the UNESCO World Heritage-listed beech forests. It also boasts a centuries-old goldsmith tradition.

The selected municipalities were then examined in terms of all the accommodation facilities that are present within their territories. The facilities were then contacted by the Authors to ask for their interest in participating in the environmental sustainability assessment by providing all the necessary data. So far, three facilities have agreed to collaborate (one from Sulmona, one from Santo Stefano di Sessanio and one from Scanno).

3.2. Carbon Footprint: Goal and Scope Definition and Life Cycle Inventory

The 3 analysed accommodation facilities include: a 1-room Bed & Breakfast (BB A), a 5-room Bed & Breakfast (BB B), and a 29-room hotel (Hotel), all situated in the region of Abruzzo, Italy (please refer to Section 2). The data collection for all three facilities was carried out with reference to the year 2019 in order to avoid any bias attributable to the COVID-19 pandemic. In line with the scientific literature (e.g., Soratana et al., 2021), the functional unit (FU) was defined as an overnight stay (1 night) of a guest, including all related activities (reception/check-in, accommodation in the room, check-out, maintenance/cleaning), with the exception of the breakfast service. Figure 1 shows the boundary of the system under analysis that was considered in all three cases.

Figure 1. System boundary (elaborated by the Authors).



The data collection was carried out at directly the facilities by using specific questionnaires and data collection forms. As regards the material inputs (different for each facility), the following consumptions were taken into consideration: laundry detergent (the service is performed directly on site for "BB A" and "BB B", whilst it is performed externally for "Hotel"), cleaning detergent, bleach, floor rags, brooms, gloves, shampoo, soap, toilet paper, disposable plastic cups, bath caps, sewing kits, light bulbs, paper used in reception. These consumptions were quantified on the basis of purchases made in the reference year, assuming that all the materials purchased were consumed in the same period of time (without an increase/decrease in stocks), whilst data were provided also for the external laundry as well as the related transport. The values were then normalised to the single overnight stay by considering the total number of overnight stays during that year.

On the other hand, with regard to energy inputs, the consumption of electricity and natural gas were taken into consideration. Finally, water consumption was also taken into account. For water, electricity and gas, for facilities "BB A" and "BB B" and given that they are small and without additional services (e.g., restaurant, swimming pool, etc.), the consumption that was taken directly from the supply bills was used (for the reference year), without making any allocations. When it comes to the "Hotel" facility, however, a 15% decrease in the total billed consumption was performed (Hotel Energy Solutions, 2011). Finally, all packaging materials and waste with the related destinations (e.g., landfill, recycling, etc.) were considered. With regard to packaging, the three facilities provided information on the type of material used as well as on the mass (in the few cases where the mass was not indicated, estimates were used: in any case, since these are minimal quantities, they could possibly be also excluded, by implementing a 99% cut-off −please refer to ISO 14040:2006 (ISO, 2006a) and 14044:2006 (ISO, 2006b)).

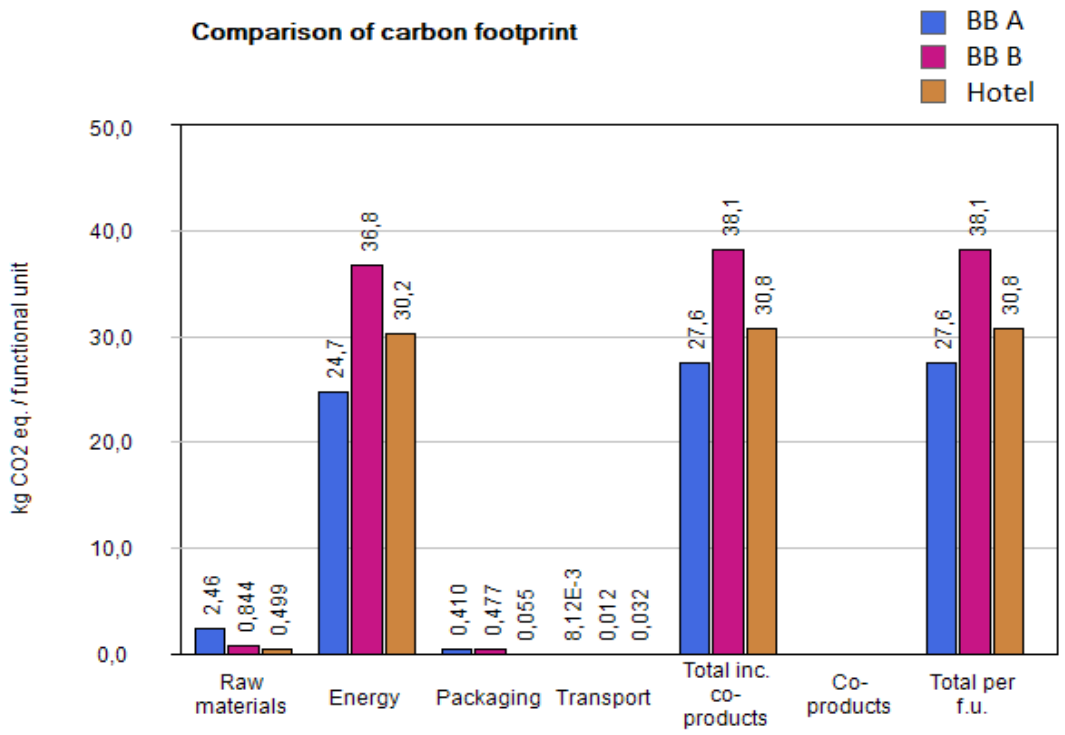
As far as the transport of the various inputs from the supply points to the locations of the facilities are concerned, in the case of "BB A" the owners used their own passenger car for a distance of 3 km, whilst for "BB B" a 3.5-tonne truck was used for long distances (e.g., 60-80 km) and their own car for shorter ones (approximately 30 km); finally, for "Hotel" all transport was carried out using a small van (the distance is 60 km). In all cases, the owners of the facilities have also indicated, for each means of transport, the European reference standard relating to polluting emissions from vehicles (e.g., EURO5).

Subsequently, the collected data was entered into the CCaLC software, using its incorporated database, paying the utmost attention to select, amongst the processes present in the database, the most relevant to those identified during data collection. No problems were highlighted during this operation: indeed, all the relevant processes were identified in the database. Nonetheless, for the case of soap, shampoos and detergents, these had to be aggregated under the same entry "soap", given that the software did not provide differentiated entries.

4. Results and Discussion: Carbon Footprint Life Cycle Impact Assessment and Interpretation

The CCaLC software calculations follow the international ISO 14044:2006 (ISO, 2006b) and PAS2050 (BSI, 2011) standards and provide the characterisation results for the environmental impact category "climate change"/ CF. The CF results (Figure 2) showed that it is "BB B" to reach the highest total CF score (38.1 kg CO_2-eq per FU), which strongly depended on energy consumption (36.8 kg CO_2-eq per FU) and to a lesser degree on the other inputs (called "raw materials" in CCaLC) (0.844 kg CO_2-eq per FU) and packaging (0.477 kg CO_2-eq per FU). The second-highest CF score derived from "Hotel" of 30.8 kg CO_2-eq per FU, which once again mainly depended on energy consumption (30.2 kg CO_2-eq per FU). Finally, "BB A" reached a total of 27.6 kg CO_2-eq per FU, which also depended mostly on energy consumption (24.7 kg CO_2-eq per FU). Such a value for the total CF is higher than the global average of 14 kg CO_2-eq per FU found in the scientific literature (Gössling and Lund-Durlacher, 2021); this can be justified by the fact that the area under analysis is a mountainous region that requires the facilities to consume high amounts of energy for heating during wintertime.

Figure 2. Carbon Footprint comparison of the three facilities (extracted from the CCaLC software; elaborated by the Authors).



Indeed, a more in-depth analysis of the CF of the three facilities in terms of energy consumption was performed to confirm that. As Figures 3-5 demonstrate, for all three facilities (irrespective of the type of accommodation) it is the consumption of natural gas, which is mainly used for heating, to have the greatest impact in terms of CF: 17.6 kg CO_2-eq per FU for "BB A", 32.8 kg CO_2-eq per FU for "BB B", and 28.1 kg CO_2-eq per FU. Such findings confirm the importance of energy consumption in CF and, more in general, in Life Cycle Assessment (LCA) studies in the hospitality sector (e.g., Filimonau, 2016; Nofriya, 2022).

Figure 3. Carbon Footprint related to the energy consumption of "BB A" (extracted from the software; elaborated by the Authors).

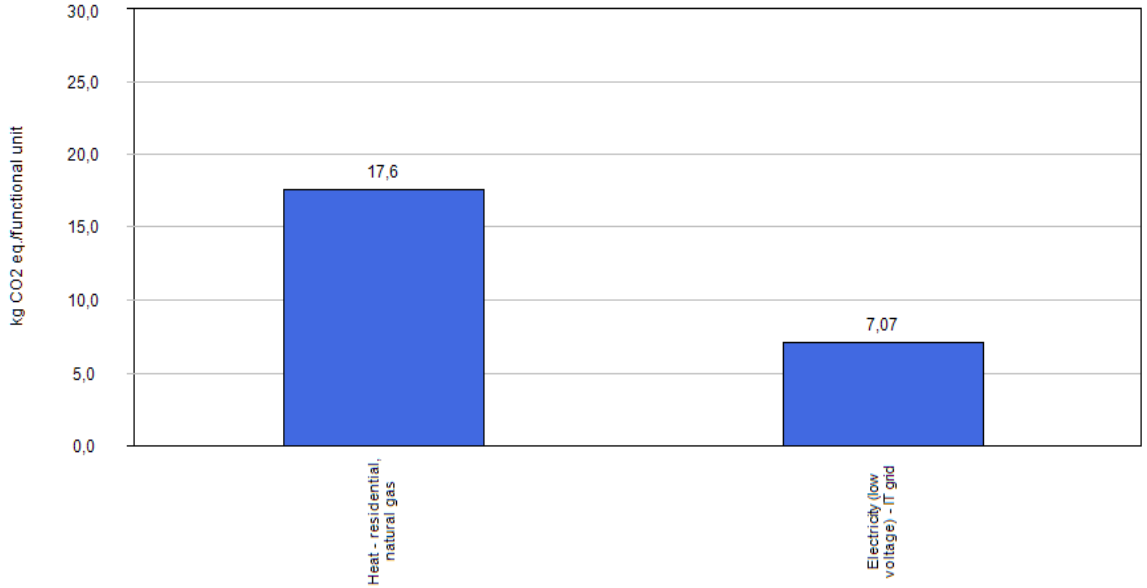


Figure 4. Carbon Footprint related to the energy consumption of "BB B" (extracted from the CCaLC software; elaborated by the Authors).

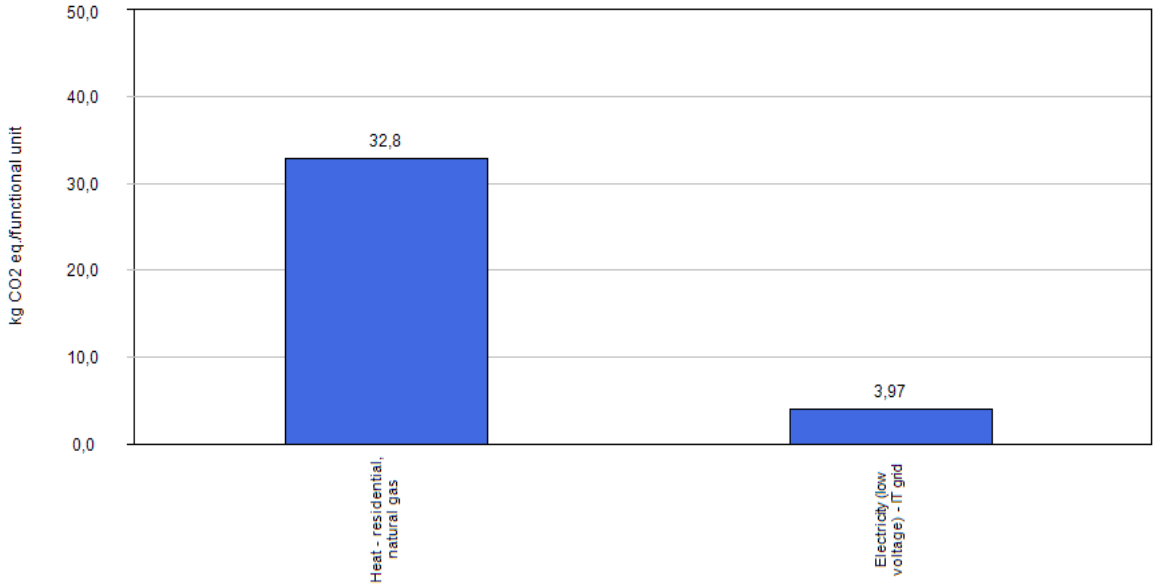
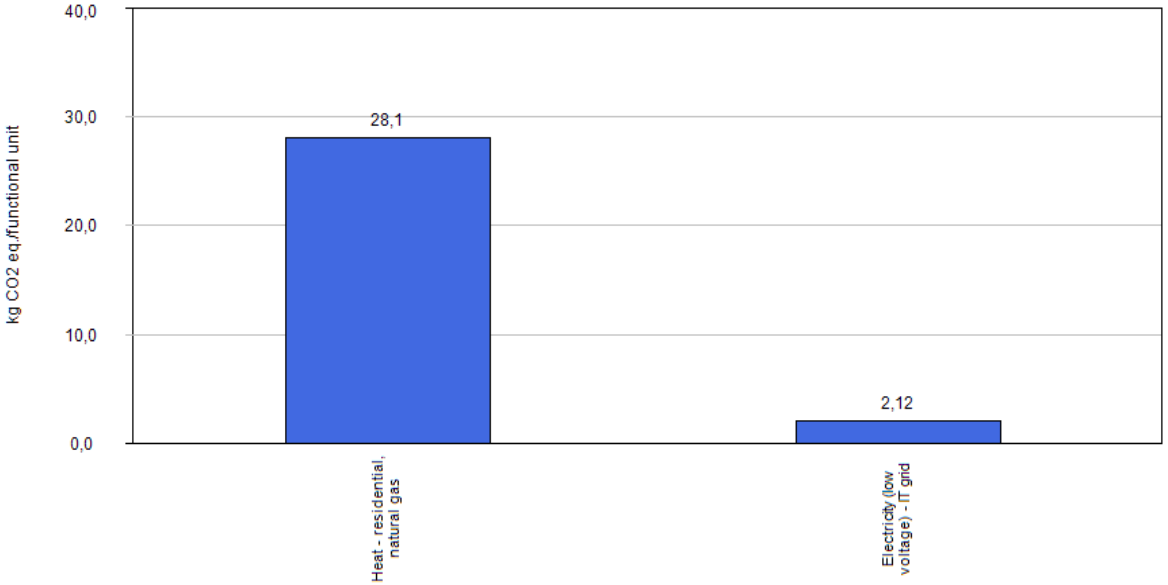


Figure 5. Carbon Footprint related to the energy consumption of "Hotel" (extracted from the CCaLC software; elaborated by the Authors).



Finally, in terms of raw materials (i.e., the input-related materials for one overnight stay), it is the consumption of soap to be more impacting for "BB A" and "Hotel", followed by water consumption (Figures 6 and 8), whilst for "BB B" it is the use of LED lamps the most impacting followed by water consumption (Figure 7); however such values are much lower than the energy consumption-related ones (Figure 2). As aforementioned (Section 3), the inputs soap, shampoos and detergents had to be aggregated under the same entry "soap", given that the software did not provide differentiated entries. For this reason, no detail can be acquired in terms of which of the soap, shampoos or detergents impacted the most (however, given their low impact in terms of CF, a higher level of detail would not be significant). Furthermore, the water consumption (Figures 6-8) refers to the best available dataset that was present in the software's database ("UK tap water"). Nonetheless, it has to be acknowledged that the choice of an "Italian tap water", which was absent in the database, could have entailed different CF results.

Figure 6. Carbon Footprint related to raw materials of "BB A" (extracted from the CCaLC software; elaborated by the Authors).

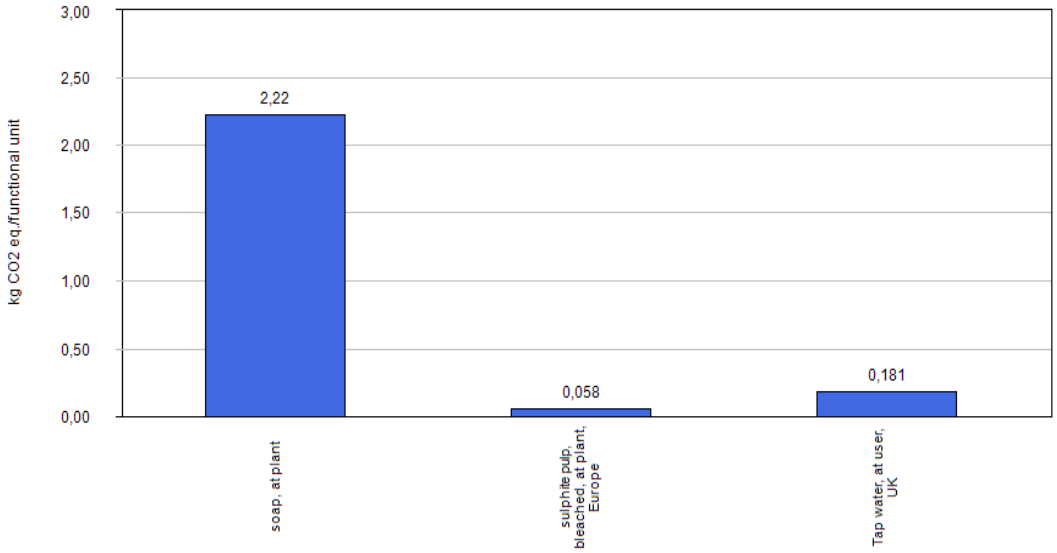


Figure 7. Carbon Footprint related to raw materials of "BB B" (extracted from the software; elaborated by the Authors).

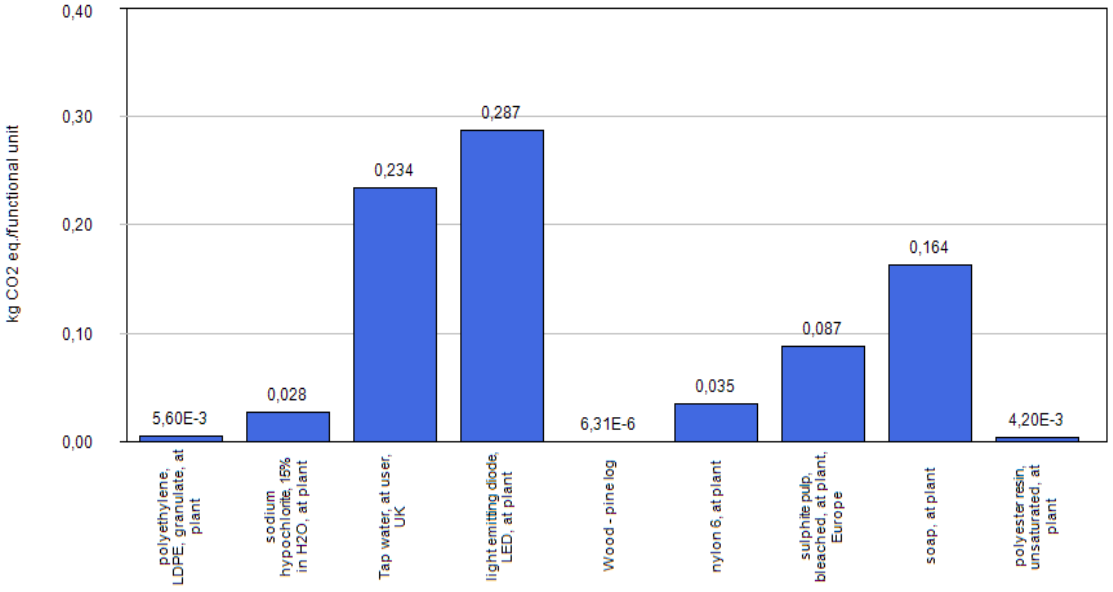
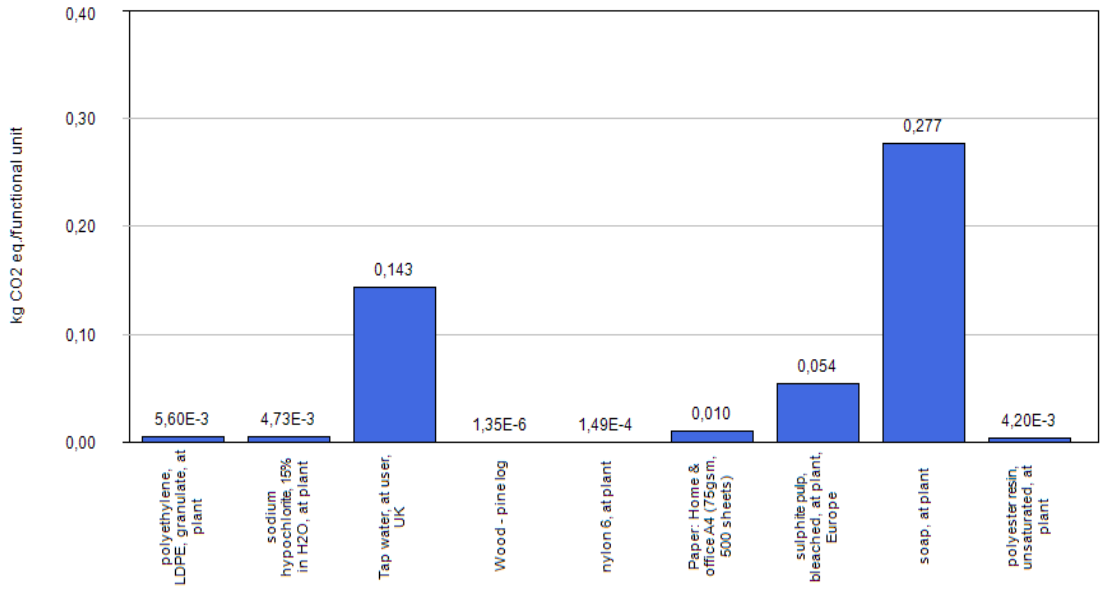


Figure 8. Carbon Footprint related to raw materials of "Hotel" (extracted from the CCaLC software; elaborated by the Authors).



5. Conclusions

Tourism is amongst the fastest growing economic sectors, with an ever-growing attention that has been paid to sustainability by various stakeholders and intensified also by the need to meet the United Nations SDGs. Online booking platforms have become one of the most common means of booking and information within them could guide the user in choosing more environmentally friendly or "green" accommodation facilities. This article explored the inclusion of CF as a possible life cycle-based indicator to be used in online booking platforms by addressing the CF of a selected sample of accommodation facilities in Italy. In this direction, a sampling strategy of the accommodations was implemented for exploratory analysis and until now three of them agreed to collaborate and were then assessed in terms of their CF related to one overnight stay.

The results highlighted that the highest "climate change"-related impact is attributable to "BB B", followed by "Hotel" and "BB A", thus demonstrating that such an impact does not depend on the type of accommodation. Such a statement however has to be taken carefully, given the limited number of facilities considered so far.

An important finding, which seems to confirm the existing scientific literature, is that energy consumption is the most impacting input in terms of CF (*circa* 90% of the total CF for "BB A", 97% for "BB B" and 98% for "Hotel"), which in this case depends strongly on the heating used during wintertime. Therefore, the owners of the facilities should work on this in order to reduce their total CF, e.g., via insulation activities to reduce building energy losses and/or replacing the energy source with a cleaner one.

Future developments of this study will include more facilities in order to assess the robustness of the results that have been acquired so far. Furthermore, full LCA implementations will be carried out in order for a holistic assessment of not just one environmental impact category to be performed. In this way, the most affected environmental impact categories, as well as any trade-offs between impacts will be identified.

6. Acknowledgement

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TRACK 5
Production, consumption and innovation

5a. Corporate Sustainability and Corporate Social Responsibility

Abstracts

65

Sustainable corporate management models using disruptive technologies in the energy sector

Dr. Istvan Vokony, Dr. Maria Szalmane Csete
Budapest University of Technology and Economics, Faculty of Economic and Social Sciences, Department of Environmental Economics and Sustainability, Budapest, Hungary

DR. ISTVAN VOKONY

DR. MARIA SZALMANE CSETE

Abstract

The digital transformation and its effects significantly change the support of the core functions of energy distribution. Nowadays, it is almost impossible to solve any task or complete a simple work phase without a computer or IT device, the location data, the description of the work schedule, the parameters, etc. without obtaining it. The main goal of research to find an answer how is it possible to formulate appropriate company structure, keep the sustainability goals and gain affordable efficiency. First, the transformational steps of corporate structure and operation are under analysis. After that, the focus will be on the efficient planning of resources representing the target state, as well as ensuring the path leading to it, both from the point of view of project management and application and/or infrastructure landscape. In the final stage of the research, the role and significance of digitization is under scope, how much it is a tool or a catalyst of decisive weight in the transformation of large corporate operations, and whether the next development level and state can be projected as a result. I use the synergy of my professional background and my current position when defining the research area. Thanks to my basic education, I am familiar with the operation of electricity systems, and the management and IT strategy of large companies are also well suited to this. The currently ongoing local industrial restructuring, "revolution", if you will, is a great breeding ground for empirical research, and I am building the research plan along these lines, focusing on 3 main topics.

- IT support for corporate transformation - Carve-in vs Integration!
- Agile architecture design in the utility sector
- Digitization in energy: robotics, plant management, work management

It is very likely that no clear correlation can be shown among the triggers, the change can be predicted to be the result of a dynamic interaction. The expected result of the research is the weighting of the interaction in the examined industry and the examined segment, based on the ability of each factor to influence. In a non-negligible way, the decision support function can also be a valuable output as an indirect result, but primarily the exploration of the influencing ability of the factors and the behavioral characteristics of the interactions between them enables the verification and re-validation of the results of the first research topic.

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Business contribution to sustainable development – a stepwise approach by the CapSEM model.

Professor Annik Magerholm Fet
Norwegian University of Science and Technology - NTNU, Alesund, Norway

PROFESSOR ANNIK MAGERHOLM FET

Abstract

The toolbox for helping business transition towards sustainability has been development over a period of about 30 to 40 years. The international United Nation Environmental Program (UNEP) established in the eighties cleaner production centers in many countries at all continents. The main goal of these centers was to build capacity in academia and in research centers, and further use this to train the trainers for implementation of cleaner production processes, cleaner products, and cleaner production strategies in business. Since then, the toolbox for sustainability analyses has been extended with a large set on new tools. For companies it might be difficult to understand when and how these tools best should be applied. The CapSEM model presents how these tools can be used in a systematic way according to the needs in the business community and from the practitioners.

The CapSEM model sorts the toolbox at four levels: production processes, the products and their life cycles, the business organization and the society. Tools for analyzing processes and products are at levels 1 and 2 in the model. Level 3 in the model is concerned with tools for implementation at the strategic level of the company, e.g. environmental management, life cycle management of suppliers, reporting and communication systems, and business models for sustainability are addressed. On this level corporate social responsibility (CSR) is also placed. This leads further to level 4 which can be represented by the society, either as a local community, a region or on a larger system.

Most of the tools presented in the CapSEM model can be linked to SDG number 12 – responsible consumption and production. Responsible production can be evaluated according to the impact the materials used in the production processes have on the environment, and how companies can use CP-strategies to improve the processes on this level. Similarly, LCA-tools enable the producer to provide information about the environmental aspects and impacts of the life cycle of the products so the consumer can consider which products to choose according to the documented impacts. Life cycle management tools can also be used to set requirements to suppliers regarding their responsibility.

The paper will discuss the role of the CapSEM model regarding the contribution to additional SDGs, especially the SDG number 6, 13, 14 and 15 by using tools presented at level 1, and SDG 8, 9 and 10 for level 3.

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Exploring the sustainable development of bamboo industry under China's rural revitalization strategy: the case of Hunan Taohuajiang Bamboo Science and Technology Co.

Doctor Jian Peng, Xuepeng Wang

Hunan University, Changsha, China

Abstract

The rural revitalization strategy, as a national strategy in China, is a comprehensive, long-term and forward-looking plan which is essential to the overall development of the country. The success of rural revitalization is crucial to fundamentally resolving the problem of urban-rural disparities, unbalanced and insufficient rural development in China, and achieving balanced and sustainable development between urban and rural areas, as well as integrating agriculture into the overall development strategy of the country.

China is the largest producer and consumer of bamboo products in the world, with its bamboo forest area accounting for approximately 37.2% of the global total and bamboo production contributing to around 80% of the world's supply. The bamboo industry, as a distinctive sector in China's economy, serves as a major source of income for farmers and a critical support industry for the economy in mountainous regions. As a renewable, sustainable, and eco-friendly material, bamboo aligns perfectly with the principles of green and sustainable development in rural revitalization. Moreover, it embodies the notion of "green mountains and clear waters are as valuable as mountains of gold and silver," and represents a vital pathway to support the revitalization of rural areas. However, the traditional bamboo industry in China is facing shared challenges in sustainable development as demographic dividend gradually fades and environmental protection regulations become increasingly stringent, such as low utilization of bamboo resources, increased pollution from bleaching of materials and insufficient automation of production processes.

Using methods such as literature research, field research, interviews, and data analysis, this paper examines the development process of China's bamboo company, Hunan Taohuajiang Bamboo Science and Technology Co., which has been established for 24 years, as a case study. Firstly, the development process of the company can be summarized into four stages based on the concept of sustainable development: 1. Primary processing with a single product; 2. Primary processing with a variety of products; 3. Advanced processing with a single product; 4. Advanced processing with a variety of products. Subsequently, shared problems in the pursuit of sustainable development in the Chinese bamboo industry are identified, such as unstable product quality and uncertain market demand. Finally, driven by the rural revitalization strategy, this paper creatively proposes the direction and strategies for the sustainable development of China's bamboo industry by introducing a new type of bamboo material, high-performance bamboo-based fiber composite, and innovative products such as bamboo prefabricated components developed through cooperation between Hunan Taohuajiang Bamboo Science and Technology Co. and universities.

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Start-ups in Sustainability Business: An Exploratory Study

Ms. Suman Phalswal, Dr. Reeti Kulshrestha, Dr. Arunaditya Sahay
Birla Institute of Management Technology, Gautam Budh Nagar, India

Abstract

This research paper explores the challenge of balancing sustainability and profitability goals for start-ups in sustainable business. The study focuses on how start-ups align their business models to achieve sustainable outcomes – economic, social and environmental. Sustainable Development Goals (SDGs) provide the background for this study which is undertaken with a qualitative case study approach. The sample cases are purposefully chosen from start-ups across diverse fields of operation.

The study found that start-ups face challenges in balancing economic and social goals due to difficulty in convincing investors to support their social business models, limited financial and human resources, and lack of market awareness. However, such start-ups can overcome these challenges by adopting several alignment strategies.

The first strategy is to incorporate sustainability into the core business. By integrating sustainability into their products, services, and operations, start-ups can improve their competitive position and increase appeal to investors. For example, one of the start-ups in the study, an online booking platform for arranging eco-friendly stays, aligned its business model with SDG 12 (Responsible production and consumption) by providing their lodging and boarding at a place where organic farming, solar power generation, composting of food waste, etc. are done. The second strategy is to leverage partnerships and collaborations (SDG 17). By partnering with other organizations, start-ups can access new markets, resources, and expertise, enabling them to scale up their business. The third strategy was found to be that of innovative financing mechanisms. By using alternative financing options, such as impact investing or crowdfunding, start-ups can attract investors who are committed to sustainability goals and are willing to support their business models.

Overall, this study provides important insights into the challenges and opportunities for entrepreneurs who are in businesses that promote sustainability and contribute to the attainment of some of the SDG goals. These start-ups can balance economic and social goals by incorporating sustainability into their core business activities. Policymakers can make provisions for higher support start-ups in this business, thus, contributing to the achievement of SDGs.

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The Coherence of Corporate Social Responsibility Regulations to Achieve the SDGs in Developing Countries: Evidence from Indonesian Textile Companies

Ratna Artha Windari[1,2], Yetty Komalasari Dewi[1], Prof. Andri Gunawan Wibisana[1], Dr. Annalisa Yahanan[3]
[1]Universitas Indonesia, Jakarta, Indonesia. [2]Universitas Pendidikan Ganesha, Singaraja, Indonesia. [3]Universitas Sriwijaya, Palembang, Indonesia

R A T N A A R T H A W I N D A R I

Abstract

Indonesia is a developing country that regulates CSR on a mandatory basis through Law Number 40 of 2007 concerning Limited Liability Companies (hereinafter, the 2007 Company Law). One industry that plays a vital role in Indonesia's economic development and categorized as a strategic and priority industry is the textile industry by its ability to absorb a large number of workers and increase the country's foreign exchange significantly. As a country that has agreed to participate in implementing the Sustainable Development Goals (SDGs), economic development must prioritize sustainability by protecting the earth's resources for future generations due to industrial activities as stated in 6.3 SDGs's targets by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally. Despite the fact that the core business of textile industry not directly engaged in natural resources, the impact arising from its business activities on environmental pollution and the decline in the quality of natural resources is massive. Therefore, the textile industries are subject to the regulation of CSR obligations as stated in article 74 para (1) of the 2007 Company Law. There are many cases of river pollution due to waste from textile and garment companies in Indonesia, especially in Bandung as the centre of the textile and garment industry. If referring to the provisions of article 66 para (1) letter c the 2007 Company Law, one indicator of the fulfilment of CSR obligations is disclosing the reporting of CSR activities through annual reports. Unfortunately, CSR regulation in Indonesia is ineffective because the provisions are vague and unclear. Based on this, it is essential to explore how the implementation of CSR provisions in Indonesia's textile companies and the coherence of CSR provisions toward achieving the SDGs' targets. This paper is doctrinal research by evaluating the annual reports of textile and garment companies located in Bandung area and listed on the Indonesia Stock Exchange. This paper also analyses the coherence between CSR regulations in Indonesia and indicators in target 6.3 of SDGs. The study finds that many textile companies are more focused on community development, while environmental CSR is still limited. Several legal and formal activities are categorized as obligations that companies must fulfil but are included as CSR activities in the company's annual report. There is lack of detailed and explicit provisions in CSR regulation to achieve the SDGs target, also there are still many cases of environmental pollution due to the disposal of textile industrial waste. A visible recommendation to achieve SDGs in 2030 is to reformulate CSR regulation in Indonesia through a substantial review of CSR provisions to be comprehensive and interlink with SDGs' indicators target.

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Social and Environmental Sustainability through Sustainable Banking Practices: A Critical Analysis

Mr Md. Nur-E-Alam Siddique, Dr. Shifa Mohd Nor, Assoc. Prof. Dr. Zizah Che Senik, Prof. Dr. Nor Asiah Omar
Universiti Kebangsaan Malaysia, Bangi, Malaysia

Abstract

Sustainability is a significant global agenda to ensure social equity and a livable planet. Global leaders emphasize businessmen to operate their businesses sustainably. Due to stakeholder pressure and self-responsibility, many banks worldwide have shifted their concentration to sustainable banking (SB) from traditional banking practices. This study aimed at exploring how the banks perform sustainable banking activities to implement the social and environmental sustainability agenda. The library research method was applied to accomplish the study objective as this method supported gathering more relevant information and readings related to the study topic. This study critically analyzed relevant books, articles, periodicals and reports related to sustainable banking practices and sustainability. Based on the institutional theory, this study reveals that banks focus mainly on corporate social responsibility (CSR), green banking (GB) and financial inclusion (FI) as sustainable banking practices. Through CSR practices, banks address some significant social and environmental issues. Considering the countries' socioeconomic contexts, banks focus on health, education, disaster and humanitarian reliefs, women empowerment and poverty alleviation as the CSR for the society. Moreover, banks focus on environmental conservation, environmental social risk management (ESRM), greenwashing, responsible use of natural resources and a homogeneous environment as the CSR for the environment. Banks concentrate on green bank management (GBM) and green financing (GF) as the GB practices. As GBM, banks use renewable energy in their banking operations as much as possible and encourage their customers and employees to adopt paperless banking through online banking and automation. Banks invest as loans and advances in sustainable and green projects as the GF initiatives. The main purposes of the GF are to minimize carbon emissions and control pollution. Through FI, banks take initiatives to provide banking services to the marginal people who are financially insolvent. Socially responsible finance (SRF) and socially responsible investment (SRI) are focused as FI. Though other businesses contribute to sustainability, banks play the role of originators in ensuring social and environmental sustainability through these three initiatives (CSR, GB and FI) related to SB. This study is an important input to the policymakers and researchers related to sustainability as this study opens the horizon of rethinking sustainable banking practices as the source of sustainability.

Full Papers

Social and Environmental Sustainability through SustainableBanking Practices: A Critical Analysis

Md. Nur-E-Alam Siddique[1], Shifa Mohd Nor[1*], Zizah Che Senik[1] and Nor Asiah Omar[1]

[1] Faculty of Economics and Management, Universiti Kebangsaan Malaysia (UKM), Bangi – 43600, Selangor, Malaysia

[*]Corresponding author's e-mail address: shifa@ukm.edu.my

Abstract. Sustainability is a significant global agenda to ensure the social equity and a liveable planet. Global leaders emphasize businessmen to operate their businesses sustainably. Due to thestakeholder pressure and self-responsibility, many banks around the world shift their concentration to sustainable banking (SB) from traditional banking practices. This study aims at explaining how the banks perform sustainable banking activities to implement the social and environmental sustainability agenda. The library research method was applied to accomplish thestudy objective as this method supported gathering more relevant information and readings related to the study topic. This study critically analysed relevant books, articles, periodicals andreports related to sustainable banking practices and sustainability. Based on the institutional theory, this study reveals that banks focus on mainly corporate social responsibility (CSR), greenbanking (GB) and financial inclusion (FI) as the sustainable banking practices. Through CSR practices, banks address some significant social and environmental issues. Considering the countries' socioeconomic contexts, banks focus on health, education, disaster and humanitarianreliefs, women empowerment and poverty alleviation as the CSR for the society. Moreover, banks focus on environmental conservation, environmental social risk management (ESRM), greenwashing, responsible use of natural resources and homogeneous environment as the CSR for the environment. Banks concentrate on green bank management (GBM) and green financing(GF) as the GB practices. As GBM, banks use renewable energy in their banking operations as much as possible and encourage their customers and employees to adopt paperless banking through online banking and automation. Banks invest as loans and advances in sustainable and green projects as the GF initiatives. The main purposes of the GF are to minimize the carbon emissions and control pollution. Through FI, banks take initiatives to provide banking services to the marginal people who are financially insolvent. Socially responsible finance (SRF) and socially responsible investment (SRI) are focused as FI. Though other businesses contribute to the sustainability, banks play the role of originators in ensuring social and environmental sustainability through these three initiatives (CSR, GB and FI) related to SB. This study is an important input to the policymakers and researchers related to sustainability as this study opens the horizon of rethinking the sustainable banking practices as the source of sustainability.

Keywords: Sustainable banking, social and environmental sustainability, corporate social responsibility, green banking, financial inclusion.

1. Introduction

Sustainability is a global agenda to the global leaders considering the challenges of social inequality, human rights, environmental degradation, climate change and global warming (Roy, 2022). The sustainability agenda has been getting institutionalized emphasize after the declaration of the Paris Agreement and the United Nations' (UN) Sustainable Development Goals (SDGs) (Tabash, Farooq, Anagreh and Al-Faryan, 2023). SDGs contain 17 goals, the majority of which mainly focus on social and environmental sustainability (Mio, Panfilo and Blundo, 2020). Businesses need to be actively involved in the implementation of the SDGs side by side with the government, voluntary institutions and development agencies. For a sustainable economy, businesses need to prioritize people and the planet over profits and concentrate on the social and environmental initiatives (Siddique *et al.*, 2023). Sustainability is connected with making decisions that do not have a negative impact on the current and future generations, the environment and society (Botchway and Bradley, 2023). The demand for sustainability from stakeholders across the world is pressurizing companies to perform their business in a responsible and ethical way (Mahmood and Khan, 2022).

The financial institutions including banks can be the significant players in ensuring sustainability by taking social and environmental initiatives. Banks are the significant contributors to the economic development and production-oriented activities as they finance those activities (Adu, 2022). Productionand development-related activities boost up economic development but those activities are not free fromthe adverse effect on the society and environment. Banks can responsibly contribute to the social and environmental sustainability by taking social and environmental initiatives (Nájera-Sánchez, 2020).

The literature shows that many researchers and academia concentrate on sustainability-related studies considering the current focus of the businesses and practitioners (Siddique *et al.*, 2023). The majority ofthe studies focus on the traditional corporate social responsibility (CSR) practices of different industriesand companies (Mir and Bhat, 2022). They predominantly consider the CSR practices as the sustainability initiatives excluding other significant sustainability initiatives. This study focuses on CSR, financial inclusion and green banking as the input to the social and environmental sustainability that might be the significant sustainable banking practices (Yuen *et al.*, 2022). So, this study aims at explaining how the banks perform sustainable banking activities to ensure the social and environmentalsustainability. More specifically, applying the Institutional Theory (Meyer and Rowan, 1977) , this study identifies and summarizes the critical dimensions of social and environmental sustainability in connection with sustainable banking.

2. Literature Review

This study focused on the significant concepts of social and environmental sustainability and sustainable banking. Moreover, institutional theory supported to understand how the banks are currently shifting from the traditional banking to sustainable banking to contribute to the social and environmental sustainability.

2.1. Social Sustainability

Society includes the people. Social sustainability is connected with the wellbeing of the people especially connecting the socially disadvantageous people with the mainstream social facilities by ensuring equity and equality (Carroll and Brown, 2018). The ability of a society to satisfy the present and future demands of its people while creating fair opportunities, sustaining social cohesiveness, and promoting human well-being is referred to as social sustainability. It incorporates economic and social components in order to promote sustainable societal growth and development. Scholars explain social sustainability from the perspective of sustainable banking precisely (Ahmad *et al.*, 2021). From the standpoint of sustainable banking, social sustainability refers to the incorporation of social issues into banking practices in order to promote fair and inclusive societal development (Roy, 2022). It entails identifying and resolving the social consequences of banking activities, assuring the well-being of individuals and communities, and promoting long-term social stability and cohesiveness.

2.2. Environmental Sustainability

The physical, biological, and ecological settings of the planet in which living beings survive are referredto

as the environment. Environmental sustainability is the management and responsible use of natural resources, ecosystems, and the environment in order to fulfil current demands without compromising the capacity for the future generations' own demands (Carroll and Brown, 2018). It entails preserving ecology and biodiversity and reducing the harmful effect on the environment. Scholars explain environmental sustainability from the perspective of sustainable banking precisely (El Sayad and Diab,2022). From the standpoint of sustainable banking, environmental sustainability refers to incorporating environmental concerns into banking operations, practices, and decision-making processes in order to minimize negative environmental consequences and create a more sustainable future (Úbeda *et al.*, 2022). It entails integrating financial operations with environmental goals, encouraging responsible financing and investing, and assisting in the transition to a low-carbon, resource-efficient economy.

2.3. Sustainable Banking

Literature shows that banks are shifting from traditional banking practices to the socially and environmentally responsible banking practices which are the significant basis of sustainable banking (Úbeda *et al.*, 2022). Scholars narrate sustainable banking precisely as the banking strategy that includes addressing the environmental and social issues into key business practices (Suandi *et al.*, 2022). It focuses on linking financial activities with sustainability goals ensuring social and environmental sustainability while maintaining financial stability.

2.4. Institutional Theory

The basic assumption of Institutional Theory (Meyer and Rowan, 1977) is that the approach to understand management practices of business is the outcome of social pressure rather than economic. This theory narrates that the management practices and behavior of a company are guided by the institutional environment. One of the important elements of this environment is the society which includes people. So, business behavior is governed by the social influence. The society creates pressure through three mechanisms such as coercive, mimetic and normative (Aggarwal and Jha, 2019). Furthermore, a company's social behavior is also influenced by regulatory, normative and cognitive aspects (Ruiviejo and Morales, 2016; Forgione and Migliardo, 2020). The majority scholars focus on the application of institutional theory from the perspective of society while less focus on the environment(Siddique *et al.*, 2023). This study attempted to explain the sustainable banking practices based on the institutional theory focusing on both the society and environment. The logic behind using institutional theory in this study was that this theory guided to reveal the social and environmental sustainability dimensions in connection to sustainable banking practices.

3. Methodology

This study applies library research technique to identify and explain the dimensions of social and environmental sustainability in connection with sustainable banking. The library research method is also familiar as the conceptual review. It is a method for gathering and evaluating existing literature, such as books, articles, and other published works to comprehend the existing state of knowledge on specific concepts or a topic based on a specific research objective or question (Sanji, Behzadi & Gomroki, 2022).The library research approach was used as a critical conceptual review in the context of social and environmental sustainability through sustainable banking practices where this study followed significant steps. This study followed the steps applied by Sanji, Behzadi and Gomroki (2022). First, the research objective was clearly defined that was to identify and explain the dimensions of social and environmental sustainability in connection with sustainable banking. Second, relevant literature was searched from the established databases based on the keywords such as "social sustainability," "environmental sustainability" and "sustainable banking". Third, the sources were selected and evaluated to determine the relevance and credibility of the articles to be reviewed. Web of Science (WoS) and Scopus databases were given priority as these two databases covered the majority of studies related to the sustainable banking. Fourth, extracted articles were thoroughly read and synthesized to identify and summarize the dimensions connected with this study. Finally, the dimensions and conceptsrelated to the social and environmental sustainability in connection with sustainable banking identifiedfrom the literature were organized and presented through findings and discussion.

4. Findings and Discussion

Based on the literature, the findings reveal that the scholars experimented sustainable banking with different concepts including social and environmental sustainability (Roy, 2022). Sustainable banking contributes to the social and environmental sustainability through corporate social responsibility (CSR) practices, financial inclusion (FI) and green banking (GB) practices that include different dimensions that address the issues related to the society and environment.

4.1. Corporate Social Responsibility

Corporate social responsibility (CSR) is the managerial practice through which companies participate in addressing the environmental and social issues to operate their business and manage the stakeholders (Carroll 2012). Since the 1950s, different scholars have been experimenting the concept of CSR with different paradigms and paradoxes (Carroll 2021; Freeman & Hasnaoui 2011; Wagner-Tsukamoto 2019; Witek-Crabb 2019b). In the 21st century, researchers focus on experimenting the CSR practices from the perspective of sustainable banking considering its ability to contribute to social and environmental sustainability which is a burning issue nowadays. The findings reveal that banks' CSR practices can address both social and environmental issues to implement the sustainability agenda.

4.1.1. Social Sustainability. As the sustainable banking practices, banks can contribute to the society by addressing some significant social issues. The banks' society-related CSR practices address health [36], education, women empowerment (Mogaji, Hinson and Nwoba, 2021) social justice (Ahmed and El-belihy, 2017; Roy, Al-Abdin and Quazi, 2021), poverty alleviation (Úbeda et al., 2022) anddistributed reliefs in disaster moments (Khan, Bose and Johns, 2020) to enhance the living standard of the people. The findings reveal that banks address different social issues but their common purpose is to contribute to the social sustainability.

4.1.2. Environmental Sustainability. As the sustainable banking practices, banks can contribute to the environment by addressing some significant environmental issues (Athari, 2022a). The banks' environmental CSR practices address the issues of preventive banking and defensive banking (Adu, 2022), greenwashing (Khan et al., 2021), environmental awareness (Mera, 2019), sensible use of naturalresources (Buddu and Scheepers, 2022), ecological funds (Mera, 2019) and CSR regulations (Nosratabadi et al., 2020) to enhance the environmental wellbeing and lessen the negative impact of business activities to the environment. One of the significant CSR practices as sustainable banking is the environmental social risk management (ESRM) (Saeudy, Atkins and Barone, 2022) which is a comprehensive practice to ensure sustainability. The findings reveal that banks address different environmental issues but their common purpose is to contribute to the environmental sustainability.

4.2. Financial Inclusion (FI)

Financial inclusion (FI) is one of the significant mechanisms of sustainable banking which caneffectively contribute to the social sustainability. As sustainable banking, FI is the banking practice that allows individuals and communities to have access to the affordable and relevant banking services regardless of their socioeconomic status (Athari, 2022b). FI ensures allows the marginal people to takefinancial services. The findings reveal that banks usually practice FI by offering socially responsible financing (SRF) and socially responsible investment (SRI) (Mera, 2019; Mahmood and Khan, 2022). SRF is the sustainable banking practice of giving financial support to the businesses and projects that have a positive impact on the society and alignment with sustainable development goals (SDGs) (Chen*et al.*, 2022). Furthermore, SRI is the sustainable banking practice of making investment decisions considering social and environmental impact rather than profit consideration only (Mahmood and Khan,2022). The purpose of FI is to overcome the barriers and inequalities in accessing formal financial services and encourage financial empowerment for the marginal people and poverty alleviation.Financial Inclusion effectively contributes to the sustainability.

4.3. Green Banking (GB)

Green banking (GB) is the incorporation of environmental issues and sustainability principles into banking operations and financial products offering to promote environmental preservation, resource efficiency, and the transition to a low-carbon economy (Asim *et al.*, 2020). The findings reveal that fromthe perspective of

sustainable banking, GB includes green financing, environmental risk management, green bonds and sustainable investment, sustainable bank operations and environmental reporting and transparency. As green finance, banks offer financial products that support eco-friendly projects such as renewable energy, green building and clean technology (Kumar *et al.*, 2022). Through environmentalrisk management, green banks assess and manage the potential environmental risks associated with the projects they finance (Redwanuzzaman, 2021). As green bond and investment, banks issue green bonds and invest in environmentally friendly financial products like clean energy projects and climateadaptation programs (Caby, Ziane and Lamarque, 2020). As sustainable bank operations, banks adoptsustainable practices into their operations by executing energy-saving measures, lower use of paper, recycling and trash reduction and adopting sustainable procurement practices in all possible banking activities (Jena *et al.*, 2020). Finally, banks publish information about their environmental practices, green finance portfolios, and the environmental results obtained via their investments in order to promote accountability, assist stakeholders in making informed decisions, and foster best practices within the banking industry (Tahri and El Khamlichi, 2019). All the green banking-related activities contribute to the environmental sustainability.

5. Conclusion

Sustainable banking in the form of CSR, financial inclusion and green banking have significant contributions to the social and environmental sustainability. This study contributed to body of the knowledge on social and environmental sustainability and sustainable banking practices by identifyingand summarizing the sustainable banking practices and their underlying dimensions based on the institutional theory. Researchers can experiment those sustainable banking practices with social and environmental sustainability dimensions and SDGs. The findings of this critical review study consist of significant implications for the business management and sustainability practitioner. Experts can selectthe effective sustainable banking practices and dimensions for ensuring social and environmental sustainability considering the contexts which can open a new debate in the banking literature and research horizon.

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Business Contributions to Sustainable Development: A Stepwise Approach Using the CapSEM Model

ANNIK MAGERHOLM FET*

*Department of International Business, Norwegian University of Science and Technology - NTNU

ABSTRACT

Tools for helping business transition towards sustainability have been in development over a period of some 30 to 40 years. The International United Nation Environmental Program (UNEP) established Cleaner Production centers in many countries across all continents in the 1980s. The main goal of these centers was to build capacity in academia and research centers, and further use this to train the trainers in implementing cleaner production processes, cleaner products, and cleaner production strategies in business. Since then, the number of methods and tools for sustainability analyses and life cycle management has increased. However, it may be problematic for many companies to understand when, and indeed, how, any of these tools should best be applied in their efforts to answer the many new requirements needed to be met on the way towards more sustainable practices. The CapSEM Model presents a way in which these tools can be used in a structured and systematic way.

The CapSEM Model organizes this toolbox at four distinct Levels: production processes, products and their life cycles, business organization and society. Most of the tools presented in the CapSEM Model can be linked to SDG number 12: responsible consumption and production. Responsible production can be evaluated according to the impact materials used in the production processes have on the environment, and how companies can use CP-strategies to improve processes on this Level.

The paper will discuss the role of the CapSEM Model regarding its contribution to additional SDGs, especially SDG numbers 6, 13, 14 and 15 by using tools presented at Level 1, and SDGs 8, 9 and 10 at Level 3. This paper will therefore begin by looking at the background and historical context within which sustainable development lies, moving onto an explanation of how the CapSEM Model works. The paper shows how companies or businesses can apply the toolbox, finishing with a few examples on how the tools contribute to the SDGs and finally with some reflections on the way from business as usual to net-positive transformation.

INTRODUCTION

The concept of sustainable development has gained significant attention in recent decades as societies worldwide recognize the need for balanced economic growth, environmental preservation, and social progress. Sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987). It emphasizes the interdependence and interconnectedness of economic, environmental, and social, aspects of development. Businesses play a crucial role in sustainable development due to their economic influence, resource consumption, and impact on society. However, incorporating sustainable development principles into business practices has several key challenges. To effectively address these challenges, it is crucial for businesses to adopt a systematic approach. A systematic approach ensures that sustainability efforts are integrated in the operations of businesses and into the core strategies, leading to meaningful and measurable contributions to sustainable development.

According to Brattebø, Ehrenfeld and Røine Industrial Ecology, chapter1,'Framing and defining industrial ecology' (2011) the emergence of new methodologies to manage and analyze industries impact on nature can be seen as part of a much larger change in how environmental issues have been addressed over the last 50 years. There has been a gradual shift towards systems thinking which means that one seeks to better understand the complex relationships between causes and effects within a system and its system elements, and between the system and its surroundings. This includes trying to examine the system as a whole rather than looking at elements, variables and activities in isolation. Pollution has been regarded as something that should be dealt with at the end of the production process. While addressing environmental issues, pollution awareness has moved towards more preventative actions. The need for a toolbox for a more holistic analysis of environmental problems has been recognized, as has the need for political instruments.

The history behind sustainability can briefly be summarized by looking at 4 time periods. In the first, from about 1850 until around the 1960s, awareness about the environment was very low throughout the world. Population growth and pollution were considered indicators of development and economic growth. The environment, on the other hand, was considered a legitimate place to dump waste. However, an important change was triggered by the publication of the book Silent Spring by Rachel Carson (Carson 1962). This was the start of second period, also recognized as a period of environmental revolution and growth of environmental advocates. Silent Spring documented the loss of birds and insects due to the accumulation of DDT (Dichlorodiphenyltrichloroethane) used as insecticide in the food chains of large birds such as pelicans and eagles. Another book of great importance in changing responses in environmental consciousness was the book Tragedy of the common (Hardin, 1968) which pointed out the increasing usage of natural resources by industries and creation of value for industry while the burden for dealing with any environmental issues was left to society and governments. Meadows et al in the book Limits to Growth (1972) concluded that if existing trends in world population, pollution, industrialization, food production, and resource depletion continued unchanged, the limits to growth on the planet would be reached within one hundred years. The rise of environmental activism and increased public awareness increased, led to a third period. During the period 1970 – 2000, a series of regulations and new practices were implemented. Under the first global environment conference in Stockholm in 1972, the UN environmental program (UNEP) was established, where economic development, environmental protection and social justice were combined in a synergistic framework. Instead of end-of-pipe solutions, cleaner production (CP) and pollution prevention concepts were introduced: industrial ecology (IE) emerged as the best chance for sustainability, i.e. organizing industrial processes according to ecological principles (Brattebø et al, 2011, Fet and Deshpande, 2023). In the years which followed, many industrial companies' attitudes towards the environment changed in parallel to the evolving environmental concerns and signals from scientific and regulatory institutions. The concepts of CP, life cycle management (LCM) and sustainable production and consumption aimed at providing increasingly strong systems-thinking approaches to industry-related environmental challenges. Taking this as its background, the CapSEM Model was introduced though different stages (Fet and Knudson, 2021) until the model presented in Ch. 2 in the book Business Transition: A Path to Sustainability (Fet, 2023).

THE CapSEM MODEL

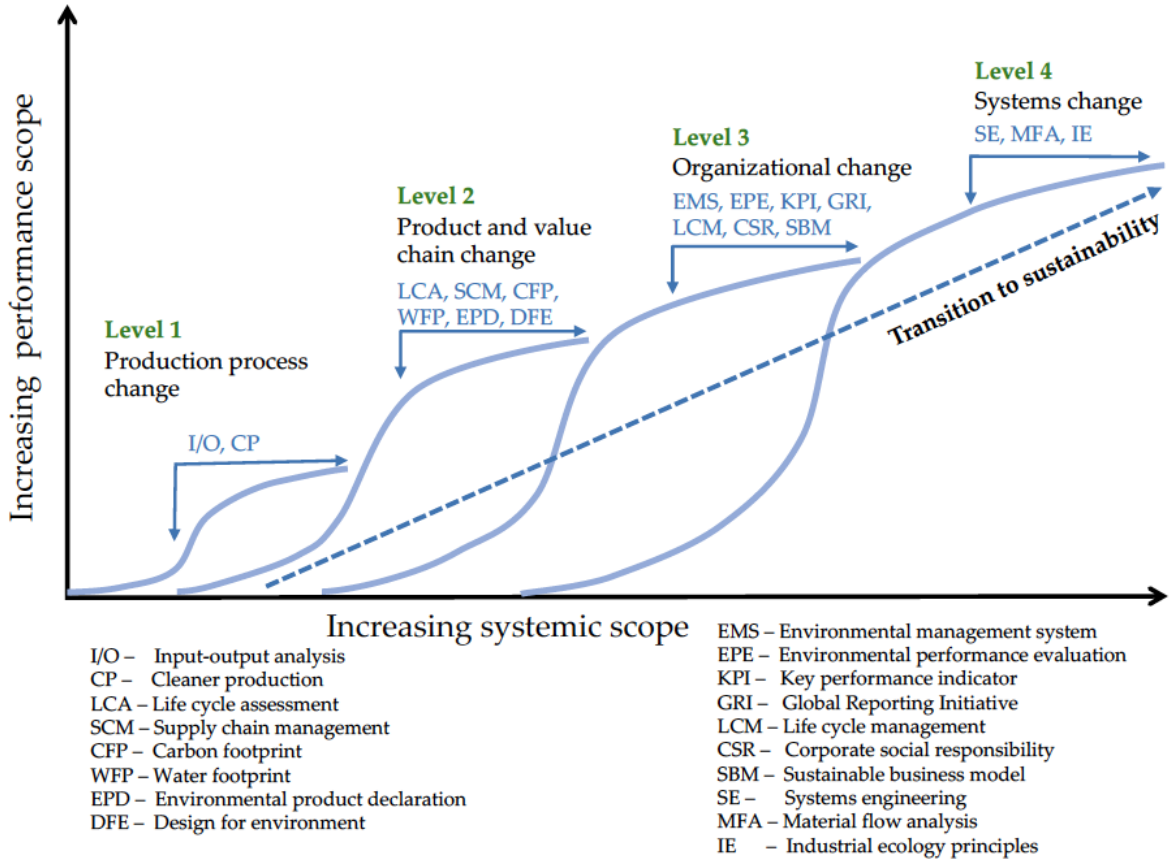
CapSEM is an abbreviation which stands for Capacity building in Sustainability and Environmental Management. It can support companies understand their location and relations of their actions within different Levels of related systems. The model is presented in Figure 1. The waves in the model illustrate different Levels of performance of the systems under study, and the abbreviations used in the figure are the acronyms for the different tools placed at different Levels in the model. The term change is used here as meaning the reduction of negative impacts and increase of, or replacement with, positive impacts—ultimately leading to strong, proactive, and holistic sustainability as companies move toward the upper right of the model. As an organization traverses the Levels, knowledge and tools from the previous Levels are used as input for more extensive methods, meaning that each Level, in turn, encompasses the Level(s) below it. Each axis in Figure 1 describes a change in scope where the horizontal axis shows the system scope, and the vertical axis delineates the performance scope, meaning here the potential for enacting the greatest impact across environmental and social dimensions on sustainability. From a systemic perspective, these different system levels could be described as subsystems and system elements of much larger societal system (Fet and Knudson, 2023).

The focus at Level 1 in the CapSEM Model, is on improving the environmental performance of production processes by following strategies for resource efficiency, waste reduction, and pollution prevention. Quantification of material and energy flows can be achieved by input- and output (I/O) analyses, and further identify potential pollution sources and enable timely corrective actions. CP principles and cleaner technologies (CT) can be implemented to achieve changes towards more sustainable practices. Resource efficiency is a critical component of sustainable production processes as it aims to optimize the use of resources while minimizing waste. Waste reduction can be achieved by minimizing waste at the source by implementing recycling infrastructure and partnering with recycling organizations. By minimizing the generation of pollutants, businesses can reduce the need for end-of-pipe treatment.

The tools presented at Level 2 are life cycle assessment (LCA), supply chain management (SCM), carbon or water footprint of products (CFP and WPF), environmental product declarations (EPD), and design for the environment (DfE). To achieve sustainability, businesses need to go beyond the production process Level and consider the entire life cycle of their products. The product life cycle encompasses all stages, including raw materials extraction, manufacturing, distribution, use by consumers, and end-of-life management. By taking a holistic approach to product life cycle management (LCM), businesses can identify opportunities for improvement and reduce environmental impacts.

Conducting an LCA can help identify environmental hotspots and inform decision-making to look at more sustainable alternatives. The results from an LCA contribute to product information communicated by different type of "footprints", e.g. CFP and WFP according to standardized methods (Fet and Panthi, 2012). The most comprehensive system is by EPDs in line with ISO 14025 (Fet, Skaar and Michelsen 2009, ISO 2006).

FIGURE 1. Capacity building in Sustainability and Environmental Management (CapSEM) Model: a systemic approach towards sustainability



Source: Fet and Knudson (2023)

DfE principles are those such as design for dismantling, recyclability, repairability, material recovery, and promoting modularity and upgradability, to facilitate the circularity of products. Key strategies for integrating sustainability principles into product design and development include life cycle thinking and user-centered design.

The tools presented at Level 3 in in Figure 1 are EMS, EPE, KPI, GRI, LCM, CSR, SBM (the full titles are listed in Figure 1). As per Level 2, businesses can minimize environmental impacts, enhance social responsibility, and drive innovation by implementing sustainability requirements in the supply chain. By employing supply chain management (SCM) businesses can, in addition to improving their products, enhance their environmental performance, promote social responsibility, and create long-term value. This enables businesses to identify potential environmental and social risks and opportunities. Businesses can engage suppliers in sustainability initiatives, share best practices, and provide training and capacity-building support. Building strong partnerships based on mutual trust and shared sustainability goals promotes innovation and ensures the continuous improvement of their products.

There is no clearly defined border between actions taken in the product supply chain at Level 2 and the strategic decisions taken by a production company at Level 3. At Level 2, the analytical tools for product improvements are presented, while Level 3 presents the strategic management practice necessary for getting the potential improvements implemented. Strategies for the adoption of sustainable practices also include green procurement by prioritizing the procurement of sustainable and eco-friendly materials, products, and services in the supply chain. This can involve evaluating suppliers based on their environmental and social performance, favoring products with eco-labels or certifications, and supporting local and fair-trade suppliers. By considering the entire product life cycle, businesses can identify opportunities to reduce environmental impacts, improve resource efficiency, and create value from waste.

Collaboration with stakeholders throughout the value chain is crucial for successful implementation, including suppliers, consumers, recycling facilities, and regulatory bodies.

CONTRIBUTION TO SUSTAINABLE DEVELOPMENT

To effectively contribute to sustainable development, businesses must embed sustainability into their core business strategy by setting clear goals, allocating resources, and integrating sustainability into the overall strategic vision of the organization. This ensures that sustainability is woven into Level 1 and 2 activities. Establishing environmental management systems (EMS), such as ISO 14001 or other recognized management standards, to systematically manage environmental impacts, set targets, and monitor performance, will support continuous improvements and ensure compliance with environmental regulations.
Integrating sustainability into financial decision-making and reporting is essential for driving sustainable development. Strategies for sustainable finance include triple bottom line reporting where environmental, social, and governance (ESG) factors are considered when decisions are made around investment and initiatives that align with sustainability goals. This can involve investing in renewable energy, sustainable infrastructure, or social enterprises. The Global Reporting Initiative (GRI 2022) or Sustainability Accounting Standards (SA 8000, 2023) provide transparency to stakeholders and demonstrate the organization's commitment to sustainability. By embedding sustainability into the core business strategy and operations, organizations can drive transformative changes. Sustainability-focused business models are designed to create economic value while simultaneously addressing environmental and social challenges. One example of sustainable business models (SBM) or business models for sustainability (BMfS) is the circular economy[2] which aims to maximize resource efficiency by keeping products, components, and materials in circulation for as long as possible (Geissdoerfer et al., 2017).

Collaboration with stakeholders is essential for businesses to effectively contribute to sustainable societal development, represented by Level 4 in the CapSEM Model. Businesses play a significant role in the broader societal context, including efforts to shape policies and regulations that promote sustainability. Investing in the well-being and development of local communities where a business operates, can involve supporting local initiatives, providing job opportunities, contributing to community infrastructure, or engaging in philanthropic activities aligned with sustainability goals, as well as promoting sustainability education. By collaborating with societal stakeholders, businesses can ensure that their efforts towards sustainability are aligned with societal needs and foster a sense of shared responsibility for sustainable development.

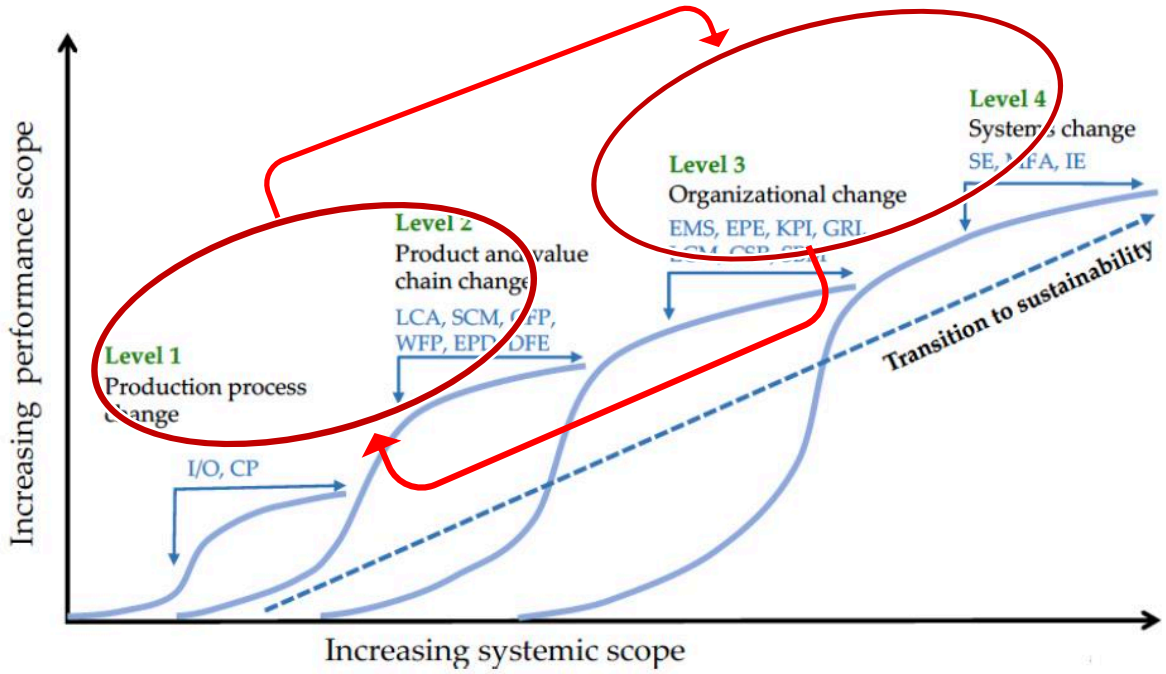
Strategies for integrating sustainability into decision-making processes at Level 4 include establishing clear sustainability criteria and metrics that align with the organization's values and goals: strategies for stakeholder engagement in sustainability include communication and awareness through effective communication channels to share information about these. Platforms to share best practices, success stories, and lessons learned related to sustainability, will create opportunities for a learning culture and collaboration in society.

FEEDBACK LOOPS FOR CONTINUOUS IMPROVEMENTS

The aim of the CapSEM Model was originally to guide business and other organizations in a systematic approach to meet and solve their sustainability challenges. However, results from analyses and actions for changes towards more sustainable practices at Level 1 and 2 are of great help for strategic business decisions and policy making at Level 3 and Level 4. However, by using the tools in a bottom-up approach and implementing results, the achievements by corporate and society will create new insight and thereby encourage to additional analyses on the lower Levels. This will, with the right competence, understanding, involvement and engagement with internal as well as external stakeholder, contribute to longer-term continuous improvement. Lessons learned from analyses of individual processes, activities and products at Levels 1 and 2, can help business and government in strategic decision making at Level 3 and Level 4 which in the next time leads to stricter sustainability requirements and regulations to certain processes and products. This is illustrated in Figure 2 by feedback loops between the decision-makers at Levels 3 and 4, and the practical actions to be taken for changes at Level 1 and 2 for more sustainable products and services, and thereby create a long-term systemic change.

[2] There is a wealth of literature on the Circular Economy, however an in-depth analysis of this is outside the scope of this paper.

FIGURE 2. Feedback-loops between the decision-makers at Levels 3 and 4, and the practical actions at Level 1 and 2.



THE CapSEM MODEL AND THE SDGs

HOW CAN SDGs HELP WITH SYSTEMIC TRANSITION?

A further question is how the CapSEM Model contributes to the transition to sustainability through sustainable development goals (SDGs) being achieved. By advocating for sustainable policies and actively contributing to SDGs, businesses as responsible global citizens and stakeholders in sustainable development, can drive systemic change, support the broader sustainability agenda, and contribute to a long-term transition towards sustainability.

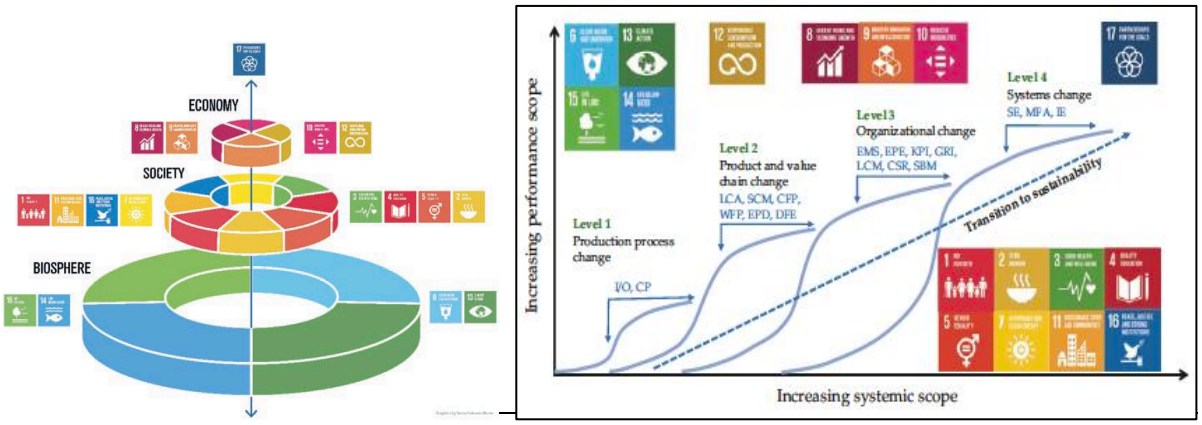
The wedding-cake model as shown at the left side of Figure 3 (Rockström and Sukhdev 2016) is often used to illustrate how the 17 SDGs can contribute to the environmental, social, and economic categories of sustainability. This nested model illustrates an embedded view of the three dimensions of sustainability. The economic layer, or system represented by the SDGs 8, 9, 10 and 12, is nested within the societal layer represented by the SDGs 1, 2, 3, 4, 5, 7, 11 and 16, which is ultimately nested inside the Earth's biosphere represented by the SDGs 6, 13, 14 and 15. This communicates the essential fact that all activities must be considered within the Earth system. Relationships and interactions between the layers and therefore between the goals, then become apparent (Fet, Knudson and Keitsch 2023). The impacts on the environment are mainly caused by the interactions between man-made systems by (resource extraction from the nature) or releases of pollutants, emissions and other material flows ending up in the natural environment.

The CapSEM Model places the tools for measuring environmental and social performance in a similar system thinking approach. The right-hand side of Figure 3 shows the SDGs placed along the four Levels of the CapSEM Model. Although the goals are each placed on a single Level, the SDGs overlap and transgress. Their placement on specific Levels indicates an emphasis on certain areas but does not lock them in or prevent their being considered in other Levels.

SDGs related to the biosphere (SDGs 6, 13, 14 and 15) are placed on Level 1 where energy and material flows are measured by tracking their movement in and out of the man-made systems under study, referred to as production processes. These material flows impact different systems of the biosphere, such as land, sea or air. Material flows also occur at Level 2, however, the flows are calculated using the same basic principles as they are for Level 1.

Rather than specific production processes (Level 1), the respective processes are summarized as the systems of the product value chain (Level 2). Strategic decisions and policies at business Level (Level 3) and societal Level (Level 4) will regulate material flows within their systems as an endpoint and thereby influence a change in impacts on the different parts of the biosphere. Impacts, therefore, are likely to result from activity on the upper Levels in the CapSEM Model, but be caused by the material flows as already described for Level 1.

FIGURE 3. The SDGs in the wedding-cake model (Rockstøm and Sukhdev 2016) and in the CapSEM Model



Source: Fet, Knudson and Keitsch (2023).

SDGs 12, 8, 9 and 10 reflect impact on the economy and are placed on that Level in the wedding cake model. However, these SDGs are placed on Levels 2 and 3 of the CapSEM Model. SDG 12, for example, concerns responsible consumption and production. This reflects the activities upstream and downstream in the value chain of products (Level 2). The achievement of this goal is also dependent upon strategic choices made by the organization involved in production (Level 3), and on consumers at Level 4 of the CapSEM Model.

The rest of the SDGs are grouped on the societal Level in Figure 3. These are not placed at one specific Level of the CapSEM Model, but rather shown as goals that should be used as contextually appropriate for driving an organization's transition to sustainability. The use of these goals should therefore be considered according to the specific sector being studied or problem analyzed. An example of this is SDG 7: this shows how affordable and clean renewable energy will play an important contribution to changes towards sustainable solutions on all Levels. SDG 17 is placed both on the top of the wedding-cake and the CapSEM Model as the overarching goal to be focused on during the entirety of the transition process.

HOW DO THE TOOLS ON EACH LEVEL IN THE CapSEM MODEL CONTRIBUTE TO THE SDGs?

Let us take a closer look at how applying the tools contributes to the SDGs. The following description focuses primarily on the strategic role business can play in fostering the transition to sustainability.

The Level 1 tools are I/O and CP. By applying I/O-analyses, businesses and policymakers can gain a better understanding of the material flows and their impacts on SDG 6, 13, 14 and 15. The efficiency of material-use, waste treatment practices and pollution prevention measures in various sectors, can be evaluated. Results from these can inform policy makers and investment decisions in order to drive progress towards sustainable development while minimizing negative environmental impacts. Table 1 gives examples as to how Level 1-tools can contribute to the transition to sustainability based on these SDGs.

TABLE 1. Level 1 tools' contribution to SDG 6, 13, 14 and 15

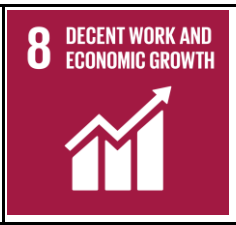
SDGs	Level 1-tools

	I/O- analysis can identify water-intensive sectors (agriculture, energy production, manufacturing) and quantify water footprint of sectors. CP- techniques can improve water management, reduce water consumption by water recycling, efficient irrigation systems, and water-saving technologies.
	I/O-analysis can assess the greenhouse gas emissions and carbon footprints of different processes. CP-techniques can include adopting renewable energy sources, improving energy efficiency, and implementing energy management systems.
	I/O-analysis in combination with impact assessments, can help assess the impact on marine ecosystems and contribute to the conservation and sustainable use of oceans and marine resources. CP-techniques can be used for example to reduce impacts from different fishing gears.
	I/O-analysis can help quantify the land use, deforestation, and resource extraction associated with agriculture, forestry, mining, and construction. CP-techniques can guide policies for sustainable land use, conservation, and restoration efforts to protect, restore, and manage terrestrial ecosystems.

HOW DO LEVEL 3 TOOLS (THE BUSINESS MANAGEMENT TOOLS) CONTRIBUTE TO THE ACHIEVEMENTS OF SDGS 12, 8, 9, 10?

According to the wedding-cake model, SDGs 12, 8, 9 and 10 are defined as belonging to the economic category of sustainability. Businesses can identify areas for improvement, set targets, and implement strategies to align their operations with these SDGs. The most relevant tools for achieving the SDGs 12, 8, 9 and 10 are mainly presented at Level 3, but also Level 2 and to a certain degree Level 4, for SDG 12. Table 2 gives an overview of the Level 3-tools and these SDGs. The colored areas are used to exemplify how the tools can contribute to these SDGs.

TABLE 2. Level 3 tools applied for the SDGs 12, 8, 9 and 10.

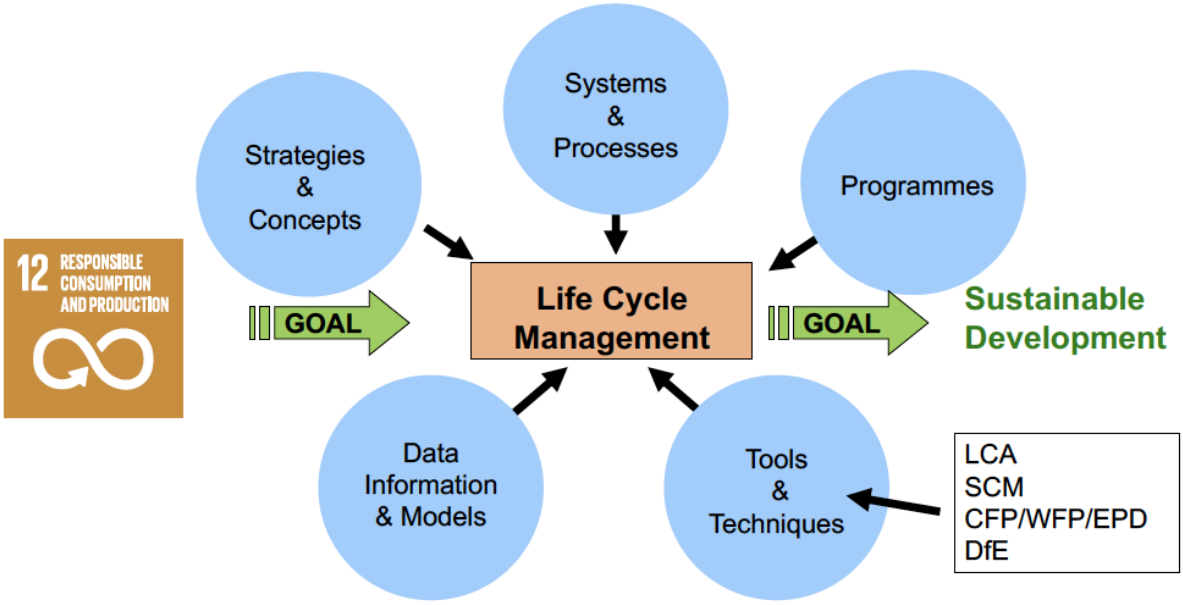
Level 3 management tools				
EMS				
EPE				
KPI				
GRI/ESG				
LCM				
CSR				
SBM				

SDG 12 (Responsible consumption and production) includes assessing efforts to implement more sustainability practices in product design and development that consider not only both sustainability and adopting circular economy principles along the entire value chain of the products, but also educate consumers and producers by encouraging sustainable consumption patterns and minimize loss of valuable materials as waste.

As seen in Table 2, the management tools, Life Cycle Management (LCM) and Corporate Social Responsibility (CSR) are selected to illustrate how business can address SDG 12.

LCM is used to establish systematic management of the life cycle of products and services, and combines a variety of tools and approaches to look at how these factors are interconnected and how to best address these issues throughout a product's life cycle. The weighting of these factors depends on what is of most importance to the organization responsible for management.

FIGURE 4. Elements of Life Cycle Management



Source: UNEP (2007)

LCM is a dynamic process and constitutes several elements as shown in Figure 4. Tools and techniques for product analysis are available at Level 2 in the CapSEM Model. Level 2-tools are a mix of analytical tools as well as tools for communicating information about products or services. Briefly, LCA is to be used to analyze the environmental impacts throughout the different life cycle phases and of the components of a product; SCM is to be used for judging decisions to improve problems detected by the LCA, and communicate these requirements in the supply chain; CFP, WFP and EPD are to be used to inform retailers and consumers, and help them make responsible decisions regarding sustainability of products; DFE is to be used when producers want to integrate sustainable solution for new products design, e.g. design for longer life of products, design for dismantling and separation of material after end of life, design for recycling etc. Results from the above-mentioned tools will help to develop improved products and services which support SDG 12.

CSR IN THE SUPPLY CHAIN

Promoting responsibility in the value chain of a product should be the responsibility of the producer or the retailer. Figure 5 illustrates the product value chain from resource extraction to a product is at the retailer. If the retailer has a strong CSR-strategy which means he has assumed responsibility for implementing CSR-management procedures to inform his customer about responsibility taken in the entire value chain, he obliges all suppliers to communicate their CSR-actions. Information can be given using, for example, KPIs in an EPD. Different stakeholders will put pressure on different life cycle stages as indicated on the right-hand side in Figure 5.

FIGURE 5. CSR-issues in the value chain.

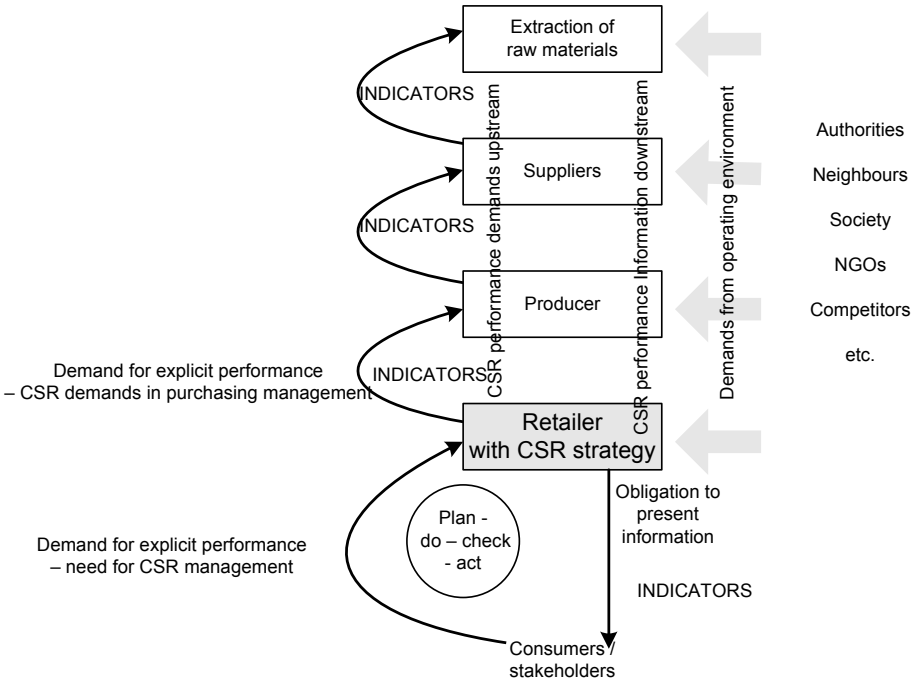


Table 2 also gives examples of how to address the other SDGs in the economic area in the *wedding-cake* model. SDGs related to the biosphere (SDGs 6, 13, 14 and 15) are placed on Level 1 where energy and material flows are measured by tracking their movement in and out of the man-made systems under study, referred to as production processes. These material flows impact different systems of the biosphere, such as land, sea or air. Material flows also occur at Level 2, however, the flows are calculated using the same basic principles as they are for Level 1. Rather than specific production processes (Level 1), the respective processes are summarized as the systems of the product value chain (Level 2). Strategic decisions and policies at business Level (Level 3) and societal Level (Level 4) will regulate material flows within their systems as an endpoint and thereby influence a change in impacts on the different parts of the biosphere. Impacts, therefore, are likely to result from activity on the upper Levels in the CapSEM Model, but be caused by the material flows as already described for Level 1.

SDG 8 (Decent Work and Economic Growth) includes assessing the integration of sustainability principles within businesses' operations, for example by promoting resource efficiency and minimizing the environmental impact of economic activities, and whilst also better controlling indoor emissions of dust and noise including assessing impacts on occupational health and safety. In addition, fair labor practices, training and capacity building form part of this category of decent work. In Table 2 KPIs and GRI/ESG are selected to exemplify how to work towards achievement of this SDG.

SDG 9 (Industry, innovation and infrastructure) assessment will involve evaluating to which extent industries and infrastructure development align with sustainability principles. In Table 2 EMS, EPE and SBM are selected to exemplify how Level 3 tools can help achieve SDG 9. EMS represents good management structures, and EPE represents evaluation of innovations and ensuring that industrial activities are conducted in an environmentally responsible manner. Implementation of SBM means that sustainability criteria should be integrated in the core strategy of a company.

SDG 10 (Reduced Inequalities) includes assessing business practices related to diversity and inclusion, fair wages and working conditions, and supply chain management that respects human rights. Sustainable business models (SBM) and CSR can promote inclusive value chains, provide fair economic opportunities, and engage in responsible sourcing practices.

Assessing SDGs 8, 9, 10, and 12 through the management tools at Level 3 can help businesses identify areas for improvement, set targets, and implement strategies to align their operations in line with these goals. This approach promotes responsible and inclusive business practices, fosters innovation, reduces inequalities, and promotes sustainable consumption and production patterns, thus contributing to the achievement of these SDGs.

THE ROLE OF BUSINESS AND SOCIETAL ACTORS - LEVEL 3 AND 4 ACTIONS AND IMPLICATIONS TO SOCIETY

So far, we have looked at the tools in the CapSEM Model Level 1-3 and how well they contribute to SDGs in the ecological and economic categories of sustainability. We might now ask the question as to how well business actors (associated with Level 3) and the societal actors (associated by Level 4) are able to use the toolbox suggested for each SDG. Do they have sufficient knowledge to use the tools in their work for more sustainable solutions?

Business-leaders and policymakers can target interventions and technologies to improve resource management practices or technologies that contribute to the transition to sustainability. The role of SDGs 1, 2, 3, 4, 5, 7, 11, 16 and 17 is not described or discussed in this paper since the purpose was to look at the business' role in the transition. However, as long business is part of the society, either through Responsible Citizenship[3], as a driver for innovation or as a job creator in the region, they will also have a role through stakeholder interactions to form the society.

FROM HISTORY TO THE FUTURE

This paper started with a brief history of sustainability development. Much has happened since the first international conference in 1972, now over 50 years ago. The Stockholm + 50 conference held in 2022 resulted in a set of recommendations which can be summarized as below (SEI and CEEW, 2022):

A. Cooperation between countries to reduce the climate crisis, loss of resources and biological diversity and pollution.
B. Cooperation across sectors through joint focus on measures.
C. New economic models for, e.g. a green or circular economy that contributes to development without an environmentally harmful footprint.
D. Science, technology and data must be both accessible and used effectively.
E. Increase awareness of the global nature of environmental problems.

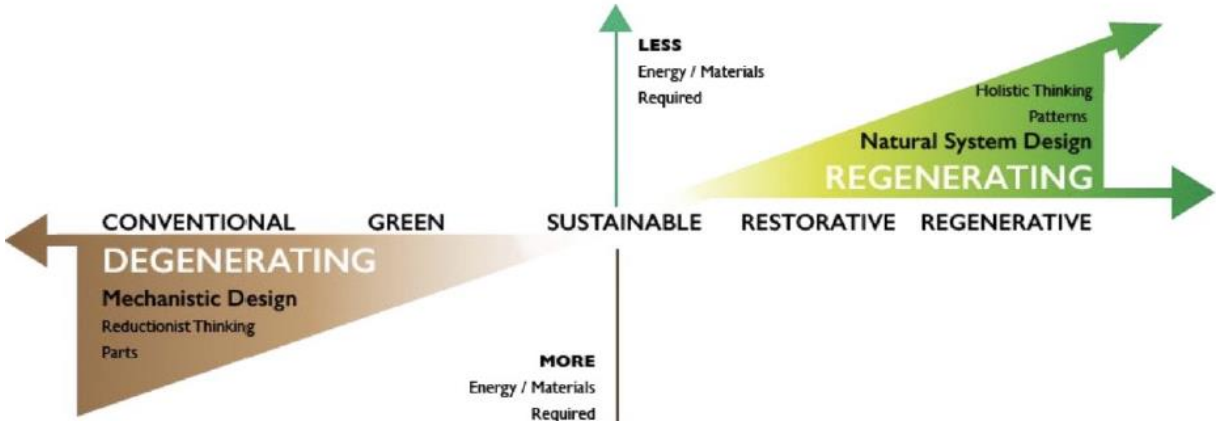
The CapSEM Model is a model which can act as a guide for business to choose tools that can help advance their sustainability performance. The way in which the model is introduced here, is a bottom-up approach; however, it can also be used as a top-down approach, starting with the global frameworks that support the SDGs. It is also possible to go directly to the Level of most importance. The advice given in the CapSEM Model is mainly based upon reductionistic thinking where business should understand how to make incremental systemic changes.

The book Limits to growth pointed out the challenges around resource scarcity in the future. Figure 6 shows the need for a systemic change from degenerating the environment towards regenerative models where regenerative businesses seek to achieve net positive impacts while focusing on the wider system within which they operate. Regenerative businesses seek to achieve net positive impacts while focusing on the wider system within which they operate.

The need still remains to develop a better overall understanding of sustainability and sustainable development. Amongst other things this is related to the best way in which to handle goal conflicts that cannot be easily resolved without prioritizing one consideration over another. This is not only a question of more knowledge. It is primarily about political and value priorities. There is a large degree of dynamism in the system, so that political orders are quickly translated into regulations. This places great demands on competence development and change management within the sectors concerned.

FIGURE 6. From degenerative to regenerative sustainability strategies

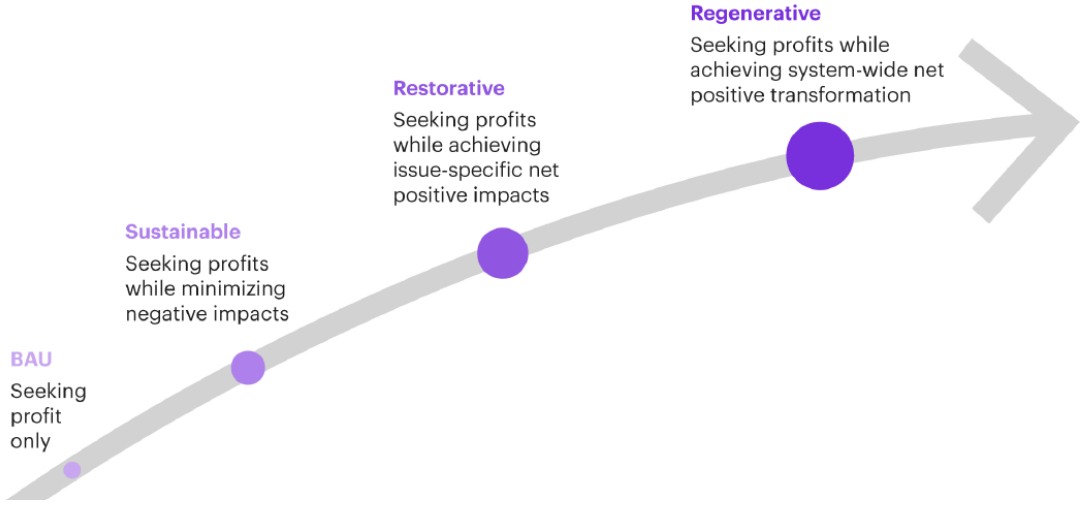
[3] Responsible Citizenship can be defined as taking an active role in society by engaging in constructive behavior that promotes personal, social, and institutional values of justice, equity, respect, and responsibility.



Source: Konietzko, Das, and Bocken (2023)

Figure 7 illustrates different levels of sustainability efforts, ranging from business as usual (seeking profit only), to sustainability (seeking profits while monitoring negative impacts). The next step is restorative: seeking profit while achieving issue specific net positive impacts. Future efforts should investigate regenerative efforts: seeking profit while achieving system wide net positive transformation.

FIGURE 7. The way ahead from business as usual (BAU) to regenerative and net-positive transformation



Source: Fullerton (2015)

CONCLUDING COMMENTS

In recent years, it has become increasingly common to distinguish between sustainability, understood as reducing our negative impact on the environment, and regeneration, which also includes restoring or at best improving the ability of existing systems to function in a robust way over time. The term is used to describe new ways of approaching design, economics or even a new form of capitalism. Although the distinction between sustainable and regenerative may appear to partly overlap, it may also seem that there is a corresponding shift underway in thinking around regulation and restructuring of various sectors in society. In the area of climate change, it has long been clear that we will not reach our goals with such transitions without taking into account so-called negative emissions, i.e. nature-based or technological interventions that remove carbon which has already been released into the atmosphere. The idea, then, is to restore balance in the carbon cycle between emissions from human activity and nature's ability to store carbon over shorter or longer periods of time.

In this paper a model to help businesses transition to more sustainable practices, processes and systems, has been presented. To date, the interaction between a scientific understanding of the problems and the development of tools at different Levels and within different sectors has been central to our understanding of the role of sustainability in business development. The drivers exist. The tools are being continuously put into practice and can be further developed as they are used. It now rests with businesses to truly pick up the baton to drive these changes forward.

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TRACK 5
Production, consumption and innovation

5b. Design for sustainability

Abstracts

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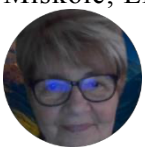
Developing bio-based building elements for sustainable, smart and circular architecture

associate professzor István Kocserha[1], senior researcher András Velősy[2], senior researcher Zsuzsanna Józsa[3], senior reserchер; associate professor Anita Terjék[4], Office manager Levente Radomszki[2], ret.professor; senior researcher Klára Tóthné Szita[5]
[1]University of Miskolc, Miskolc, Hungary. [2]ÉMI nkft, Szentendre, Hungary. [3]ÉMI nkft; BME, Szentendre; Budapest, Hungary. [4]EMI nkft; BME, Szentendre; Budapest, Hungary. [5]University of Miskolc; ÉMI nkft, Miskolc; Szentendre, Hungary



RET.PROFESSOR; SENIOR RESEARCHER KLÁRA TÓTHNÉ SZITA

Abstract

The interest in low-energy building materials is growing and bio-based materials are a key part of this group. The use of bio-based building materials offers the potential to reduce the amount of greenhouse gases embodied in construction products and even to sequester carbon dioxide. Several research projects around the world have aimed at developing building components using plant aggregates. Previous research has already demonstrated the potential of bio-based materials such as hemp, flax, mycelium, lignin-based fibres, wood waste, sunflower, cork, corn husk, coconut, rice husk, wood, and bamboo particles in inorganic matrices (e.g., lime and limestone).

The aim of the present research is to analyse the environmental, social, and economic impact of bio-based concrete using a regionalised LCA model and to evaluate the results in terms of technical and engineering parameters. The LCA-based studies include the preparation of an environmental LCA, a life cycle costing (LCC) and a social life cycle analysis (SLCA). The research follows methodologically the PCR requirements and standards defined for concrete elements. The biomaterials used for the production of bio-based concrete elements are local products and the technology follows the principles of the circular economy.

In the initial stage of the research, potentially usable natural materials (reed, bamboo, hazelnut, willow cane, grass, hemp) will be examined until they can be incorporated and the environmental, economic and social effects of the materials will be compared , which will include the stages of agricultural production, harvesting and primary processing. The functional unit for this stage is 1kg.

The second stage of the study is the production of the bio-based building element, where the bio-based component is already present in the concrete. The environmental, economic and social impact of bio-based concrete element production will also be assessed and compared on the basis of a matrix of technical and functional parameters. In this case, the functional unit is 1 m2. Preliminary studies based on multi criteria testing will contribute greatly to the design of a sustainable product chain.

Key words: LCA, LCC, SLCA, biobased concrete, sustainable product chain

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Considering packaging's role in fighting food waste

Associate Professor Lukas Parker[1,2], Professor Linda Brennan[1,2], Associate Professor Simon Lockrey[3,2], Dr Bruno Schivinski[1,2], Dr Michaela Jackson[1,2], Dr Tej Pochun[4,2], Dr Eloise Florence[1,2], Dr Sophie Langley[1,2], Allister Hill[3,2], Maddison Ryder[3,2], Associate Professor Karli Verghese[3,2], Dr Caroline Francis[3,2], Anouk Sherman[1,2], Natalia Alessi[1,2], Nhat Tram Phan-Le[1,2], Dr Ella Chorazy[1,2]
[1]School of Media and Communication, RMIT University, Melbourne, Australia. [2]Fight Food Waste Cooperative Research Centre, Adelaide, Australia. [3]School of Design, RMIT University, Melbourne, Australia. [4]Department of Marketing, Monash University, Melbourne, Australia

ASSOCIATE PROFESSOR LUKAS PARKER

Abstract

Food packaging is a significant environmental issue. Yet, the relationship between packaging and food waste, and the impacts that food waste can have on the environment, is underrepresented in sustainability campaigns for consumers. Packaging is often viewed as having a negative environmental impact because it is 'left over' once a product is consumed and must be disposed of. However, often, packaging protects food and prolongs its shelf-life, reducing food waste and the consequent negative environmental impact. Packaging designed with food waste in mind can extend the shelf-life of food products, cater to different-sized households, communicate how to use and store food, and assist households in using date labels to manage their food better.

This project from the Fight Food Waste Cooperative Research Centre in Australia aimed to develop deep and broad insights into consumers' attitudes towards food waste and how it relates to packaging. It also aimed to provide industry with options to develop packaging design alternatives that draw on the knowledge of consumers' use and understanding of packaging to reduce food waste. The project aligns with the Australian Government's commitment to reduce food waste by half by 2030, consistent with United Nations' Sustainable Development Goal 12.

Design thinking and ethnographic approaches, combined with quantifiable validation procedures, were used in this 12-stage multiple-methods project. Consumer and industry participants provided insights across the top five food categories that are wasted in Australia: (1) fresh fruit and vegetables, (2) meat and seafood, (3) dairy and eggs, (4) bakery items, and (5) packaged and processed foods. In turn, packaging design alternatives were developed to prioritise consumers' perceptions and industry priorities.

Key consumer insights were that packaging design should provide short-form information with simple text and symbols, and that consumers will use QR codes if available. Packaging should show thoughtful recipe ideas for leftovers, clearer indications of portion size and serves, and easy-to-understand storage advice. Consumers understood that foods from different categories need different treatments in terms of packaging. One example was that meat and seafood packaging needed more emphasis on safety cues, while information on repurposing and refreshing fruit and vegetables would be more helpful on those products. Regarding date labelling, the term 'best before' on the packaging is confusing but clearer than other terms like 'eat me' or 'freshest by'. The term 'Eat within X number of days' is helpful for consumers.

Industry participants considered that further consumer education on packaging reuse and recycling is needed, but more thought to portion-controlled packaging is also required. There were also concerns about the costs associated with sustainable packaging and the feasibility of implementing changes without a whole-of-system approach to reducing food waste.

These insights provide industry and government with foundational advice to inform interventions and campaigns to enable consumers to reduce food waste in the home regarding packaging. Further research is needed to use these consumer insights for developing policy and affecting packaging designers' and producers' approaches to using food waste, particularly around date mark labelling and storage advice.

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Definition of design strategies for sustainability for fashion accessories of the Made in Italy footwear sector, through Life Cycle Assessment methodology. The case-study of a brass buckle for footwear by Santoni Srl

Full Professor Lucia Pietroni, Researcher Daniele Galloppo, Engineer Raffaele Scialdoni
University of Camerino, Ascoli Piceno, Italy

FULL PROFESSOR LUCIA PIETRONI

RESEARCHER DANIELE GALLOPPO

ENGINEER RAFFAELE SCIALDONI

Abstract

The Italian footwear sector is among the pillars of the Made-in-Italy Fashion System, and has always been a leader among high-end and luxury footwear manufacturers. The success of the sector is due to the entrepreneurial ability and typical organization of the industry, which is in the context of a "long production chain", consisting of a system of high-quality sub-suppliers, raw materials, components, accessories, machine manufacturers, pattern makers and stylists. This Italian model has made it possible to develop high quality products and to strengthen the competitiveness of Italian companies compared to their competitors. Today, considered the ever-increasing importance of the issues of environmental sustainability of products and production processes, the long supply chain of the footwear sector creates greater complexity in the sustainable management: from the sourcing of raw materials to the multiple processing and finishing of components. In addition, research conducted by Quantis (2018). showed that more than 60 percent of the emissions of footwear production are generated in the processing phases of components and accessories, thus upstream of the assembly and distribution phase. Recently, several BtoB companies in the footwear production chain have taken a proactive approach to environmental sustainability. The objective is to seek where their greatest environmental impacts reside and how to make improvements to make footwear components and accessories more sustainable and circular (LIFE GreenShoes4All, 2020). Among the most critical products are brass, zinc or steel accessories, which are covered with a thin layer of precious metal; this finishing process generates pollutants that are difficult to recycle and dispose of. Therefore, the case study of Santoni Srl, represents a significant example of a preventive approach to sustainability, which can contribute to understanding the importance of using LCA-Life Cycle Assessment methodology to define ecodesign strategies to improve the environmental performance of both product, and company. The LCA, performed according to ISO 14040, was carried out on one of the company's most representative and best-selling products in recent years: a brass buckle for the Made in Italy footwear sector. The objective of the analysis was to detect the main environmental criticalities, from cradle to gate, and to identify improvement strategies to improve sustainability and circularity. Finally, the environmental performance of the new product developed according to Design for Sustainability strategies was estimated. The result was an overall reduction in kg CO2 emissions of up to twenty times, compared to the current model.

The paper relates to the topic of the conference in that it highlights the importance for Made-in-Italy SMEs, to activate Design for Sustainability strategies to accelerate the transition process to the Circular Economy by quantifying the environmental impacts of their products and beginning to affect sustainable supply chain management. In addition, the paper presents a case study of a company in the footwear sector that initiated

this approach in line with the "Planet" target and SDG 12: "Responsible Consumption and Production", moving toward more sustainable production processes and consolidating its green reputation.

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Design of sandbags for flood control and water purificationbased on KJ/FAST/CATIA

Postgraduate Haorui Tian, Postgraduate Meng Zhang, professor Li Zhang
Guangdong University of Technology, Guangzhou, China

POSTGRADUATE HAORUI TIAN

Abstract

Flood sandbags are emergency products used in emergency disasters to provide water resistance for public facilities, etc. Existing flood sandbags are classified into canvas sandbags, silicone sandbags, etc. depending on the material. Traditional sandbags need to be prepared by tedious filling to use, while the assembly, transportation, and installation of sandbags can be completed with the support of sufficient manpower and heavy machinery, and the whole process is time-consuming and laborious. In the face of sudden flooding, traditional sandbags cannot provide the corresponding protection function in a short time. The use of sand and gravel as the filling material of sandbags leads to their small water absorption capacity and low drainage efficiency. Therefore, the ergonomics, materials, and functions of traditional sandbags need to be updated to meet the basic needs of flood control and to provide the functionality to emotional relief to the affected people, and dual physical and psychological security from disaster to post-disaster. To meet the emergency rescue needs of the affected people under flooding scenarios, we design a flood prevention and water purification sandbag that better meets the physiological and psychological needs of users with the design goal of quick rescue and self-help. Analyze the causes and characteristics of flood disasters, combine the KJ method to investigate user needs in-depth, prioritize the needs systematically, analyze the main functional needs and related technical issues through the black box model, establish the product FAST function tree to derive the main functional module design guidelines for flood sandbags, establish the form matrix of flood sandbags around functional innovation and integration, and then propose a new product innovation model. Finally, the ergonomics module of CATIA software was used to virtually simulate the user's operating posture of sandbag handling and to analyze and evaluate the comfort of the user's posture. The study shows that: KJ/FAST/CATIA model can synthesize the objective needs of users and the subjective initiative of designers to ensure both the core requirements of the product and design innovation and establish a design creation model that unites the subject and the customer. The designer can systematically probe the real needs of users, input the requirements into the FAST model to output the innovative functions of the product and its principle explanation, and establish mapping relationships with relevant design tools to improve the existing flood control sandbags and other problems of functionality and ergonomics. Through the modular design of the appearance and function of the flood control sandbags, it is verified that KJ/FAST/CATIA can propose an innovation path to discover, analyze and solve product problems, realize the functional expansion of the product in terms of modularity and human-machine relationship, build an innovative design of flood control sandbags that meets users' needs such as water purification, and effectively improve the emergency rescue efficiency and use the experience of flood control products. In the future design of emergency, rescue products need to think more deeply about the emotional needs of users, highlighting the humanity and affinity of the product.

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Research on the environmental protection design of cultural and creative products under the regional cultural background of Wuhan, China

Siyun Teng

China University of Geosciences, Wuhan, WUHAN, China

Abstract

The innovation of cultural and creative products is an effective way to promote cultural communication and improve economic benefits. The degree of cultural development is also an important symbol of a country's social civilization and development level. In recent years, all countries in the world have vigorously promoted and developed the development of cultural and creative industry, starting from the local regional culture. This paper is mainly based on the regional culture of Wuhan, China, Exploring the sustainability of cultural and creative product design and development under the background of Wuhan regional culture. First, we explore the characteristics of the regional culture, Outlines the folk customs, folk crafts, characteristic buildings of Wuhan. And expounds the role of regional culture in the integration of cultural and creative products, For example, it is conducive to the image building of Wuhan city, the development of Wuhan city, and increases the charm and attraction of Wuhan city.The concept, type, origin, development, significance and function of cultural and creative products are summarized, Focus on combining their own design principles and design concept, Explore the practical application of regional cultural and creative products. From the perspective of environmentally friendly materials and sustainable design, To sketch, design plans, To making models, making real objects, etc. Finally, the work was exhibited in cooperation with Hubei Provincial Library. The sustainable development goal of this conference is the inheritance and protection of intangible cultural heritage and the application of environmental protection materials in the design. The significance of this article and the work is to promote people's awakening to culture, promote the prosperity of the world's diverse cultures and the continuation of the earth's cultural resources.

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Research on the Application of Service Design in the cultivation of rural environmental awareness -- A case study of rural garbage disposal system in eastern coastal areas of China

MR Wenbo Wang[1], MS Hanxiao Mao[2]
[1]China Jiliang University, Hangzhou, China. [2]Zhejiang University of Science and Technology, Hangzhou, China

Abstract

The cultivation of rural environmental awareness is extremely important for sustainable strategy. Cultivating environmental protection thinking and consciousness can not only implement environmental protection measures better, but also be an important basis for realizing sustainable development. When environmental awareness is developing from bottom to top, villagers will be able to actively participate in the construction of environmental protection in the villages, thus achieving the goal of sustainable development in the future.

Service design is a relatively new design discipline, which meets the needs of technology and economic development in these years. Different from individual design, service design expand the category to social hirarchy, and provides full-cycle and full-coverage design strategies and contents for specific groups or communities.

Aiming at the public service system, the service design creates a human-centered service system by focusing on the connection between users and touchpoints in the service, and at the same time potentially affects people's awareness, consciousness, and behaviors.

The research on the cultivation of environmental awareness from the perspective of service design intervention can enter into the system process from different roles, and evaluate the effect of each touchpoint in the process on the cultivation of environmental awareness more accurately and effectively.

This paper will take the rural garbage disposal system in the eastern coastal areas of China as an example to explore the status of service design in the system and its influence in the cultivation of rural environmental awareness. The eastern coastal area of China, which is one of the three Chinese economically developed deltas, is the earliest area of garbage sorting and recycling in China.

With a large population density, a small gap between urban and rural construction, and an advanced awareness of environmental protection, this region is also the first in China to pilot the reform of the rural garbage disposal system. Therefore, the study on the rural garbage disposal system in the eastern coastal areas of China has a positive and realistic reference value for the vast underdeveloped areas in the central and western parts of China and even some developing countries in Southeast Asia.

This article will be expanded as follows:

First of all, this paper studies the theoretical convergence of service design and sustainable strategy, and explores how service design thinking guides the design of public service systems -- touchpoints, to guide subsequent research.

Secondly, this paper will take the rural garbage disposal system in the eastern coastal areas of China as a case study of public service system design, analyze the touchpoints in the process from the perspective of service design thinking, and qualitatively study the role and significance of these touchpoints in the cultivation of rural environmental awareness through interviews, questionnaires, observation, and other methods.

Finally, from the perspective of cultivation mode, the paper summarizes and analyzes the methods and strategies applied in the cultivation of rural environmental awareness by service design and evaluates the practical effects.

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Integrating Life Cycle Thinking in Early Design Phases: A practical case for constructive sustainability assessment of emerging energy storage technologies

Hüseyin Ersoy[1], Dr. Manuel Baumann[1], Prof. Tomás Ramos[2], Dr. Marcel Weil[1,3]
[1]Karlsruhe Institute of Technology (KIT), Institute for Technology Assessment and System Analysis (ITAS), Karlsruhe, Germany. [2]CENSE – Center for Environmental and Sustainability Research & CHANGE - Global Change and Sustainability Institute, NOVA School of Science and Technology, NOVA University Lisbon, Lisbon, Portugal. [3]Karlsruhe Institute of Technology (KIT), Helmholtz Institute Ulm for Electrochemical Energy Storage (HIU), Ulm, Germany

H Ü S E Y I N E R S O Y

Abstract

A transition towards a sustainable energy system enforces many potentially conflicting considerations (e.g., economic, environmental and social aspects) regarding the development of new technologies. In addition to efforts for increasing renewable shares, existence of sustainable storage technologies is vital for an overall transition. In particular for energy storage, many initiatives aim to improve the performance of emerging concepts that are thought to have high potential to contribute to a sustainable energy transition. In this respect, aluminium (Al) as a dense energy carrier is identified as a promising energy storage material for batteries where certain efforts are given for their performance improvement and commercialization. Nevertheless, most of the time sustainability performance of a technology is being considered in detail after it is commercialized. The "Collingridge Dilemma" states that in early technological development stages the technological flexibility and influence on innovations is highest but the knowledge of impacts is the minimum, where it is reversed in the later stages. Thus, the *Constructive Sustainability Assessment (CSA)* is a framework where the sustainability assessment practitioners engage with the technology development activities to broaden the perspective towards sustainability and take part in the decision-making processes using *Life Cycle Sustainability Assessment (LCSA)* methods.

With this motivation, in this research the CSA framework is operationalized using LCSA methods in order to assess the sustainability of an Al-air battery being developed for seasonal energy storage. The research is carried out by integrating LCSA to the technology development starting from the material selection for electrode materials to end-of-life of the proposed system covering the entire life cycle. Initially, fast material screenings of the potential materials for the hotspot analysis is provided. Later, full assessments are provided for the selected materials for optimizing the product sustainability. The followed approach is an empirical procedure supporting the electrochemists in order to increase their awareness on social, economic and environmental impacts caused by made choices in early phases. The impact of the made choices are consequentially presented to the developers on the system level. Considering the made interventions and modifications on the product design, the life cycle stages are planned from cradle to cradle.

As a result, the preliminary results of the ongoing research proved to have an impact on the concept design on economic, environmental and social dimensions as well. Thus, prospective life cycle approaches embedded in the technology development are considered to provide a meaningful contribution for developing more sustainable storage technologies. The achieved progress with its practical relevance to CSA framework will be presented and experience-based recommendations will be given to practitioners for further improvements.

Considering the proposed approach, use and application of sustainability assessment methods the topic demonstrates high relevance to the *SDG 12 Responsible consumption and production*, and particularly to *Task 12.6 Encourage adoption of sustainable practices*. In frame of "Half-way through Agenda 2030",

the conducted assessments and stakeholder engagement directly aim to increase the reliability and environmentally-friendliness of an emerging storage technology together with ensured societal value creation that serves for prosperity, peace and partnership indirectly.

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Making the case to revise the SDGs by creating a truly 'Responsible Living Economy' to resolve global Climate, Species and Inequality crises

Mr Greg Campbell[1], Mrs Cheryl Campbell[2]
[1]DesignOz Pty Ltd, Sydney, Australia. [2]Society for Responsible Design, Sydney, Australia

M R G R E G C A M P B E L L

Abstract

The Sustainable Development Goals (SDGs) must be radically improved and prioritised to reflect the existential challenges to all life on earth. Global feedback and many reports have confirmed that the SDGs need to be better articulated, funded and supported, or they will continue to fail. When the global stakes are so high, can individual countries aim for real sustainability while the world's rich and powerful economies follow selfish agendas? The Paris Agreement overshadowed efforts made by the SDGs to empower global support for the common good. Why was Climate Change not prioritised better? We review more beneficial ideas and options, providing a framework of lenses to develop better strategies to deliver the 5Ps of People, Planet, Prosperity, Peace and Partnership for the long term. While prioritising Goal #13 Climate Action, the United Nations will better meet the world's needs by including the missing Goal #18, 'LifeBEAM RLE, care for all Life in the Biosphere, Earth, Air, and Microbes. When the SDGs are revised using 'Responsible Living Economy' (RLE) principles, they can be better optimised, encouraging environmentally positive shifts in every sector to meet planetary boundaries. Halfway through the UN Agenda 2030 is the perfect time for this revision.

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Sustainable development of plant dyed garment products in the context of digital media

Master's Degree fangfang deng, Associate Professor wen zhu, Master's Degree shujia heng
Beijing institute of fashion technology, beijing, China

Abstract

The aim of this study is to analyse the communication value of digital media in the cultural promotion of plant dyed garment products. It also further argues for the sustainability of plant dyed in the textile field and lifestyle by combing through recent research advances in the types of dyeing materials, dyeing properties, additional functions and dyeing techniques in the textile field in China, Japan and the United States. This study applies theories from design and fashion communication. Based on a case study of three types of plant dyed garment brands in the market (plant dyed clothing series under commercial clothing brands, plant dyed independent designer clothing brands and traditional plant dyed non-heritage artisan clothing brands), the study compares the current problems in the development of the three types of brands and the composition of digital media promotion models. The research shows that: 1. plant dyeing meets the requirements of an environmentally friendly and healthy lifestyle, and is also in line with the green and sustainable development trend of the textile and garment industry, in line with the 12.5 target in the SDG; in the development process, plant dyeing should be integrated into the green garment industry chain from big picture view, and solidification standards should be set for this. 2. Based on digital media, the heritage of traditional handicraft skills should go hand in hand with industrial development, in line with the major trends of the Internet industry, to accelerate the digital transformation of plant dyed garment brands. 3.Through digital media, we will accelerate the dissemination of the non-heritage culture of plant dyeing and the concept of sustainable fashion, which is conducive to the healthy development of the plant dyed garment industry, thereby reducing the pollution of the earth's ecological environment by chemical dyes. Bringing the ancient art of plant dyeing to life and vibrancy in a new context.

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Sustainable concept Design Against Expiring Date Food

Professor Fan Yang, Mr. Baixuan Luo, Ms. Fangyuan Yang
Dalian Polytechnic University, Dalian, China

Abstract

Sustainable concept Design Against Expiring Date Food

Fan Yang, Baixuan Luo, Fangyuan Yang

Abstract

The food that people waste every year is worth over trillions of dollars. According to statistics from UNEP, in 2019, 931 million tons of food had been wasted, which was 17% of all food consumption expenditure. During 2021, nearly 193 million people in 53 countries or territories still face food problems. That's the highest number in the past 6 years and causes a direct threat to human life. The expiring date food takes an important part in the food waste, caused by the regular and service schedule of supermarkets. The business department provides the expiring food at a lower price or other promotional activities. However, the customers are desired to pick up the freshest vegetables or meats, after the produced date food loses the attraction of the consumers. Therefore, food becomes deposed after the second day when they were produced, it makes the superfluous slaughter become into waste. Exceptionally, many expiring foods go straight to waste without opening the packaging.

There is a lot of poverty existed in the urban social communities, spending on daily necessary food can take up the majority of their incomes.

In this essay, a sustainable design concept according to the expiring food is proposed, which connects the expiring food supply with poverty communities. The product is vending machine design, built-in a countdown system, which decreases the price of expiring food along the time. Working prop of this machine is relying on solar power to make sure the whole operation is eco-friendly. Additionally, a more meaningful guidance is set into the purchase instruction, poverty communities can gain expiring food through the sustainable workforce or these foods will become a sort of reward to support residents to do more efforts on protecting the environment. Rather than directly donating it, these demanded people will become an important part of the sustainability system and even achieve a profound influence on the future environment.

Key Words: Waste of expiry date food, Sustainable communities, Sustainable product design

A Sustainable Cities and Communities, Responsible Consumption and Production, Zero Hunger Target: 5b Design for Sustainability

B Through the concept of vending machine, the expiring food will turn into resources to help poverty community, the interaction process will design a positive guidance for these customers. It will influence them to contribute to sustainability or environment protection.

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Research on the design of waste textile recycling based on sustainable design concept

Luyao Chi, Wei Yue

Anhui University College of Art, Hefei, China

Abstract

【Abstract】：With the improvement of material conditions and people's living standards, people's demand for dressing is also getting higher and higher, bringing a fast-fashion consumption mode characterized by fast, making more and more waste textiles produced, the vast majority of them end up in landfills or being burned, causing pollution of the atmosphere, soil and water resources, etc., which brings enormous pressure on the world environment and also brings human health It also brings huge hidden danger to human health. Therefore, the research on recycling of waste textiles can not be delayed, which can help save resources and energy, protect the environment, and create huge economic benefits. However, due to the late start of developing countries and the lack of a systematic recycling system, waste textile recycling faces certain challenges. Based on this, this paper applies the concept of sustainable design to the design of waste textile recycling, by introducing the national policies and recycling sorting methods of several developed countries, and taking Germany, which is at the forefront of waste textile recycling technology in the world, as an example, it introduces the high percentage of closed-loop recycling model of Ecolog Recycling Company and the Wolfen Textile Waste Treatment Center of SOEX Group. By analyzing their processes of collection, sorting and reuse of waste textiles, the strategies for recycling waste textiles in the five stages of material selection, design, sales, use and recycling are summarized from the perspective of design, aiming to bring inspiration to the design of waste textile recycling systems in developing countries in the future, so as to recycle and reuse waste textiles more efficiently and realize sustainable consumption and production of textiles. The aim is to bring inspiration to the design of future waste textile recycling systems in developing countries, so as to recycle waste textiles more efficiently and achieve sustainable consumption and production of textiles, and further increase social, environmental and economic benefits.

【Key words】：Sustainable design concept, service design, recycling, closed-loop cycle

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Understanding how designing physical data visualisations can influence behaviour change: a case study on consumer food waste reduction in Australia

Mrs Regine Abos[1,2], Dr Areli Avendano Franco[3,4]
[1]Swinburne, Melbourne, Australia. [2]Fight Food Waste Cooperative Research Centre, Adelaide, Australia. [3]Deconstructing the status quo, Melbourne, Australia. [4]RMIT University, Melbourne, Australia

Abstract

In Australia, food waste produces 3% of annual greenhouse gas emissions with households accounting for the majority of it. Households comprised of working parents with children have been identified as the key demographic producing the largest amount of food waste. Data visualisations from self-trackers in particular have the potential to enable reflection on behaviour in new ways and have been studied in eco-feedback and personal informatics for their persuasive power to encourage day-to-day actions. This paper describes the preliminary data collected from a longitudinal study consisting of 30 households comprised of working parents with children across Australia engaged in the in their own homes over nine weeks. Based on combination of theories and models from consumer behaviour psychology, interaction design and data humanism, the probe consisted of two parts: 1) visual nudges and informational materials that encouraged all household members to eat leftovers, store food properly and prepare the right quantities of food, and 2) physical, tactile behaviour trackers that allowed participants to create, engage with and share data representations of their food saving behaviours using their own visual fluency. The experiment group (Group A, 46 participants) were given parts 1 and 2, while the control group (Group B, 46 participants) were given only part 1. A third group consisting of couples 55 years and over without children (Group C) were also given parts 1 and 2, to serve as social influencers to the experiment group. The results of the trackers in Groups A and C were then shared amongst each other online. The probe was supported by a survey designed to measure behaviour before the study, after the study and one month after the study. Semi-structured interviews were also conducted to support the probe and survey findings. The results were then triangulated using three methods of analysis: 1) content analysis of probe data and extra information volunteered by the participants. 2) paired samples frequency comparison between Groups A and B using data from the survey, and 3) thematic analysis of semi-structured interviews one month after the probe was completed. The reflective and creative capacity of data visualisation-making process allowed the group with the probe to sustain newly formed habits for longer than the control group. Creating their own methods of encoding data enabled agency, holding them accountable for their own actions and facilitating a deeper understanding of their own unique household dynamics and collective behaviours that lead to food waste. The social and physical aspect of the exercise were found to be the most influential factors in leading to longer term behaviour change. The study addresses Sustainable Development Goal 12 (Responsible Consumption and Production), specifically Target 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 by 2030. Thematically, it intersects with two tracks of the conference: Educating for Sustainability (2b) and Design for Sustainability (5b), since data visualisation is used a tool for communicating complex information and aid decision-making practices around sustainability.

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Sustainable design of a plastic toothbrush: a case study of design for disassembling and materials recycling

Jacopo Mascitti, Alessio D'Angelo
University of Camerino, Ascoli Piceno, Italy

JACOPO MASCITTI

ALESSIO D'ANGELO

Abstract

A toothbrush is one of the most widely used oral care items that help remove debris from the mouth and keep it germ-free. More than 3.5 billion toothbrushes are purchased each year. A market valued at USD 6.90 billion in 2022, with an estimated annual growth rate of 4.1% through 2029. More than 75% of toothbrushes sold are of the traditional manual model [1]. Growing awareness of the environmental implications in the use of disposable toothbrushes has prompted all major manufacturers to develop "eco-friendly" products, whose approach is based on three different strategies: the use of biopolymers; the use of natural materials such as bamboo; or the use of replaceable heads. However, each of these solutions hides critical issues: most bamboo toothbrushes have mechanically anchored nylon bristles that cannot be disassembled and are vulnerable to early aesthetic degradation; biopolymer toothbrushes do not show significant lifecycle environmental benefits when compared to their traditional polymer equivalents; and toothbrushes with replaceable heads are often abandoned in use due to a perception of poor hygiene, which grows with time. Based on previous LCA analyses that highlight the potential environmental benefits of a fully recyclable toothbrush embedded within an economic scheme of recovery and reuse of its materials [2-3], the paper aims to describe the environmental redesign process of one of the most popular and pervasive mass market products: the plastic disposable toothbrush made through the multi-shot injection moulding process. The project, developed within the School of Architecture and Design of the University of Camerino, is characterized by innovative technical and formal solutions that can improve the environmental performance of the product through the strategy of design for disassembling. The developed solution allows the aesthetic and ergonomic qualities of the product to remain the same and, at the same time, allows the end user an easy and intuitive disassembly of the toothbrush at the end of its life, solving the crucial problem of removing the nylon bristles. In conclusion, the paper presents a concept of a product in line with SDG goal 12, as it aims to make the production of a mass market product currently considered critical more rational and responsible.

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Practice and Enlightenment of Built Heritage Conservation and Sustainable Reuse in Singapore

Miss Xintong WEI[1,2,3], Prof. Haoming ZHOU[1,3], Mr Yao ZHANG[1,3], Mr Dazheng YANG[4]
[1]Academy of Arts & Design, Tsinghua University, Beijing, China. [2]Department of Architecture, National University of Singapore, Singapore, Singapore. [3]Institute of Sustainable Design, Art and Science Research Centre of Tsinghua University, Beijing, China. [4]School of Architecture, Yantai University, Yantai, China

MISS XINTONG WEI

PROF. HAOMING ZHOU

MR YAO ZHANG

MR DAZHENG YANG

Abstract

Abstract

Built heritage is important for maintaining the identity of residents, sustaining social cohesion and promoting sustainable urban development. The experience behind Singapore's lack of a hinterland and its late start in heritage conservation is worth learning from its success in the sustainable reuse of built heritage. This study reviews the history of heritage conservation in Singapore since the 1960s, and unpacks its institutional policies, conservation framework and practices. It also uses the NUS ArClab, a built heritage site in the Blair Plains Conservation Area, as a case study to explore its key strategies for sustainable reuse, which include rational transformation of functions, enhancement of residents' identity, new technology-assisted renovation and climate-resilient adaptation. This study argues that the establishment of a multi-party collaborative built heritage management system framework, the promotion of public participation in heritage protection in historic districts, and the integration of tangible and intangible heritage are the keys for Singapore's built heritage to promote sustainable urban development.

Key words: built heritage; Singapore; heritage conservation; sustainable reuse; NUS ArClab

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Research on affordance-based product design from the perspective of sustainability

student Jinzhuo Liu, associate professor Xiaobo Qian, student Guangming He

Jiangnan University, Wuxi, China

STUDENT JINZHUO LIU

ASSOCIATE PROFESSOR XIAOBO QIAN

STUDENT GUANGMING HE

Abstract

Sustainable lifestyle and related product design are widely recognized as more and more people paid attention to the relationship between human and nature in the last decades. However, green and healthy lifestyle are difficult to be effectively carried out in the daily lives to most people. Therefore, this paper explores how to introduce the sustainable design concept into the product's affordance design strategy, so that the sustainable life concept contained in the product can be more accurately perceived by users, and users can unconsciously carry out sustainable behavior operations in the usage process of product, so as to guide users daily sustainable lifestyle. In this paper, product affordance is summarized into five types through comparative analysis of relevant research results on the concept of affordance: functional affordance, cognitive affordance, behavioral affordance, sensory affordance and emotional affordance. And then, the sustainable intervention points that can be provided in the product life cycle are screened and designed based on the environmental, economic and social considerations of sustainable design. These intervention points are paired with the previous five types of product affordance to build a logical framework for product affordance design based on a sustainable perspective. Finally, the packaging design of a coffee brand is taken as an example to verify the rationality and feasibility of this framework. In this way, the concept of sustainability is integrated into the framework of product affordance design, which can make users perceive the concept of sustainability conveyed by the brand in the process of contact with the product more intuitive and simpler, improve the public awareness of sustainability and acceptance of sustainable lifestyle. At the same time, this article also tries to enrich the connotation of the affordance theory and makes a certain theoretical contribution and practical exploration to the development of the affordance theory.

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The Tagus estuary as a fluvial highway

Mauro Oliveira[1], Dr João Joanaz de Melo[2], Eduardo Zúquete[1]
[1]NOVA University Lisbon, Caparica, Portugal. [2]CENSE NOVA University Lisbon, Caparica, Portugal

Abstract

The transport sector is the main responsible for air pollution, including greenhouse gases, in Europe, in Portugal and particularly in the Metropolitan Area of Lisbon, and is also the chief cause of traffic congestion and noise in urban areas. Public transportation is the key solution to mitigate thos problem.

Historically there has been a decrease in the use of public transport in the Lisbon Metropolitan Area (LMA). In 2021, three quarters of motorized transport were carried out by individual transport (IT). This predominance of IT congests traffic in the city centre and strangles all accesses to Lisbon, especially across the Tagus estuary and through the 25 Abril bridge.

There is however an alternative, across the Tagus, both to enter Lisbon and to link coastal cities and towns in the wide southern bank of the estuary: the ferryboat.

This paper explores the possibility of creating several new ferryboat routes across the Tagus estuary, both longitudinal and traversing north-south. Allied to this enhanced river transport system, coordination with other transport modes is necessary, namely rail transport, which plays a fundamental role in entering and leaving the capital, but also in traveling to peripheral municipalities.

The research method included the analysis of origin-destination matrixes, transport statistics, interviews with local authorities, and an Internet-based survey targeting current and potential ferryboat users.

The modal transfer predicted upon implementation of this proposal may represent the transfer of 12 000 passengers per day to the ferry, or an emission reduction of approximately 5 kt CO2/year, and consequently a significant improvement in the congestion and air quality in the city of Lisbon.

In conclusion, river transport plays a key role in crossing the Tagus, contributing to the development of its entire riverside arc, together with rail and other public transport modes. It can also play a significant role reducing pollution and congestion in the most crowded areas of the city.

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Sustainable design study of alternative foods

YueHui Liang

Kookmin University, Seoul, Korea, Republic of

YUEHUI LIANG

Abstract

Food exists mainly as a material guarantee for human survival, but with rapid socio-economic development, the impact of food on human beings has gone beyond its dietary role and the value it carries has gone beyond its basic material function, and the development of food innovation has become increasingly important for the value of society. For example, industrialization, urbanization and the dramatic increase in material conditions on a global scale have led to food-related lifestyles that are or may be affecting the sustainability of ecosystems, climate change, social stability, economic income, and many other aspects. At the same time, the rapid depletion of water and soil resources, etc., as well as food shortages due to wars and infectious diseases, etc., have prompted more and more people to pay attention to the possible future development of food. Protein, the core nutritional element of the human diet, is currently mainly derived from meat, eggs and milk, but numerous studies have shown that future social development may lead to severe shortages of basic foods, which has led to more diverse demands on the social responsibility associated with food, and the discussion of how to deal with possible changes in food is also the core of this paper's "design" intervention.

Demographic and dietary shifts determine changes in users' food consumption and also affect various nodes in the food sustainability system. Design, as one of the effective ways to develop social innovation, provides new perspectives and creative solutions to various complex problems related to food, including sustainable design innovations for alternative foods. This study analyzes how design intervenes in the structural relationship of "future alternative foods" in the food sustainability system by sorting out food-related sustainability issues through literature analysis and summarizing existing sustainable food design cases. The aim is to explore sustainable design from the perspective of alternative foods such as plant proteins, insects, and algae, and to build a sustainable design model using "alternative foods as a carrier" to solve or alleviate possible future food problems, and to guide the development of sustainable food design. In short, this study discusses the influencing factors of design interventions in the field of alternative food innovation and how food and design are interrelated and how design methods can be used to repair and reconstruct the sustainable value of food, i.e., how to promote or sustain social innovation activities for food-related sustainable lifestyles, in response to issues and challenges such as global food shortages. The main objective of the research is to build a creative field of analysis of sustainable design in the context of alternative foods, and to try to propose or promote new possible and more desirable innovations related to alternative foods in the future through design interventions.

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Participatory Sound Fiction: Designing a sustainable future through youth engagement in urban sound environments

PhD Sofia Lundmark, PhD Martin Jonsson, Marica Myhre, Alethe Hjuberg
Södertörn University, Huddinge, Sweden

Abstract

As the United Nations Act on the Rights of the Child became law in Sweden in 2020, children and youths have the right to form, express and have their own opinions in all matters concerning them, including participation in societal development such as urban design and urban planning processes. Methods used in participatory spatial planning are mostly aimed at well-educated adult audiences and tend to focus on rational argumentation about short term needs, leaving out not only the youth's perspectives, but also the the sensory and embodied experiences of our surroundings. As sound is a prevalent element in cities, this work contributes with an analysis of how urban soundscapes can be used in urban design processes with a special interest in the inclusion of children and youth.

The study proposes and evaluates a method called *participatory sound fiction*, based on the intersection of three methodological approaches: participatory design, design fiction and sonic interaction, and how they can be combined to engage youth in urban planning processes. The method is used collaboratively between urban planners, designers, and youth, and consists of three main activities: 1) a workshop with participants, where sound cues are used as a basis for discussions, 2) the design of a "sound fiction" envisioning the future, and finally, 3) a discussion about the sound fictions with the participants. Drawing on participatory design, the method highlights the participants as being experts in their own situation, elaborating on opportunities for empowerment. Design fiction contributes with visions of the future as a means to provoke discussions about current situations and look at everyday life from new perspectives. Sonic interaction here bring to the fore the ability of sound to arouse imagination and emotions.

The method was deployed and tested in a suburban area in Stockholm, characterised by low socioeconomic status, criminality, and low levels of trust for the local government and public institutions. The study included eight youths aged 15-16 years old, recruited through the local youth centre. As part of the process a sound fiction envisioning the area in year 2170 was created. Through the activities, the participants reflected on their current situation and everyday lives in their local neighbourhood, as well as on their visions of the future.

In conclusion, the study shows how the method, participatory sound fiction, could be useful to engage youth in urban planning processes. The results show that through discussions and speculations about the future, important insights were revealed about the youths' reality, which can be of value in spatial planning processes. Furthermore, the study found that sound can broaden youths' perspective on their immediate environment, that participatory sound fiction has the potential to engage youths, and that youths prefer to discuss the present to feel that their voices are being heard.

This abstract is submitted to SDG+Target: 5b, and relates to the conference theme by providing insights on how art and design can be used to encourage sustainable development of young people in their own social and urban environment.

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Potential in service design: engaging with knowledge sharing for sustainable innovation

Miss Tong Liu, Mr Jun Cai
Tsinghua University, Beijing, China

Abstract

Service design is a research field has been used into both government and commercial project. The outcomes mostly were based on the actual needs of tangible products and virtual interaction systems. In this paper, we present service design as a sustainable approach to promote change in the mindset within organization demanding that the actors being in a team go through multiple points of views. It also captures user's pain-point and expectation in the service journey, shares with different actors in order to understand empathy further. Methodologies derived from service design method, are discussed through a case study which reveals the advanced activities of transforming sustainable insights to practical service goals, including methods such as interviews, observations and workshops. The research explores the potential of service design and the advantages of using design tools for empathy which figures a knowledge sharing purpose for actors to reach a consensus and image innovative future in holistic picture. The study argues that challenges and limitations of service design approaches and re-thinks the sustainable innovation.

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Comprehensive Analysis of the European Digital Passport: Implications for Global Adoption and Sustainable Development.

Dr Mattia Gianvincenzi, Prof Enrico Maria Mosconi, Prof. Marco Marconi, Dr. Francesco Tola, Dr. Mariarita Tarantino, Dr Alessio Matacera
Università degli Studi della Tuscia, Viterbo, Italy

Abstract

The challenges and opportunities associated with Digital Product Passports (DPPs) in the context of the circular economy are examined in this study. The DPP can be broadly defined as a data set that summarizes the components and materials in a product, as well as information on reparability, spare parts, and proper disposal instructions. The data contained in the DPP is collected from all phases of the product life cycle and can be used to optimize design, production, use, and disposal. By analysing relevant literature, the role of digitalization and DPPs in promoting circularity is explored. The findings suggest that DPPs have the potential to enhance transparency, standardization, and data sharing throughout the product life cycle, facilitating the transition to a more circular economy. However, challenges related to standardization, collaboration, and regulation must be addressed for effective DPP implementation. In particular, the study evaluates the broader implications of the European Digital Passport on sustainable development, assessing its potential for global adoption and its contribution to the achievement of the Sustainable Development Goals (SDGs). This comprehensive analysis of the European Digital Passport aims to gain a thorough understanding of its components, functionalities, and implementation challenges, offering recommendations for leveraging it as a transformative tool for advancing economic and environmental progress in the future.

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Addressing food waste through design

PhD Eleonora Fiore, Full professor Paolo Tamborrini
University of Parma, Parma, Italy

Abstract

According to the FAO, an estimated one-third of all food produced globally is lost or goes to waste. Aware that food loss and food waste occur in different phases, this paper mainly focuses on food waste from home as it pertains to consumers and individuals. It investigates the causes of food waste, starting from users with ethnographic research methods [1,2,3] such as fridge studies, fridge stories, shop-along, at-home visits, interviews, food mapping, diaries studies, and the refrigerator in the first place as the object in charge of preserving food [4,5]. In addition, the implication of digitisation on the Circular Economy [6,7] has been considered from the design perspective. Generally, fridges contain foodstuffs with no common features. Consumers have a key role since their food choices and behaviours clearly impact domestic waste production. Major issues deriving from the relation with food are linked to purchase and conservation methods and have an impact on domestic food waste. Although production processes become more sustainable, the quantity of household waste and resource consumption generated in industrial nations continues to rise. Indeed, ecodesign strategies alone were not enough to deal with the sustainability challenges that our society is facing, due to the ever-increasing production and consumption of products [8]. Increasing the knowledge of food characteristics and preservation requirements and accounting for user interaction and its implications on food waste is a significant effort. Designers will thus be able to leverage user tasks and practices in the design phase through guidelines and recommendations for designing meaningful products for the user in order to reduce food waste.

Full Papers

Developing bio-based building elements for sustainable, smart, and circular architecture

István Kocserha[1], Alexandra Hamza[2], András Velősy[3], Zsuzsanna Józsa[4], Anita Terjék[5], Levente Radomszki[6], Klára Tóthné Szita[7]

[1] University of Miskolc
[2] University of Miskolc
[3] ÉMI nkft,
[4] ÉMI nkft, BME,
[5] ÉMI nkft, BME
[6] ÉMI nkft
[7] ÉMI nkft, University of Miskolc

Corresponding author's e-mail address: regszita@uni-miskolc.hu

Abstract

The interest in low-energy building materials is growing and bio-based materials are a key part of this group. The use of bio-based building materials offers the potential to reduce the amount of greenhouse gases embodied in construction products and even to sequester carbon dioxide. Several research projects around the world have aimed at developing building components using plant aggregates. Previous research has already demonstrated the potential of bio-based materials such as hemp, flax, mycelium, lignin-based fibres, wood waste, sunflower, cork, corn husk, coconut, rice husk, wood, and bamboo particles in inorganic matrices (e.g., lime and limestone). The aim of the present research is to analyse the environmental, social, and economic impact of bio-based concrete using a regionalised LCA model and to evaluate the results in terms of technical and engineering parameters. The LCA-based studies focus on the environmental LCA. The research follows methodologically the PCR requirements and standards defined for concrete elements. The biomaterials used to produce bio-based concrete elements are local products and the technology follows the principles of the circular economy. In the initial stage of the research, potentially usable natural materials will be examined until they can be incorporated, and the environmental, economic, and social effects of the materials will be compared, which will include the stages of agricultural production, harvesting and primary processing. The functional unit for this stage is 1kg. The second stage of the study is the production of the bio-based building element, where the bio-based component is already present in the concrete. The environmental, economic impact of bio-based concrete element production will also be assessed and compared based on a matrix of technical and functional parameters. In this case, the functional unit is 1 m^3. Preliminary studies based on multi criteria testing will contribute greatly to the design of a sustainable product chain.

Key words: *LCA, bio-based concrete, sustainable product chain*

1. Introduction

The development of bio-based building materials and circularity is a priority because the EU construction sector is the largest consumer of energy and resources in Europe, mainly because of the large amount of cement used. The construction sector is responsible for 40% of final energy use and around 75% of buildings are not energy efficient (EC, 2020). Given the poor energy efficiency, decarbonisation of the building stock is a long-term goal for the EU. The Directive on the energy performance of buildings (2010/31/EU) and the revision of it (EU 2018/844) state that the energy consumption of buildings should be improved, in line with climate and local considerations. The Directive aims at the cost-effective renovation of existing buildings and the use of smart technologies in buildings and requires a long-term renovation strategy to achieve an 80-95% reduction of greenhouse gas emissions in buildings by 2050 compared to 1990 levels. The strategy should also include indicative milestones for 2030, 2040 and 2050. The focus areas of Green Deal (EC 2021) are Energy efficiency, Material savings and Circular solutions. This includes the increased use of bio-based materials in architecture. If concrete can be partially replaced with bio-based materials, not only resources and energy can be saved, but also the thermal insulation properties of the building element are improved. Bio-based building elements play a significant role in sustainable construction sector of Europe. These elements are derived from renewable biological resources, such as plants and trees, and offer several

important advantages in terms of environmental impact, energy efficiency, and carbon footprint reduction. The bio-based materials as parts of bioeconomy - are replacement of fossil resources. Saving fossil resources and developing the bioeconomy go hand in hand, as the bioeconomy offers sustainable alternatives to fossil-based resources. By following this approach, societies can reduce their dependency on non-renewable resources, decrease greenhouse gas emissions, and promote sustainable economic growth. The bioeconomy offers a pathway towards a more sustainable future, where renewable resources are utilized efficiently, waste is minimized, and environmental impacts are reduced. Our study reviews the research on bio-based materials for construction purposes based on literature sources, examines the environmental impact of potential bio-based materials, and then illustrates the potential development outcome through the example of LCA-based development of a reed infill product.

2. Literature Review

The literature on bio-based materials is extremely rich. In the science direct search engine, 4119 articles appear for bio-based building materials, of which 1781 (43% of all articles) have been published as of 2021. A significant number of the articles investigate the properties of bio-based materials, while others examine their role in the manufacture of building components or analyse the impact on mechanical properties (Affan et al. 2023, Chen et al. 2023, Althoey et al. 2023, Hamdaoui et al. 2023). Moletti et al. (2023) studied the hygroscopic behaviour of bio-based walls. In addition, many papers investigate the environmental performance of bio-based building materials and their role in reducing the greenhouse effect based on life cycle studies (Mouton et al. 2023, Boskovich et al. 2023). Their part in the circular economy is also mentioned by several authors (Zhang et al. 2023), to reflect only recent publications.

The performance of bio-based materials is a key area in modern construction, according to Jones (2017), their behaviour should be considered at the design stage. In his study, he outlines the status of bio-based materials in the construction industry, the benefits they bring, and the challenges and opportunities associated with their correct use. The author reviews the properties, current and historical uses, and state-of-the-art research on the most relevant or innovative raw materials: flax, hemp, straw, bamboo and rattan, reed, wool, peat, grass, and several seed plants. He describes the most important properties, namely durability, moisture resistance, aesthetic performance, thermal performance, and fire resistance. E. Suttie et al. (2017) highlights the current and future environmental requirements that products must meet in the built environment. This is generally based on Life Cycle Assessment (LCA) techniques, and of particular interest for bio-based products how embodied carbon is considered in the assessment of products. It then explains how these fit with models such as the circular economy and the low carbon economy, while addressing the building sector's significant contribution to climate change. This paper also highlights existing measurement and certification schemes, including eco-labels and environmental product declarations, as well as internationally used whole building assessment schemes.

As the overuse of plastic-based hazardous materials is a growing concern, the need to save and protect our ecosystem and environment has led researchers worldwide to make bio-based materials more efficient and reliable (Xie et al. 2023). It is believed that bio-based materials can be suitable substitutes for synthetic materials, which serve the purpose of synthetics and are highly environmentally friendly (Mehrizi et al. 2023). Although bio-based materials are already widely used in various industrial and household applications, there is still a long way to go before they can replace synthetics. There are still many industries, such as energy, green chemistry, biomedicine, and food packaging, where further developments are needed to fully exploit such environmentally friendly materials (Bradu et al. 2022). This has encouraged our researchers to explore additional bio-based materials, so that existing bio-based materials do not face overuse problems. There are widely used bio-based materials such as biofibres, biopolymers, biofilms, and bio composites (Matkó et al. 2005, Lazko et al. 2013, Chang et al. 2020, Tyagi et al. 2023) and those have majority environment friendly prospects.

Literature research confirms that the use of bio-based building materials reduces material and energy use, greenhouse gas emissions and even contributes to carbon sequestration. These conclusions are based on a comparative LCA assessment of conventional and different bio-based building elements in European case studies. The LCA of bio-based building element variants - wood-, straw- and hemp-based solutions - was carried out (Mouton et al. 2023). Bio-based components in sandwich structures were used to improve the insulating properties.

The results show that bio-based building elements generally have significantly lower embodied greenhouse gas emissions than conventional solutions such as brick-or concrete-based elements. The environmental impact analysis has identified the most controversial environmental issues throughout the life cycle of the selected bio-based building options, such as global warming potential (GWP), particulate matter (PM) and land use (LU), which is important in bio-and bio-based construction; the most important life cycle stages in terms of environmental impact are material production, maintenance in operation and replacement, especially for surface treatments. To investigate the carbon removal potentials, the carbon content of the selected bio-based options was calculated, and straw-based building elements were considered the most efficient, due to their high biogenic carbon content and fast (annual) regrowth cycles.

Interest in bio-based building blocks has increased in recent years for two reasons. One is to increase resource efficiency and minimise the use of depleting resources, the other is to meet climate policy objectives. Bio-based building components are increasingly used in the construction industry as a more sustainable and environmentally friendly alternative to conventional building materials. Bio-based materials are made from renewable resources such as plants, agricultural waste or forest residues and can significantly reduce the environmental impact of construction projects. In practice, several types of bio-based building materials and building elements are used, including:

- Wood: one of the most used bio-based building materials and has been used as a building material for centuries. It is renewable, biodegradable and has excellent insulating properties.
- Bamboo: a fast-growing grass that can be harvested sustainably and used as a building material. It is strong, lightweight and has a high strength-to-weight ratio.
- Straw bales: made from waste products from crops such as wheat, oats and barley. They are stacked and used as insulation and building blocks.
- Hempcrete: made from the woody seeds of the hemp plant, mixed with lime and water. It is used as a sustainable alternative to concrete and has excellent insulating properties.
- Cork: a renewable material made from the bark of cork oaks. It is lightweight, fire-resistant and has excellent insulating properties.
- Reed: a traditional roofing material in many parts of the world, including parts of Europe, Africa, and Asia. Typically, thatched roofs are made by tightly stacking long, thin bundles of thatch on a frame of wooden poles, securing them with wire. Thatched roofs are lightweight and have good thermal insulation properties, making them a good choice for certain types of structures, such as small garden sheds and summer houses.

In addition to the above, other bio-based materials and examples of practical applications can be found in the literature, such as dune grass, roadside or floodplain grass, hazelnut or willow husk, peanut shell, groundnut shell, eggshell, coconut shell, etc.

The use of natural biological components in construction is multi-purpose:

- use as main building element (Penazola, 2017, Alawode et al. 2023, Claudiane et al. 2023, Sikkema et al. 2023 Berwart et al. 2022),
- use as insulating material, pressed, glued or in natural form (Lecompte and Picandet, 2022),
- as a composite component in resins, concrete, (Amziane, Sonebi 2016; Feugeas et al. 2018, Eggum et al. 2020, Conci et al. 2022; Teleky and Vodnár 2019, Blok et al. 2019, Capucci et al. 2022).
- as additives, e.g., to control heat and moisture transfer or to improve corrosion inhibiting properties, (Bamaga, 2022, Alioua, 2019, Mnasri et al. 2020),
- for phase change properties (Parameshwaran et al. 2021, Junaid et al, 2022, Sawadogo et al. 2022).

Bio-based building elements can be used as structural elements, insulation and roofing or cladding, among other things, in both residential and commercial construction. They are often used in sustainable or green building projects. Bio-based materials are becoming increasingly popular as more people become aware of the need for sustainable building practices. Bio-based building materials have the advantage of saving resources by replacing natural mineral ones. They are renewable resources having a lower carbon footprint and are also carbon sequesters. The carbon footprint of bio-based building materials can vary depending on the material and the way it is produced. In general, bio-based materials can be considered to have a lower carbon footprint than conventional building materials because they are made from renewable resources and are able to sequester carbon. Bio-based materials are typically made from materials such as wood, straw, hemp, bamboo, and cork.

The carbon footprint of bio-based building materials is determined by the amount of carbon emitted during production, transport, use and disposal. The production phase includes activities such as harvesting, processing, and manufacturing. The transport phase includes the transport of raw materials and finished products. The use phase includes the energy needed to heat or cool the building and keep it running. The disposal phase includes end-of-life options for the material, such as recycling or degradation. To reduce the carbon footprint of bio-based building materials, it is important to consider sustainable sourcing of materials, efficient manufacturing processes and responsible disposal options. In addition, the use of bio-based materials in energy efficient buildings can further reduce the overall carbon footprint of the building. It is worth noting that some bio-based materials, such as those made from plants grown specifically for construction, can result in a larger carbon footprint than conventional materials due to the energy and resources required to produce them. It is therefore important to assess these materials and their production methods to determine their overall environmental impact. It is difficult to compare the environmental impacts of bio-based building components because different functional units are used in the literature and only a few materials have a database analysis per 1 kg of bio-based material.

Table 1. Global warming potential of some biological materials, including biomass extraction, transport, processing and end-product production.

Title	kg CO_2eq/GJ	kg CO_2eq/kg	kgCO_2/m^2	Notes
elderberry bush	7,9			Jasinskas et al. 2020
reed	7,3			Jasinskas et al. 2020
reed canary grass	10,1			Phalaris arundinacea
rape seed		1,4604051-0.707		Bieńkowski et al. 2015
grass seed		2,5743589		
cotton fibre		3,0538705		
cotton fiber		1,808		https://www.ajsosteniblebcn.cat/38172.pdf
clover seed		6,9132724		
bamboo		from 0,5 to -1,5	70	Gan et al. 2022
hemp wool		-0,3214		GaBi 4 database
hemp fibre long		-1,0347		GaBi GWP 100 years
wood		-1,0953		GaBI GWP 100 years
reed		-1,10044		FIEK, 2021
coconut fibre		-4,529		GaBi GWP 100
flax fibre		-0,79167		GaBi GWP 100
sisal fibre		0,6837		GaBi GWP 100
willow		0,3320-0,4483		Frank et al. 2022

Source: own research

Bio-based materials have a long history in applications such as concrete mold release agents, pavement joint sealants, hardeners, paints and sealants, and cleaning solvents. The commercial use of these sustainable products in concrete applications has accelerated in recent years. There are many examples of bio-renewable materials on the market today. There are a significant number of manufacturers of non-toxic, environmentally friendly solvents used for wood and steel molds used to form concrete. Other products include sealants and paints and curing agents. They are bio-based and significantly improve the life cycle of concrete and reduce waste. Bio-based plastificators increase the fluidity of cement products, allowing higher admixture loadings, which can reduce the amount of water used in the mix, thus increasing the compressive strength of Portland

cement products (Heggs, 2022). They can be bio-based as well as self-healers (Udhaya et al. 2023), CO_2 emission reducers (Eggum et al. 2020), or more sustainable with bio renewable materials.

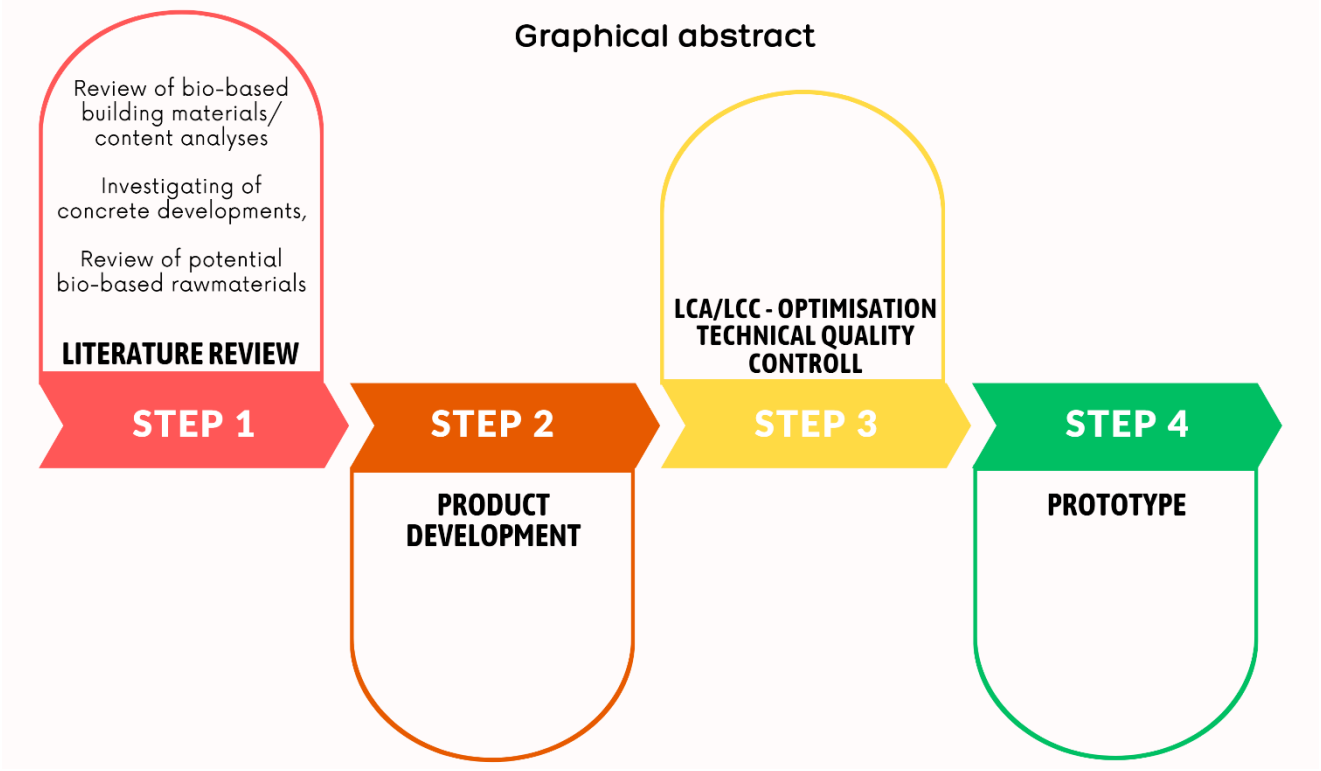
3. Applied Methodology

The research was based on literature review, we carried out a content analysis of studies dealing with the development of bio-based building elements, on the other hand, it included the experimental stages of the incorporation of reed into foamed concrete, the development of the recipe for the appropriate concrete composition, and the technology of the design of the reed armature, and thirdly, the life cycle assessment of the product, environmental life cycle impact assessment and life cycle cost analysis. The tests were based on the ISO 14040 and ISO 14044 standards and covered an impact assessment using the GaBi 10 LCA software covering the impact categories according to the CML and included a life cycle cost analysis following the SETAC LCC methodology (Swarr et al. 2011), it is based on information received from stakeholders and market and statistical data. Finally, we tested the compliance of the product with various standard tests: compressive strength, thermal conductivity, fire resistance, etc.

In the initial stage of the research, we examine the environmental, economic and social effects of the potentially usable natural materials, especially focus to the reed until it can be incorporated, which includes the stages of agricultural production, harvesting and primary processing. The functional unit for this section is 1 kg.

The second stage of the investigation is related to the production of the pre-pilot bio-based building element, when the bio-based component already appears in the concrete. During the production of bio-based concrete elements, the environmental, economic and social effects are evaluated and compared in an iterative way based on the matrix of technical parameters. In this case, the functional unit is 1 m^2. During the research, preliminary tests based on many criteria contribute to the development of a sustainable product chain. The research process is summarised in Figure 1.

Figure 1. Graphical abstract.



4. Research and Discussion

The main aim of our research is to develop light eco-friendly concrete building elements with apply of bio-based materials, that could be used universally. The research also aims to assess their environmental, economic and social impact through life-cycle assessments in parallel with product development. Together, the environmental life cycle assessment (LCA), life cycle cost analysis (LCC) and social life cycle analysis (SLCA) will provide information on the life cycle sustainability performance (LCSA) of the product. Sustainable product development should consider how to achieve a lower carbon footprint. The research orientations so far outline 3 possible ways to reduce the carbon footprint:
- Firstly, reducing the amount of cement in concrete - using different cement substitutes (fly ash, slag, glass foam) to promote circular solutions; (Rodrigez et al. 2022);
- on the other hand, using renewable energy sources to provide the energy needed for production e.g., solar, gravity hydro, wind, hydrogen.
- thirdly, using bio-based materials. (Pandiaraj et al. 2022, Heidari et al. 2019, Keena et al. 2022)
In our research, we focused on the latter, with an emphasis on circularity and sustainability. In addition to prioritising environmental and functional aspects in the development of concrete elements, we also considered it important to investigate the social impacts associated with the production of the product.

4.1. Short description of concrete element with reed

The aim of our research has basically determined the direction of development, as a low CO_2 equivalent product can only be imagined on a renewable basis. In Europe and in our region, reed has long been used as a roofing material. Its use in the construction industry has been mainly for the stabilization of plaster on ceilings as a reed fabric. Our concept went beyond this, the goal was to develop a thermal insulation panel, masonry wall panel or masonry element. Basically, we wanted to make a prototype that behaved well enough, had well-characterised architectural properties and was easy to use from an architectural point of view. In this chapter, we briefly describe the conceptual ideas behind some of the steps in the development of a masonry panel with reed core and the finished product. As a starting point, it is necessary to define the technological and technical parameters that the product must satisfy while considering its ecological footprint. The technical starting point for the development was to study the different types of reeds and to learn about their material properties. The physical and mechanical parameters of the reed were investigated, such as diameter and wall thickness, diameter distribution, strength, water absorption and thermal conductivity. Reed can be placed in a building element in several ways. On the one hand, it can be in the form of chopped fibres, cut into pieces of a few mm in length, but it is also possible to use longer fibres, parallel or perpendicular to the vertical axis of the building element and in different lengths. In each case, a matrix material is needed to stabilize the fibres, which can be concrete, lightweight concrete or adobe. All three arrangements or combinations of them were investigated during development, but finally, the arrangement parallel to the vertical axis was used in the prototype.

Figure 2 Placing the bundled reeds in the template.

Since bio-based materials are generally burnable, it is necessary to change their flammability properties. This can be done in two ways. The first option is impregnation, also known as mineralisation, i.e., impregnating

the organic material with an inorganic substance. The second option is to form a fire barrier on the surface of the organic material. We opted for the latter, in which we placed a protective cover made of a suitably chosen non-combustible material around the core inside the product. The external protective cover must fulfil several functions. It must provide mechanical stability to the building element; it also provides the external visible surface and ensures the connection of the building elements. On the other hand, create a fire protection envelope around the bio-inlay. This was achieved by a layer of cement foam of a few cm thickness, using hydrogen peroxide as a foaming agent.

Research in the literature has shown that the ratio of cement, water and aggregate to reed is crucial, but reed size or particle size is also a determinant of the strength and insulating properties of the sample. (Bjelajac, 2014, Ryu Hee Lyong, 2010, Chang-Seon et al. 2019, Udvardi et al. 2020)

We also carried out combustion tests. Unfortunately, we could not have standard SBI tests performed because the SBI device is not suitable for receiving samples with a wall thickness of 30 cm. Therefore, we performed small sample studies. The reed inlay did not show any damage (temperature rise required for reed burning) even under the influence of a long-lasting (30 min), intense flame.

Figure 3. The cement foam used for the building element.

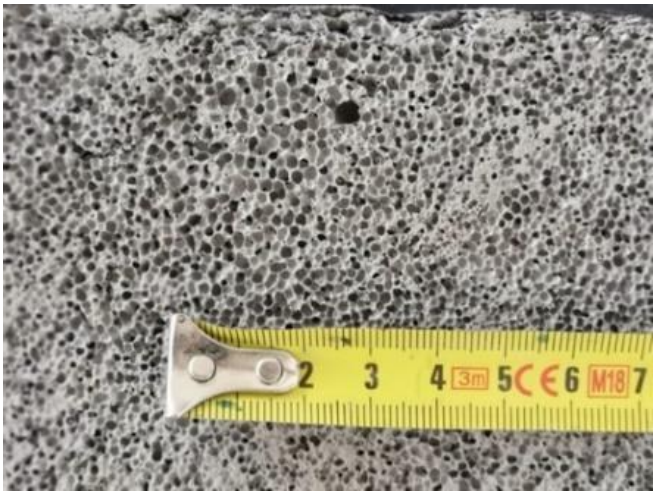


Figure 4. A sample placed against a gas burner during the fire resistance test**.**

Figure 5. The sample surface after the test.

In the case of the outer protective layer, great importance is attached to its thermal insulation properties, so we have tried to keep the thermal conductivity below 0.15 W/mK, while maintaining the compressive strength of the product. The aim was also to develop a building element that contributes to

improving the energy performance of the building so that the thermal transmittance value of the wall meets the current standard. If the wall has good thermal insulation properties, this will indirectly reduce heating costs, thus also contributing to the reduction of CO_2 emissions.

The wall constructed from the prototypes is shown in the figure below. The product can be produced in different sizes according to the masonry needs. Some typical technical data of the prototype are summarised in the table 2 below.

Table 2. Product characteristics

Body density [kg/m^3], MSZ-EN 1602:1998	450 - 500
Compressive strength, [N/mm^2] MSZ EN 772-1:2011+A1:2015	2 - 3.5
Thermal conductivity [W/mK]	0.063 – 0.067

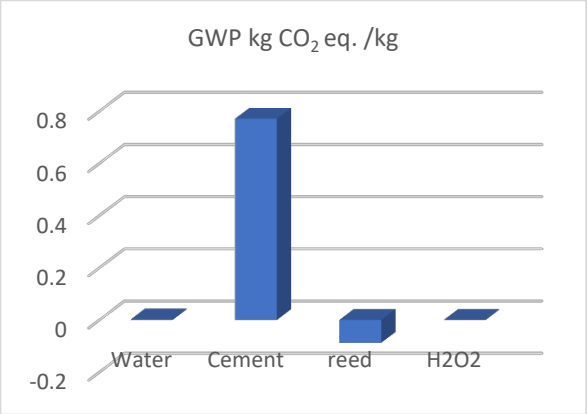
Figure 6. The wall built from prototypes.

The field of use of the new product is primarily the construction industry, where it can also be advantageously used as a infill wall element for buildings with wooden, metal, or concrete frames.

4.2. Results of life cycle studies (LCA, LCC)

We chose 1 m^3 as the functional unit of the lightweight masonry element with reed inlay, but we also determined its mass. The system boundaries were covered by A1-A3 according to EN 15804 standard. The results are presented as kg per kg, and kg per m^3 sample body. The environmental life cycle analysis (according to ISO 14044), the global warming potential of the CML 2001 method - except for carbon of biological origin - was examined for 100 years (0.643 kg CO_2 eq./1 kg and 289.6 kg CO_2 eq./1 m^3 sample body, respectively). In the life cycle cost analysis, we considered the cost of materials and energy.

Figure 7. Global warming potential, kg CO_2 eq./kg. **Figure 8.** Acidification potential kg SO_2 eq. /kg.



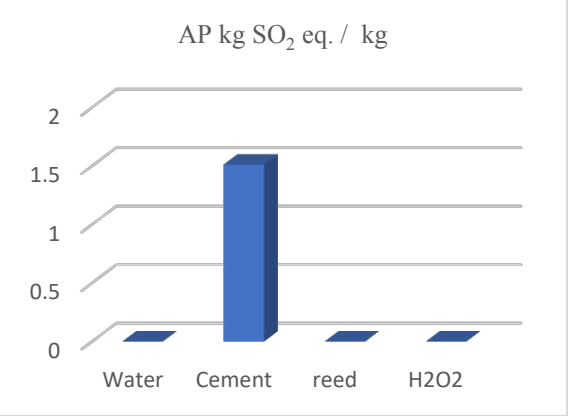
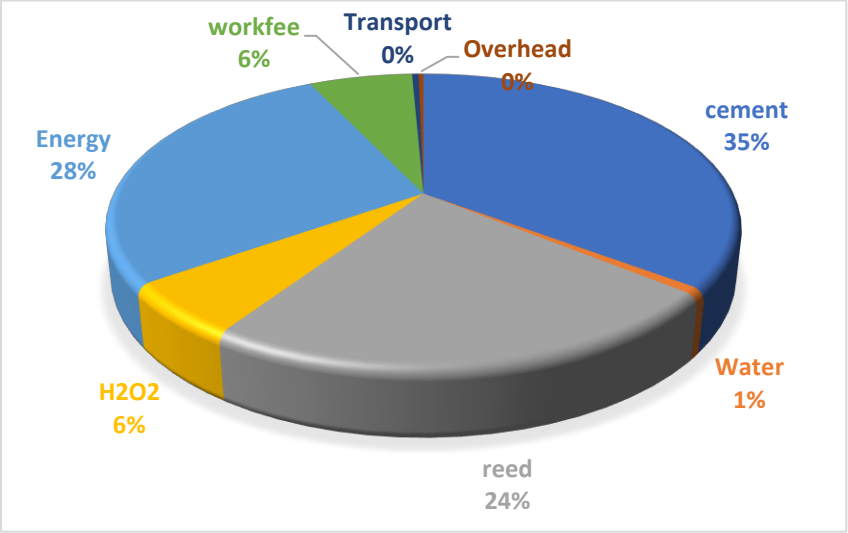


Table 3. Main results of LCA/LCC studies.

Sample size	GWP kg CO_2 eq./masonry element	LCC material cost (HUF)/masonry element
500/300/200	8.69	~527
300/300/200	7.82	~317

Figure 9. Cost distribution between components.



The disadvantaged regions of the country, with the production of such a product get new jobs, livelihoods, and benefits from a social point of view. The potentially usable natural materials (reed, bamboo, hazelnut, willow cane, grass, hemp) will be examined until they can be incorporated, and the environmental, economic, and social effects of the materials will be compared, which will include the stages of agricultural production, harvesting and primary processing. The functional unit for this stage is 1 kg.

4.3. The potential bio-based materials

Around half of Hungary's land area, about 4.5 million hectares, is under arable crops. There are hundreds of thousands of hectares of arable land where, even with current subsidies, there is no guarantee of a livelihood from conventional crops (wheat, maize, sunflower). These areas are often waterlogged and prone to inland water and are also characterised by extreme water and nutrient management, mostly sandy or sandy loam soils. All agricultural soils are suitable for the cultivation of fast-growing tree species (Gyuricza, 2014). Non-

food and feed production was mainly for energy recovery, such as biodiesel, bioethanol, or biogas production. The use of biomass for construction purposes has so far been carried out in the case of reed and straw in Hungary, but no life cycle studies have been carried out. The life cycle of biomass production should be studied from cradle to gate, which means pre-treatment from cultivation to processing.

The bio-based lightweight concrete elements are expected to have similar properties to the reed element, saving concrete and reducing carbon dioxide emissions, but the technological design is still under development, given the significant differences in the physical properties of other biological materials compared to the reed tubular structure. The environmental impact of the cultivation is also different, as their cultivation requirements and yields per hectare are different, and the production of the concrete requires different preparation.

2008). The potential materials and those environmental impacts depend on various parameters, (Barta et al. 2008, Krzyżaniaket al. 2015, Bacenetti et al. 2016, Yang, et al. 2020, Frank et al.2022, Livingstone et al. 2022, Teagasc and AFBI, 2015a, Teagasc and AFBI, 2015b).

5. Conclusions

Given the environmental pressure of the construction industry, it is understandable that more and more reasearchers are looking to develop more sustainable, lower impact but durable building elements. Research is partly focused on resource substitution, partly on the use of renewable resources, or on the development of reuse. The guiding principle is sustainability, using circular solutions to ensure that buildings meet the most demanding requirements, in line with net zero building energy standards. Our research aims to develop bio-based building components, which, in addition to being environmentally friendly, allow the creation of a smart family of building components with unique design, and have a beneficial impact on the social ecosystem. The use of bio-based materials in construction plays an important role in greening building elements, reducing greenhouse gas emissions and saving non-renewable resources. The lightweight concrete masonry units produced in this way can be used to construct buildings quickly and provide a huge help in underdeveloped areas and disaster-stricken areas. In addition to environmental gains, lightweight concrete building blocks also provide economic and social benefits. If, as with reed, the other biomaterials tested show similar results in terms of both technology and technical performance, this newly developed product range will offer further potential for smart, sustainable, or even early ageing economies.

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Definition of design strategies for sustainability for fashion accessories of the Made in Italy footwear sector, through Life Cycle Assessment methodology. The case-study of a brass buckle for footwear by Santoni Srl.

Lucia Pietroni[1], Daniele Galloppo[2] and Raffaele Scialdoni[3] [4]

[1] Faculty of Architecture and Design, University of Camerino
[2] Faculty of Architecture and Design, University of Camerino
[3] Faculty of Architecture and Design, University of Camerino

[4] lucia.pietroni@unicam.it

Abstract. The success of the Italian footwear sector is due to the entrepreneurial ability and typical organization of the industry, which is in the context of a "long production chain", consisting of a system of high-quality sub-suppliers. Today, considered the ever-increasing importance of the issues of environmental sustainability of products and production processes several BtoB companies in the footwear production chain have taken a proactive approach to environmental sustainability. The objective is to seek where their greatest environmental impacts reside and how to make improvements to make footwear components and accessories more sustainable and circular. Among the most critical products are brass accessories and their finishing process that generates pollutants that are difficult to recycle and dispose of. Therefore, the case study of Santoni Srl, represents a significant example of a preventive approach to sustainability, which can contribute to understanding the importance of using LCA-Life Cycle Assessment methodology to define ecodesign strategies to improve sustainability and circularity. The paper presents a case study of a company in the footwear sector that initiated this approach in line with the "Planet" target and SDG 12, moving toward more sustainable production processes and consolidating its green reputation.

1. Introduction

The Italian footwear sector is one of the pillars of the Made in Italy Fashion System and has always been a leader among the producers of high-end and luxury footwear. In 2021, Italy, is the first footwear producer in the European Union, and the eighth exporting country worldwide, in terms of volume, only second to China, in terms of value, (Apiccaps, 2022, pp.4-5). The success of the sector is related to the entrepreneurial capacity and to the typical structure of the sector, embedded in a context of Supply Chain, consisting of a high-quality sub-supply system of raw materials, tanneries, components, accessories, machine manufacturers, pattern makers and stylists. The result is, therefore, a territorial concentration of companies organized in areas and industrial districts, mainly located in seven Italian regions: Marche, Tuscany, Veneto, Campania, Lombardy, Puglia, and Emilia-Romagna.

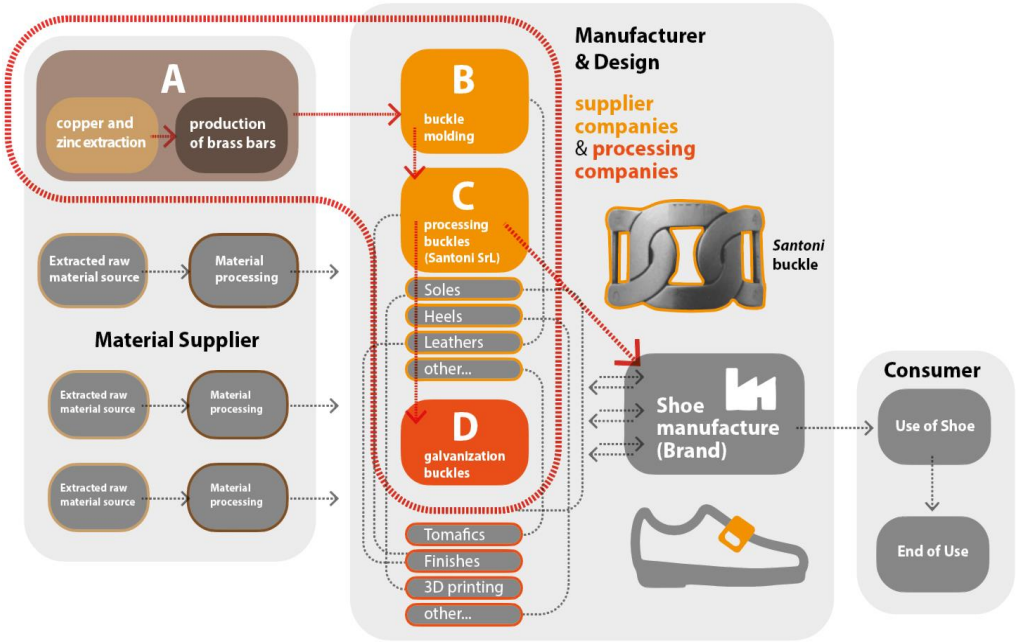
The "long supply chains" of the footwear sector are characterized by the presence of a few large companies, holders of one or more brands, which deal with the creative and commercial phases, and many highly specialized small and medium-sized companies, which have high technical processing skills in developing footwear components and accessories. It is an economic-productive reality, which questions different sectors and protagonists, and attributes an important role to all the players in the supply chain (suppliers, sub-suppliers, etc.). As shown in figure 1, the supply chain is a heterogeneous system of companies dedicated to the manufacture of different materials (leather, leather, textile, rubber) and components that contribute to the production of the shoe (accessories, die-makers, sole factories, heel factories, insole factories), while others are services suppliers, aimed at commercial activities. This Italian district model has allowed to develop high quality products and to strengthen the competitiveness of Italian companies against their competitors, thus contributing to the global success of the footwear sector. However, today, given the ever-growing importance of the environmental sustainability issues of products, and production processes, the long-chain structure of the footwear sector creates greater complexity in the sustainable management of the entire supply chain: from the procurement of raw materials to the multiple

processes and finishing of components, to the creation of accessories, up to the production and marketing of the final product. Furthermore, the final report of the study carried out by Quantis (2022, p.28), highlighted that more than 60% of the emissions from the production of a shoe are generated in the processing phases of the components and accessories, therefore upstream of the assembly and distribution phases. Indeed, it is precisely in the supply chain that it is necessary to intervene with environmental assessments of the components, to improve the environmental performance and the circularity of the final product. Therefore, component and accessory supplier companies, can play an important role in improving the environmental footprint of footwear and its supply chain, in turn becoming a stimulus for sustainable transformation of their suppliers and customers. Recently, several B-to-B companies in the footwear production chain, have adopted a proactive approach to environmental sustainability, seeking where their greatest environmental impacts lie and how to improve, to make the components and accessories of footwear more sustainable and circular (European Commission, 2020). The growth in this approach to sustainability and circularity of the footwear companies in the supply chain, manufacturers of accessories and components, is due to a market that is starting to demand greener products, both in the high-end and in the luxury sector. It is not uncommon the use of secondary raw materials, eco-sustainable, biodegradable, or recycled materials, as well as processing technologies and treatments with a lower environmental impact. In fact, the footwear accessories sector mainly produces items made of brass, zinc, or steel, covered with a thin layer of precious metal such as gold, ruthenium and palladium. This process of depositing the finishing material generates pollutants that are difficult to recycle and dispose of.

Therefore, the case study of Santoni S.r.l, subject of this paper, represents a significant example of a preventive approach to sustainability, which can help understand the importance of using the LCA-Life Cycle Assessment methodology, to define strategies of DfS-Design for Sustainability aimed at improving the environmental performance of the product and the company, with positive impacts on the entire supply chain. The LCA, was carried out according to the ISO 14040 standard on one of the most representative products sold by the company in recent years: a brass buckle, for the Made in Italy footwear sector. The aim of the analysis carried out, was to identify the main environmental criticalities, from cradle to gate, and to identify improving strategies, with a view to sustainability and circularity. Finally, the Design for Sustainability strategies were outlined to improve and optimise the environmental performance of the product, estimating, in their adoption, an overall reduction of CO_2 emissions (Kg CO_2-eq), up to twenty times compared to the current model.

The paper aims to highlight the importance - for Made in Italy SMEs - of activating Design for Sustainability (DfS) strategies, to accelerate the transition process towards the Circular Economy, through the quantification of the environmental impacts of their products, trying to play a conscious and important role within the supply chain in BtoB relationships. Furthermore, the contribution presents the case study of the Santoni company, a player in the footwear sector of the industrial area of the Marche region, which has started this approach in line with the "Planet" target (reducing the ecological footprint, changing the way we produce and consume goods and resources) and SDG 12: "Responsible Consumption and Production", activating, through the evaluation and planning tools of eco-design, more sustainable and circular production models.

Figure 1. Scheme of the production chain in the footwear sector, from the material production phase to the consumption phase: boundaries of the buckle system produced by the Santoni S.r.l company



2. Literature Reviews

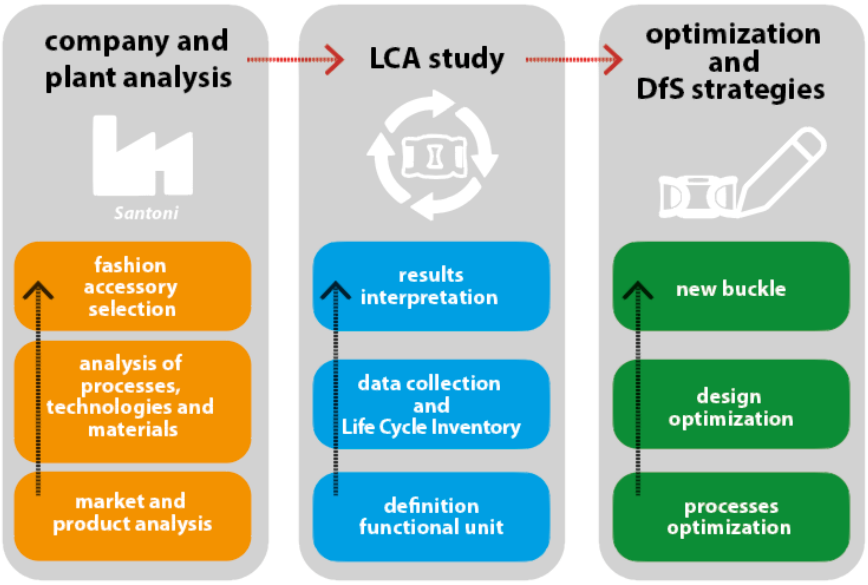
In 2018, billions of pairs of footwear were produced, with an increase of 20.5% compared to 2010. About 87.6% of world footwear production takes place in Asia, 3.2% in Europe, which however consumes 13.6% of the total. Particularly in Italy, the levels of per capita consumption are among the highest: 6.8 pairs of shoes per year (Muthu & Li, 2021, pp. 305-320). Considering the significant growth in shoe production, it has been estimated that, in 2016, the overall contribution of the footwear sector to climate change was approximately 3.29 billion tons of CO_2 (Marques et al., 2017, pp. 303-308). Estimates confirm that the fashion system is one of the most polluting industries in the world, second to the oil industry. The study also highlighted that the main drivers, influencing the impact categories, are attributable to the production of components and the extraction of raw materials. In this scenario, the main brands that govern the entire production chain, increasingly delegate the different phases of the creation of their products to many small/medium-sized enterprises scattered throughout the world (Macchion et al., 2018, pp. 9-28), sometimes, underestimating the social and environmental aspects that affect the life cycle of their products. This BtoB system, in addition to limiting the traceability of flows (materials and technologies) and establishing a transparent interaction between the various players in the supply chain, also has strong repercussions on the environmental performance of shoes. According to Macchion et al. (2020, pp. 2679-2691), considering the problem in the management and control of the inputs and outputs of the supply chain, it may be strategic to develop a sort of "identity card" of the product, as a traceability system between the actors themselves, to monitor the quality of processes and materials that influence the sustainability of products. Progress has been made in the last ten years, thanks to the work of researchers from all over the world, who have defined design guidelines - as a useful tool for companies - suitable for planning and at the same time aimed at improving sustainability criteria and circularity of the shoes. For example, in the “Handbook of Footwear Design and Manufacture”, the following are discussed: engineering design methodologies; technical solutions, aimed at reducing production waste; strategies to optimize production processes for productivity. The European Commission has also moved in this direction, developing a guiding tool for the "Circular Economy: Environmental and Waste Management". It is a questionnaire aimed at collecting data, which differentiate products in the footwear market from an environmental point of view, trying both to influence and support companies in the sector, in the choice of materials, processes and finalization, in order to reduce the emissions to soil, air, and water as much as possible (European Commission, 2013). Obviously, in the footwear sector, most of the environmental impacts depend on the nature of the raw materials and semi-finished products used in the production of the shoe body and, to a certain extent, in the development of accessories. According to Quantis (2018, p.28), the materials most used by the footwear industry are: synthetic materials, leather,

and fabrics, present respectively at 57%, 25% and 18%. Furthermore, although leather materials are present in only a quarter of footwear production, their impacts are significant, ranging between 30% and 80%, depending on the categories of environmental damage taken into consideration. To confirm this data, we report the LCA study, limited to the Swedish footwear market, which found that a pair of leather shoes shows an impact up to three times higher than a shoe made of another material (Gottfridsson & Zhange, 2015, p.41). In the same study, the impact result related to the production of footwear materials stands out, with the highest value of almost 80% of the total life cycle. Particularly for leather shoes, the main causes of impact (around 70 %) are due to the slaughter and tanning processes (Rossi et al., 2021, p.700). In summary, the materials that contribute the most to environmental impacts - per kilogramme - are leather, wool, nylon, aluminium, synthetic rubber, polyethylene terephthalate, polyurethane, and viscose. In the manufacture of accessories (hinges, buckles, eyelets, etc.), on the other hand, it is iron, copper, zinc, brass, and aluminium. Although the weight of metal accessories represents only slightly more than 10% of the final product, a recent study by LCA has shown that, unlike the other impact categories, the main contribution to eutrophication and acidification, estimated at up to 35%, is mainly due to the materials and treatments used for these accessories, especially those made of metal alloys such as brass (Zottin, 2019, p.60). The issue of processing and treatment of footwear components is a critical environmental aspect, even for small items such as eyelets and buckles. A recent study, focused on the economic and environmental comparison of three buckles for shoes and belts - one made of brass sheet and the other two buckles of the same model, made of zamak – highlighted that the greatest impact is related to the nature of the raw materials that make up the accessories (brass and zamak) and the galvanic treatment they undergo (Odorisio & Germani, 2020, p.57). To corroborate the results of this study, we report the work conducted by Bandinelli, Fani and Bindi (2021, p. 4453) on the critical question of the galvanizing process for the ennoblement of metal fashion accessories, generally coated with a thin, precious layer such as gold. The paper discusses the role of Physical Vapor Deposition (PVD), as a technology, alternative and more sustainable, compared to traditional galvanic, trying to highlight the opportunities and criticalities, compared to the numbers and complexity dictated by the fashion system, characterized by short-time delivery cycles, and by a high variance, in terms of shapes and finishes.
In conclusion, it can be stated that in recent years, the LCA methodology applied to the footwear fashion sector, has focused, as a priority, on the study of the impacts associated with the materials of the main components such as soles and uppers, neglecting the use phase of the footwear, as it is difficult to quantify in the inventory phase (LCI). Although some studies have shown that even the accessories supplied with shoes affect the sustainable behavior of the entire supply chain, the analysis of the environmental impacts of these accessories still appears to be little studied and considered marginal. However, it is evident that the production of accessories generates a quantifiable contribution over the entire life cycle of a pair of shoes, highlighting the importance, in the development phase of new models, of a weighted and sensitive choice regarding materials and types of surface treatments to be adopted. In this scenario, also the companies supplying accessories, assume a significant role in the generation of impacts and are therefore motivated to develop, through the tools and strategies of DfS, new solutions aimed both at reducing emissions and at enhancing the aesthetics of their products, an essential parameter for many fashion brands.

3. Methodology

As already mentioned, the paper intends to describe the DfS strategies, proposed to improve the environmental performance of a small-medium company in the footwear sector, a manufacturer of metal accessories for high-end footwear, i.e. Santoni S.r.l. The article describes the process and the results of the life cycle analysis (LCA) of a brass buckle produced by the company and the possible environmental optimization options. The methodology adopted was divided into three macro-phases: (i) productive-economic categorisation of the Santoni company; (ii) development of an LCA study of a brass buckle and evaluation of the environmental impacts, mainly expressed in kg of CO_2-eq; (iii) product optimization through DfS strategies.

Figure 2. Summary scheme of the methodology adopted for the environmental analysis and the redesign of the buckle



The first macro-phase aimed at reconstructing the role of the Santoni S.r.l company within the footwear supply chain, analyzing the main products developed and the manufacturing processes carried out in the production plant. At the end of this activity, a brass buckle was identified as the most significant accessory for analyzing the life cycle of a fashion accessory for the footwear industry. The purpose of the study was to evaluate the "from cradle to gate" environmental performance of the buckle, intended to complete, as an accessory, a model of classic high fashion shoes. The product is single-component, single-material and made of galvanized eco-brass (90% recycled and Pb free).

The total weight of the single buckle is approximately 36 gr. The Economic Order Quantity (EOQ) is of tens of thousands of pieces per year, and the production cycle for the realization of the product includes four important macro-processes described below, ordered by production phase: (i) macro-process "A": in this phase the semi-finished products, i.e. the eco-brass bars, are made by a foundry located in the industrial area of Florence, generated with 10% virgin material and 90% recycled; (ii) macro-process "B": the eco-brass bars are transported to another factory, also located in the industrial area near Florence, where they are reduced to billets and forged to obtain the initial geometry of the buckle, also referred to as a raw buckle. This process involves at least three highly energy-intensive steps: billet annealing, forging and metal blanking; (iii) the macro-process "C": represents the heart of the production cycle and is the main actor, object of the study. This phase takes place inside the Santoni S.r.l production plant, located in the Fermo area, and involves eleven manufacturing processes, from the grinding of the raw piece to the surface treatments of tumbling and polishing, up to the final transport to the company that makes the shoes (from process “C1” to process “C11”, as shown in figure 3). Once all the processes have been completed, the pieces are packed and shipped to the final customer; (iv) the macro-process "D": concerns the galvanizing phase, i.e. the electrolytic process responsible for the surface ennobling of the pieces, capable of improving their resistance to wear. This treatment takes place in a plant outside the Santoni S.r.l company, located in the industrial area of the province of Macerata, central Italy.

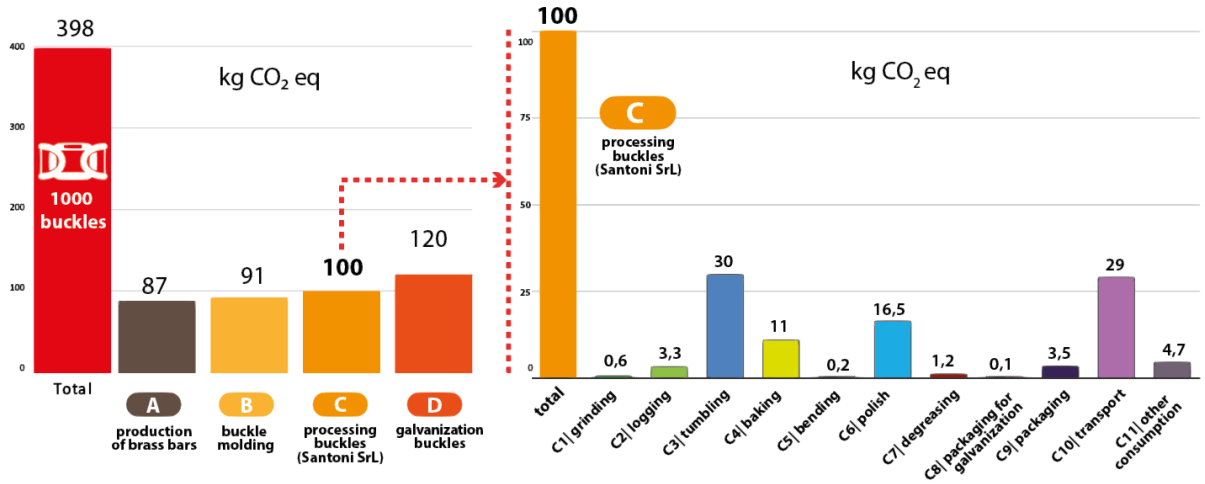
The second macro-phase of the LCA study was conducted according to the indications of the UNI EN ISO 14040/44 standard, thus carrying out: the definition of the objective and purpose of the study; inventory analysis; impact assessment; data interpretation. The activities carried out to achieve the objectives and report the results were as follows: analysis of the company's production processes; definition of the analysis objectives, system boundaries and assumptions for carrying out the inventory; identification of a product representative of the company in terms of units produced and selected as the object of analysis, or a brass buckle produced for a men's shoe of a well-known Italian brand; data collection in the company by means of structured checklists and video and photo reports of the individual production processes and surface treatment; data selection from existing databases (if direct data collection was not possible); set-up of the inventory and collection of primary and secondary data by means of measuring instruments carried out in the production plant; collection and estimation of data in the literature; data processing and evaluation through the use of Simapro software; summary and interpretation of the results of the study; identification of necessary measures for possible improvement of the environmental compatibility of processes and products.

The selected functional unit refers to the production and processing - i.e. all forming and surface treatment processes - of 1000 pieces. The Ecoinvent 3 (2021) database available in SimaPro was used for the inventory phase and the compilation of the data required for the modelling of all phases considered. Therefore, the modules already in the database were linked to the technologies and materials from which the buckles are made, identifying the direct and indirect environmental impacts and ultimately the avoided impacts. Several approximations and estimates were made to fill in the missing primary data. The information collected in the initial measurement and data collection activities was used to model all the macro processes in SimaPro ("A "+"B "+"C "+"D") that make up the production cycle for the manufacture of one thousand pieces. After defining the LCI phase, the assessment of the environmental damage associated with the production of the 1,000 eco-brass buckles was carried out. The factors of the assessment method EF 3.0 were used as impact factors. This is a method taken from the EU Communication COM /2013/0196, which sets out the procedures for the dissemination of the Product Environmental Footprint (PEF) and the Organisation Environmental Footprint (OEF). In particular, the results generated by the PEF method form the basis for communicating information on the environmental footprint of products and are therefore an effective tool for improving the company's green reputation in a transparent and correct manner. Once the phase of evaluating and interpreting the results and the environmental impact associated with the functional unit was completed, the next step was to define strategies for improving and optimising environmental performance. Through on-site research, the first step was to investigate surface treatment technologies and processes that could be an alternative to electroplating and produce the same aesthetic qualities; secondly, environmentally friendly and high-performance materials and semi-finished products were identified as an alternative to brass that could be processed using alternative technologies to forging.
Finally, a "lightweighting" process was initiated through the use of 3D modelling software, aimed at optimising the geometry and estimating a possible reduction in thickness and surface area to be machined.

4. Results and Discussion

Based on the data collection - primary and secondary - for the inventory definition and the mapping of these data in the analysis software LCA, it was possible to identify the main environmental damages related to the production of one thousand buckles - characterisation phase - with the contribution to climate change, expressed by the production of carbon dioxide in kg CO_2-eq.
"Climate change" is an important factor in understanding the evolution of energy consumption throughout the life cycle and was therefore chosen as a particularly meaningful indicator of the impacts associated with the production and distribution of the buckle. The detailed analysis of the macro-process "C" found that the biggest impacts are due to three processes: tumbling, transport paid by Santoni S.r.l. and polishing.

Figure 3. Graph with the results of climate change, expressed in Kg CO2 eq, associated with each main production and processing phase of the 1000 buckles (macro-processes "A"+"B"+"C"+"D") and detail of the individual processing phases within the macro-process "C"



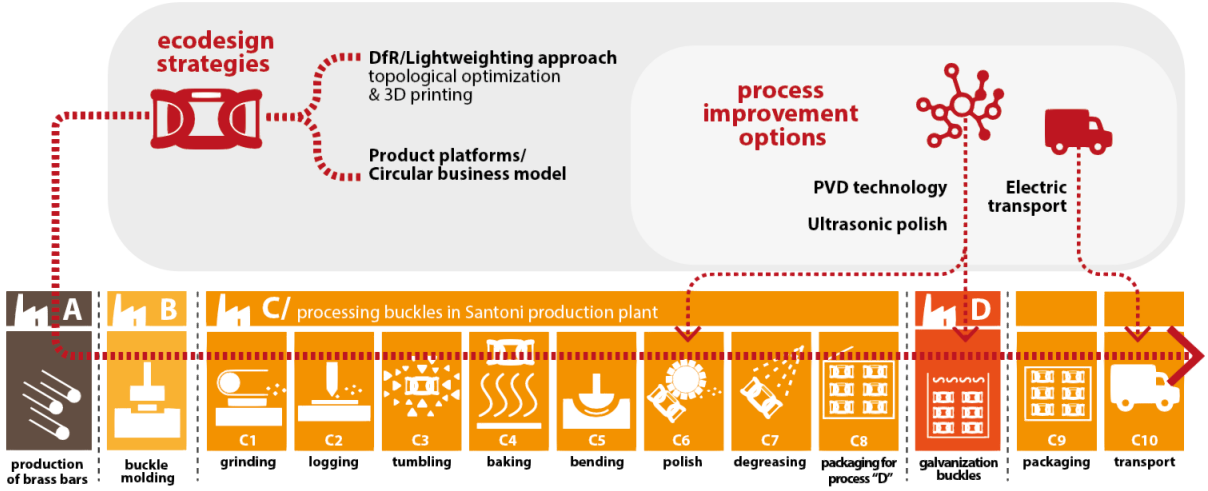
4.1 *Impact Analysis*. An analysis of the impacts generated during the entire production cycle (Figure 3), shows how the macro-processes "A", "B", "D", i.e. those outside the Santoni site, are those that generate most of the impact, both as CO_2 emissions and as a "score", according to the EF.3.0 methodology.The

interpretation phase of the study was divided into two parts: the first describes the impacts generated during the entire buckle production cycle, “A”+“B”+“C”+“D”; the second reports the results of the impacts generated within the Santoni production cycle, i.e. the macro-process "C". This approach was necessary as, with a view to identifying improvement actions, it is evident how the company responsible for marketing the product, i.e. Santoni S.r.l, can intervene both directly on the production phases that take place inside of its own plant, and on external ones, trying to stimulate and influence the procurement choices of raw materials and technological processes of its suppliers in terms of environmental improvement. In fact, the activities carried out within the manufacturing process of the Santoni company represent approximately 25% of the total CO_2 emissions: the predominant part of the impacts actually occurs upstream of the macro-process "C", i.e. for the production of the brass bars and the molding of the raw buckles, equal to about 44% of CO_2 emissions; finally, a share equal to approximately 31% of CO_2 emissions to be attributed to the galvanizing process. The results of this study highlight some relevant critical issues attributable above all to the macro-processes "A"+"B"+"D". However, the emission levels are to be considered low for some sustainable choices already undertaken by companies in the supply chain, such as: the choice of a brass rod supplier that uses recycled brass, with a low Pb content; the use of a portion of the electricity produced by the photovoltaic system of the Santoni S.r.l plant; the choice of a galvanizing process that uses gold obtained from the WEEE waste recycling chain (Elomaa et al., 2019, pp. 456-477); the start of recycling, when possible, of the processing waste generated within the Santoni S.r.l company plant (for example, defective buckles re-enter the brass recycling circuit).

4.2 Ecodesign strategies. Following the analytical phase, it was possible to develop a series of interventions, to be implemented in the future, and aimed at further increasing its performance, in terms of sustainability and circularity.

In particular, at least three macro-optimization interventions were explained: the first two aimed at improving the quality of some processes, internal and external to the Santoni company; the last one, strongly aimed at the redesign of the buckle. In summary, the following were proposed to the Santoni company, which makes the buckles: (i) "Interventions for the environmental improvement of internal processes at the Santoni plant": it is hoped that road transport means will be implemented, which are electrically powered (also to exploit the self-production capacity of electricity documented on the production site); it is required to increase the use of electricity from renewable sources; the replacement of the current degreasing process with ultrasound technology is recommended; (ii) "Environmental improvement measures relating to the surface treatment process alternative to galvanizing": it is recommended to replace the galvanizing process with processes with a lower environmental impact, such as the Physical Vapor Deposition PVD technology, for which a reduction of approximately twenty times of CO_2, compared to current values. However, this treatment requires calibration to obtain the same quality standards of the product, especially the colour; (iii) "Product environmental improvement measures": it is advisable to start a buckle redesign process which involves the adoption of appropriate strategies for the reduction and optimization of the material and capable of maintaining at the same time the same qualitative and distinctive of the current product.

Figure 4. Main environmental optimization interventions of the buckle with DfS macro strategies



The first two options for improving the impacts are limited to interventions on specific phases, in particular on the galvanizing phase, on the degreasing process, and finally, on the transport phase, which characterizes the commercial exchanges between the Santoni company plant, and its other suppliers and customers in the supply chain. Although the first two options are already able to give an important result in terms of impact reduction, it is believed that an environmental redesign action would lead to a greater contribution to all manufacturing processes, generating ripple effect benefits, throughout the Supply Chain, from macro-process "A" to macro-process "D" (Figure 4). For example, the adoption of a "Lightweighting" intervention (Tempelman, 2014, pp. 247-258), both as a replacement of material with a lighter and less energy-intensive one, and as a lesser use of brass through appropriate eco-design strategies, would lead to a significant reduction of resources and, consequently, also to a containment of the final costs for the production. In fact, the analyzed product, in addition to being characterized by an expensive material compared to other alloys and metals, appears oversized and heavy for its effective function. Although this aspect of material redundancy is dictated by a need for style, it could be interpreted as a benefit in terms of product durability. However, precisely because of its intended use, i.e. an accessory for high fashion shoes, it is subject to an aesthetic-cultural obsolescence, and therefore destined to a rather short life cycle. Therefore, a Design for Reduction-DfR approach, supported by tools capable of evaluating the effective mechanical resistance of the product, such as finite element analysis-FEM, could be strategic for dimensioning the effective thicknesses so that the buckle resists the traction of the laces without breaking, or, through a topological optimization process (a process that starts from a 3D model, to which forces and constraints are applied, and is resized to obtain the most efficient result), it would be possible to completely redesign the product and make it with the 3D printer. This technology makes it possible to improve the use of the material, optimize the surface to be treated for the final finish, limit the generation of waste and, consequently, also have benefits on transport, reducing volumes and weights. In fact, compared to the development of a traditional buckle made by forging - which produces a waste that can reach up to 48% of its actual weight - the 3D printer would lead to a significant reduction in brass scraps, generating a reduction in the CO_2 emitted during the of pre-production estimated at around 50%. Furthermore, considering that the high fashion sector is characterized by low sales volumes and high aesthetic flexibility, it is expected that the implementation of machines for rapid production would bring the company both an environmental advantage and a reduction in "time to market". As already explained, these accessories are subject to aesthetic obsolescence, therefore another redesign strategy that can be pursued by the company is the development of a platform product system. The new buckle could be designed to be disassembled and customized after the shoes' end of life. For example, in the surface area where the logo is engraved today, one could imagine easily removable and restorable inserts in terms of new logos and finishes. Furthermore, the buckle designed in this way could change its intended use and be part of the development of another fashion accessory by coupling it with other components and materials. Obviously, this type of scenario, certainly more ambitious and long-term, envisages that the company develops an ad hoc service for the recovery of products and launches a strategic marketing activity, aimed at raising the awareness of the players, up to the end user, seeking to enhance and promote a new business and circularity model within the footwear supply chain.

5. Conclusion

Through the LCA analysis conducted on the brass buckle, it was possible both to learn the environmental criticalities associated with a fashion accessory, and to verify the need to manage the complexity of the "long supply chain" of the Made in Italy footwear sector in a sustainable way. In this scenario we note the contribution of the Santoni company, as a virtuous actor, for the promotion of a change of course through the adoption of sustainable practices aimed at evaluating and increasing the environmental performance of its products. This is possible, both by intervening on manufacturing processes - through the choice of suppliers of green oriented materials and technologies - and through the use of new eco-design strategies supported by new product optimization tools such as topological analysis and production technologies energy efficient like 3D printers.

In particular, an environmental redesign approach, primarily oriented towards the reduction of materials and resources, would have a strong impact on the entire supply chain, above all if one considers that, currently, the ratio between the weight of the single buckle and the waste generated for its production, is close to a value of 1 (36g buckle/34g waste). Finally, in a future scenario, the adoption of a new business model oriented towards circularity criteria and characterized by the development of a platform product system could further increase the environmental benefits throughout the supply chain involved, enhancing the final quality of the high-end shoes and also confirming the internationally recognized "value" of Made in Italy products.

6. Acknowledgement

For the results achieved and the work carried out we thank Dr. Claudio Santoni, owner of Santoni S.r.l. of Montegiorgio, Dr. Danilo Callisti, internal consultant of the company, and all the technicians of the production chain who collaborated in the collection of data for the inventory development phase and the LCA study.

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Design of sandbags for flood control and water purification based on KJ/FAST/CATIA

Haorui Tian[1], Li Zhang[2] and Meng Zhang[3]

[1 2 3] School of art and design, Guangdong University of Technology, Guangdong, China

Abstract. To meet the emergency rescue needs of the affected people under flooding scenarios, we designed a flood prevention and water purification sandbag that better meets users' physiological and psychological needs with the design goal of quick rescue and self-help. Analyze the causes and characteristics of flood disasters, combine the KJ method to investigate user needs in-depth, prioritize the needs systematically, analyze the primary functional needs and related technical issues through the black box model, establish the product FAST function tree to derive the main functional module design guidelines for flood sandbags, establish the form matrix of flood sandbags around functional innovation and integration, and then propose a new product innovation model. The study shows that KJ/FAST/CATIA can propose an innovation path to discover, analyze, and solve product problems, realize the functional expansion of the product in terms of modularity and human-machine relationship, build an innovative design of flood control sandbags that meets users' needs such as water purification, and effectively improve the emergency rescue efficiency and use the experience of flood control products.

Keywords. Product design; Flood sandbag; KJ; FAST; CATIA

1. Introduction

According to relevant studies, in 2021, more than 200 more significant flood disasters occurred worldwide, affecting a population of about 29.2 million people and causing direct economic losses of more than $74 billion[1]. The occurrence of floods has multiple characteristics, such as uncertainty and unpredictability, i.e., there is not enough time for timely and effective crowd evacuation[2]. Therefore, flood prevention and mitigation have become essential to protect people's lives and smooth socio-economic development. Before the arrival of professional rescuers, emergency rescue products were the critical force in protecting the lives of the affected people. In flood prevention, flood sandbags are commonly used in various scenarios, such as water retention, drainage, and waterproofing. Most of the existing flood control sandbags in China use traditional methods such as filling sand and gravel, and there are certain design flaws in the functional and ergonomic areas related to sandbags. The author tries to update the existing flood control sandbags through the design method of functional innovation to provide safety protection for the affected personnel while meeting their physiological and psychological needs and further enhance the flood control performance of sandbags.

2. Design background analysis

2.1. Analysis of flooding scenarios

Flooding is a natural disaster that is difficult to prevent, sudden, widespread, and explosive[3], and it causes significant damage to the social environment and economy. They are classified as urban flooding, mountainous areas, and river flooding, depending on the regional environment, with urban flooding having the most severe impact on the social environment. Flooding in densely populated urban areas can cause many casualties, and it is difficult to provide shelter in the narrow and closed city streets and evacuate people in a timely and effective manner. Regarding health and hygiene, the pollutants the flood waters carry rise as they rise. After the flood waters fall, domestic waste and sewage will return to the city's water supply and street drainage system as the water level falls. Water contaminated by pathogens will seriously threaten human health[4][5], and the demand for clean water after the disaster cannot be guaranteed. In summary, the occurrence of floods can cause severe damage to the physiology (infectious diseases, hunger, etc.) and psychology (mental tension, mood anxiety, etc.) of affected people. The existing flood emergency products

need more consideration for the above flood hazards to protect the lives and health of the affected people in all aspects.

2.2. Flood control sandbags product analysis

Flood sandbags are products used in disasters to provide water resistance for public facilities, etc. Depending on the material, existing flood sandbags are classified into inflatable sandbags, canvas sandbags, silicone sandbags, etc. Traditional sandbags need to be prepared by tedious filling to use. In contrast, the assembly, transportation, and installation of sandbags can be completed with sufficient human resources and heavy machinery[6], and the whole process is time-consuming and laborious. In the face of sudden flooding, traditional sandbags cannot quickly provide the corresponding protection function. Using sand and gravel as the filling material of sandbags leads to their small water absorption capacity and low drainage efficiency. The limited space environment in urban areas cannot provide sufficient storage space for traditional sandbags, which leads to insufficient reserves of flood control sandbags in public facilities and seriously affects the efficiency of emergency flood control. Therefore, traditional sandbags' ergonomics, materials, and functions need to be updated to meet the basic needs of flood control and provide functionality to emotional relief to the affected people and dual physical and psychological security from disaster to post-disaster[7]. Because of this, the paper will use the KJ/FAST/CATIA for functional innovation of flood control sandbags to better meet the user's needs and provide a reference for the design and development of related flood control products.

3. Theoretical overview

3.1. KJ method

The KJ method is a quality management tool for repeatedly assembling, organizing, and analyzing relevant problems and scenarios in unknown areas[8]. The method starts by listing the research objectives and problem points, categorizing and merging them according to the cause-effect relationships between them, establishing the mapping objects of the problems by pulling them out of the complicated and confusing problems and presenting the matrix of relationships between the problems using graphic visualization to find the core problems of the research objectives quickly. Using the KJ method in the user analysis stage can provide further insight into users' The KJ method can provide further insight into the real problems and potential needs of users and provide coordinates for solving product design problems.

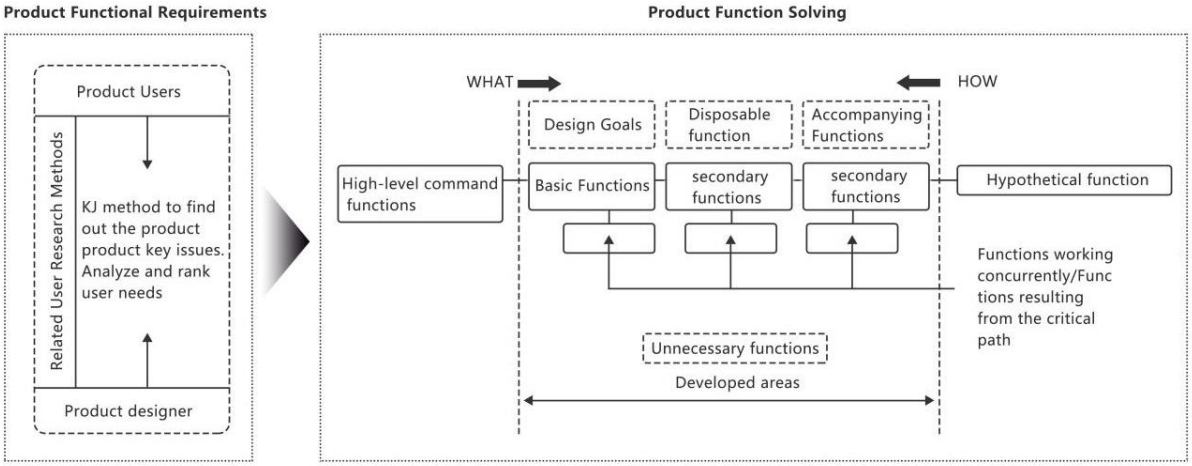
3.2. FAST method

Product is the formal carrier of function, and function is the core element of product development innovation. The functional Analysis System Technology (FSAT) method divides the total functional requirements of a product through a hierarchical system, analyzes the correlation between functional levels, and establishes a product functional tree based on the essential function as the core unit, which is expanded into multiple related sub-functions[9]. The FAST method can help designers explore the redundant parts of the overall functional structure of the product and query its missing functional components logically, which can effectively balance the development of product *functions*[10]. The dichotomy between demand and cost. The visualization analysis mode can reasonably determine and subdivide the user's functional requirements, realize the user-centered design and development, and build new concepts and values for the product.

3.3. KJ/FAST mode

The KJ method can analyze and refine user needs and propose directions for product function development. In contrast, the FAST method can help designers solve functional solution problems in flood control sandbag development and systematically guide design activities. In flood emergency rescue scenarios, the functionality of flood control products and the physiological needs of users are equally important. The design of flood control sandbags using kJ or FAST methods alone cannot simultaneously achieve insight into the real needs of users and update product functionality. Therefore, the KJ-FAST model, which is a combination of the two methods, can make up for the shortcomings of the single method, as shown in Figure 1, and update the functional structure of the flood control sandbags to better serve the target users based on understanding the real needs of the affected people.

Figure 1. KJ/FAST mode



4. Flood sandbags functional design

4.1. Product functional requirements analysis

Firstly, the design theme of the flood control sandbags was determined, and secondly, the related subject literature was studied to develop an interview framework for the target users. Interviews were conducted with 20 target users (including two firefighters, six design students, and 12 users with previous experience with flood control sandbags), and their behavioral process of using sandbags was recorded. The information collected from the interviews and behavioral observations was made into individual cards. The card information was divided under the corresponding need themes according to the correlation between the need information and then combined with the physical and psychological needs of the target users. Then, the invalid card information was eliminated, and the card combinations with similar needs were grouped into relatively independent large groups. Finally, according to the user needs to be arranged and divided by the KJ method, the user's demand items for flood control sandbags were extracted, scored, and arranged according to the importance of the needs (1 to 10 levels, ten being the highest), as shown in Table 1.

Table 1. Ranking of user requirements and functional importance

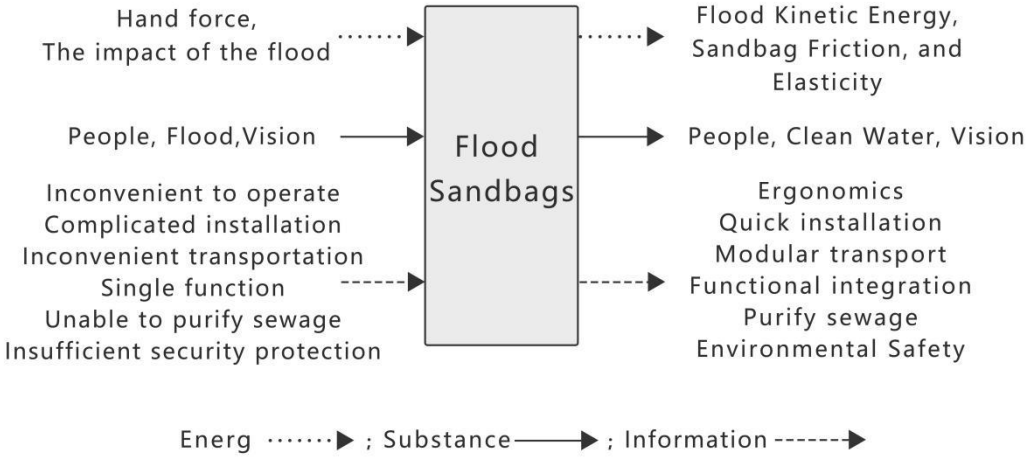
Serial number	Demand item	Description of Requirement	Importance (Level 1~10)
1	Eco-friendly material	Green materials, recycling and reuse	8
2	Reasonable man-machine size	The product meets the user's man-machine size, comfortable to use	8
3	Beautiful shape	Product appearance with good visual perception	8
4	Easy to clean materials	Product material is flat and easy to clean	8
5	Purification of sewage	Products can purify wastewater into clean water	9
6	Security Protection	Products can effectively withstand the impact of flooding	9
7	Fast Installation	Products can be installed and used quickly	9
8	Fast shipping	Product modular configuration, easy to carry	9
9	Easy to operate	The product function partition is reasonable and clear, in line with the user's usage habits	9

10	Cheap price	Low production cost, suitable for mass production	9

4.2. Construction of a black box model for flood sandbags

By abstractly inputting the information, matter, and energy in the product function into the black box model, the primary and secondary functions in the product are quickly resolved and output to help designers understand the principles of the technical modules in the product function[11]. After summarizing the user requirement items according to the KJ method, the demand indicators such as sewage purification, safety protection, and fast transportation proposed by users are transformed into relevant technical issues in the product and input into the black box model. Finally, the main functions of the product the consumer desires are output with the help of three channels: information, energy, and matter, as shown in Figure 2.

Figure 2. Black box model

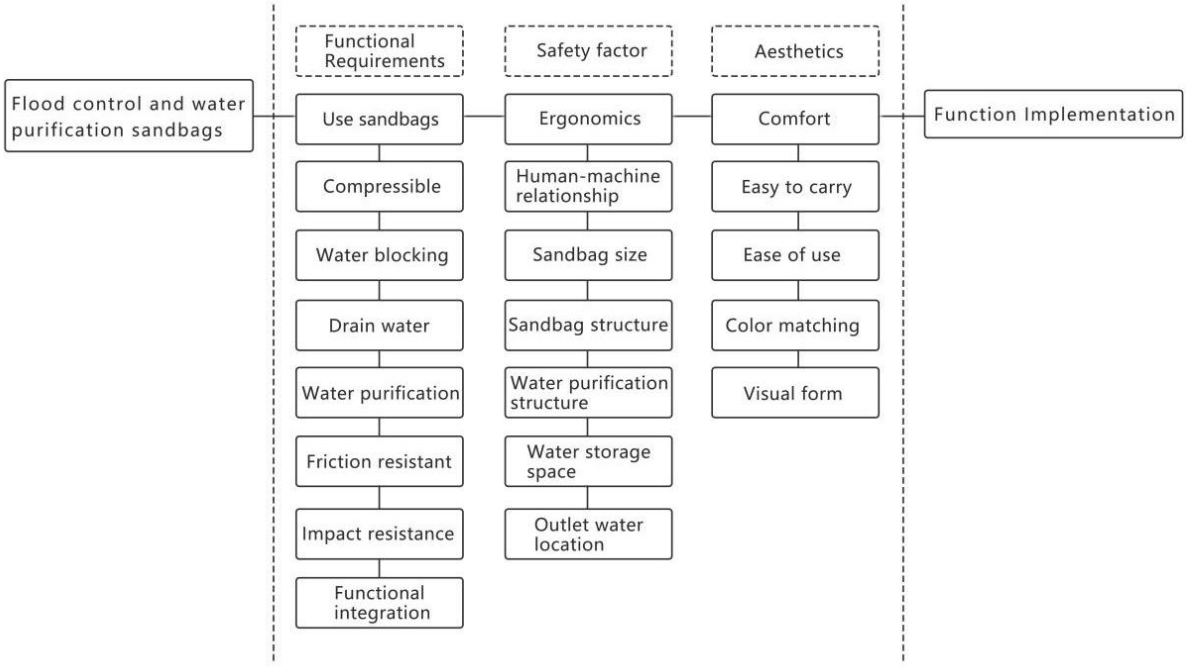


As shown in Figure 2, the model shows the functions that the user wants the flood control sandbag to have after input, transformation, and output. In the process of flood control, sandbags resisting flood impact and purification of sewage, friction, hand, and kinetic energy of water are needed to cooperate to achieve the purpose of using the product. According to the design output of functional information, fast installation, ergonomics, modular transportation, functional integration, purification of sewage, and environmental safety in the functional design of flood control sandbags should be considered.

4.3. Building a product function tree based on the FAST method

Through the functional construction method of the black box model, the output user-desired functional factors were summarized and analyzed to establish the purification of sewage, ergonomics, and functional integration as the key design elements of the flood control and water purification sandbag. The functional requirements of the sandbag were again refined to create a FAST functional tree of the flood control sandbag, as shown in Figure 3.

Figure 3. FAST function tree of flood control sandbags



The use of sandbags as the primary function of the product is placed in the first row of the first column of the function tree; because ergonomics is a secondary factor in ensuring the safe use of sandbags, it is placed in the first row of the second column; the aesthetics and comfort are included in the first row of the third column as a supplementary element of the subsequent product design. For the innovative design of flood control sandbags to meet its essential function of water retention and waterproofing, it must also provide sewage purification, modular transport, and other functional innovations. The ergonomic design needs to reasonably adjust the human scale corresponding to each component of the product to ensure the effectiveness and safety of the user's operation. The visual form of the update can actively guide the user's use of behavior, soothe their psychological pressure, and a reasonable combination of functions to maximize the effectiveness of the flood sandbags in emergency scenarios.

5. Scheme design

5.1. Establishment of product form matrix

Based on the FAST function tree established by the flood control sandbags, design innovations are developed around the functional integration and comfort of the product. Further, the primary and secondary functions, structures, and principles related to product development are combined and arranged to help designers obtain more levels of principle interpretation, generate diverse technical combination solutions, and select the best design solution on merit[12].

The morphological matrix provides a reference for the technical realization path for each function of the sandbag. Also, it allows the selection of different materials, functions, and man-machine approaches to meet

the user's needs for the product. Therefore, different functional implementation techniques are combined and matched, and the best product design solution is combined by screening multiple solutions according to the design objectives and needs. The morphological matrix of the flood control and water purification sandbags is shown in Table 2.

Table 2. Product Form Matrix

Sub-functions at all levels	Solution one	Solution two	Solution three
A. Water purification device	Activated carbon	PP cotton filter	Mixture
B. Absorbent material	High-density sponge	Mud and sand	Polymer absorbent material
C. Drainage water method	Evaporative drainage	Base Gravity Drain	Press to drain
D. Strapping method	X cross shape	Vertical symmetry	Well pattern
E. Wear-resistant method	Surface texture	Composite material	Wear-resistant coating
F. Buffer mode	Air sac	Protective cover	Buffer glue

According to the analysis of the functional and technical modules of the flood control and water purification sandbag products in the chart, the total number of product principle solutions from a theoretical perspective is listed as N=3×3×3×3×3×3=729.

Combination of functional principle solutions in the morphological matrix, in combination with the consideration of production costs, development cycle, processing technology, ease of maintenance, and other development needs, multi-angle multi-dimensional comparison of functional technology principle solutions, and finally selected by A3, B1, C3, D2, E1, F2 combination of design solutions.

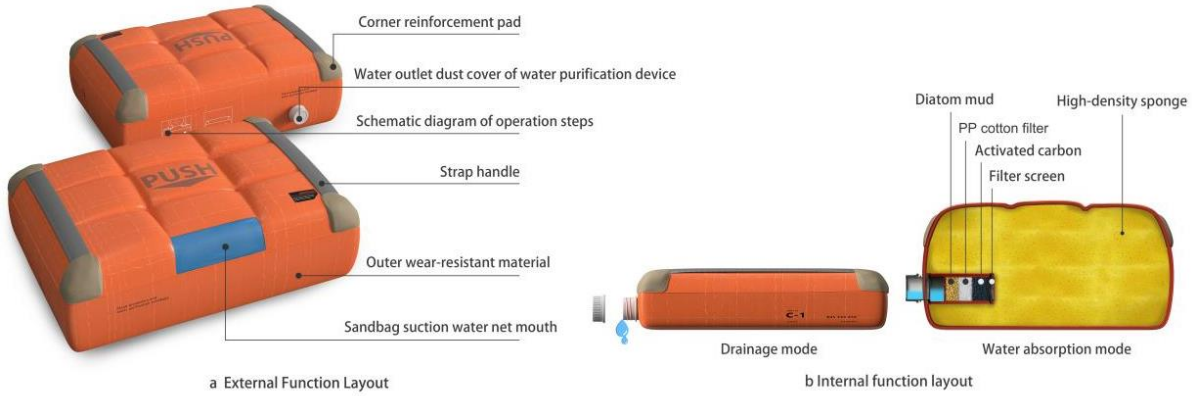
5.2. Modular design of flood sandbags

Modular design simplifies complex product components by breaking them down and reorganizing them after decomposing the system units to form subsystems that can be standardized and designed independently, characterized by versatility, independence, and interchangeability[13]. Flood disaster rescue is a complex system with high randomness and suddenness, which needs to be organized into systematic flood rescue products by disassembling and combining the functional modules of flood control products. A modular product function system can enhance versatility and quickly replace and repair damaged functional modules. However, according to the user's demand shift, design new module components to replace the old functional modules. Flood water purification sandbags utilize the concept of water purification, compression, and expansion of functional modules to achieve the sustainable design of the product and reduce its ecological footprint.

Guided by the product form matrix of flood control and water purification sandbags, the flood prevention products are broken down into three main modules: the universal module for the first module, including the sandbag straps, wear-resistant materials, protective cover, high-density water-absorbing sponge, the use of step-by-step guide chart and other essential modules to ensure the use of the basic functions of the sandbag. The second module is the water purification module, which mainly includes a water-absorbing mesh mouth, water purification mouth cover, water purification pipeline, diatomaceous earth, activated carbon, filters, and other related water purification modules to effectively protect the health of the purified water body, to provide

clean water supply for the disaster victims. The last module is the transport and storage module; the modular space layout sets two modes of water absorption and drainage for sandbags, effectively compressing the volume and weight of sandbags, which are easy to transport and store in urban space. The modular functional design makes it flexible and versatile, and the flexible, functional system can also provide better protection against flood safety. The functional layout of flood control and water purification sandbags is shown in Figure 4.

Figure 4. Functional layout of flood control and water purification sandbags



5.3. Ergonomics analysis

Ergonomics is applied to design the size, operating posture, and handling and installation of flood control sandbags, considering the affected people's psychological and physiological factors in the flood emergency rescue scenario. According to the ergonomics (GB/T 10000-1988) standard[14], flood control sandbags belong to type III product size design; that is, the average size product design, the use of the population is usually adult male, so the percentile of human body size selection formula for P50 male, the man-machine size involved in this product is calculated as follows.

Flood sandbags overall size analysis. The use of the crowd is usually bent over or squatting posture to pick up the sandbags. Therefore, in this paper, the human body squatting posture takes the relevant size data analysis by considering the amount of functional and psychological corrections to the operating space, following the best functional size of the product formula, that is, the human body size percentile + functional correction value + psychological correction value can be derived from the height of the flood sandbag range should be 180mm ~ 280mm. In addition, the human arm length is the calculation of the long range of the flood sandbag Factor. According to the workspace, seated human body size can be derived from the average upper limb of adult male work before the extension of P50 male upper limb work before the extension = 685mm, resulting in the length range of flood control sandbags should not exceed 685mm; otherwise, it will cause inconvenience to take the phenomenon occurs, affecting the efficiency of flood control emergency.

At the same time, according to the human body bending and squatting posture for product width analysis, adult male human standing shoulder width size as an essential reference basis for the width of the flood control sandbags can be derived from the width of the flood control sandbags should be between 375mm ~ 520mm, to ensure that users can more easily and effortlessly pick up the flood control sandbags.

5.3.1. The width and spacing of the strap carrying handle

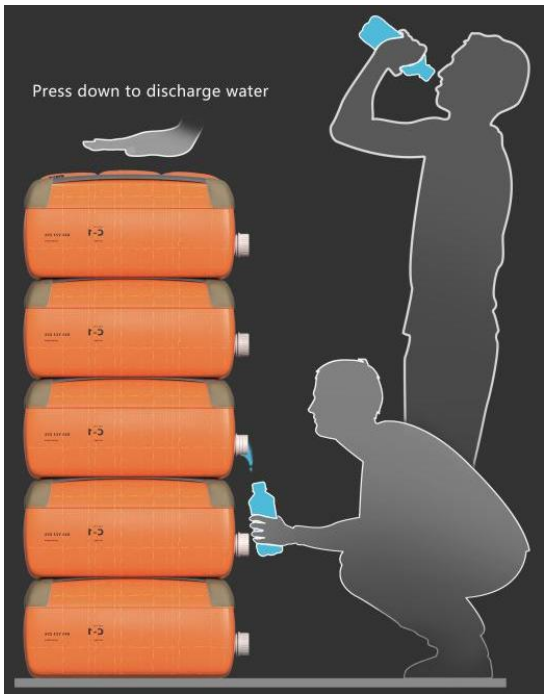
According to the ergonomics of the relevant hand ergonomics table and hand grip schematic diagram, we can learn that for adult men holding small products, grip diameter width is generally between 30 ~ and 50mm, resulting in a single strap width of the flood control sandbags should be about 40mm more appropriate to ensure the user's comfort and stability when holding and holding the sandbags. The flood sandbag strap design mainly provides the function of carrying sandbags. In this paper, the adult male human standing

shoulder width as an operating factor for calculation, that is, P50 male shoulder width = 375mm, by considering the normal area associated with the action of both hands in the operating space, by the formula for calculating the best functional size of the product, additional functional correction value and clothing shoulder width of a total of 100mm, the distance between the two straps of the flood sandbag width range should be 375mm ~ 506mm.

In summary, through ergonomics-related calculations, it is clear that the specific design dimensions of flood control sandbag products are as follows. Length: ≤ 685mm; Width: 375 mm~520 mm; Height: 180 mm~280 mm; Single strap width: 30~50mm, 40mm is the best; Double strap spacing: 375 mm~506 mm.

Sandbag size and related functional accessories refer to the standard human scale, not only to facilitate the user to quickly and effortlessly carry the sandbag but also to meet their standing and squatting to take the use of water needs. The water purification function follows the user's customary mode of operation, reducing its response time. The user presses the top of the sandbag with the help of body gravity in the most effortless way from top to bottom. The high-density sponge in the sandbag is pressed to squeeze out the sewage stored in it, which is transformed into the clean water the user needs through the water purification device in the outlet pipe, turning the sewage produced by the flood into treasure. To reduce the user's cognitive load, the sandbag each functional component through the color distinction to achieve the user's operational speed, flood water purification sandbag man-machine operation mode, as shown in Figure 5.

Figure 5. The man-machine operation mode of flood control and water purification sandbags



5.4. Color and material selection

The color of the emergency rescue products chooses simple and eye-catching color matching to remind users while providing the corresponding guidance function. Flood sandbags mainly use bright orange as the primary color; bright color is not only helpful for users to find sandbags in emergency scenarios quickly but can also convey warning information for users of flooding. The suction mouth grid using a blue color scheme represents clean water, giving psychological comfort to the affected people through visual communication. In the product selection, after a comparison test of 12 materials, the final choice was PVC, a textile fabric as the sandbag production material. Increasing the roughness of the PVC material surface texture enhances the abrasion resistance of the product surface, enhances the friction between the sandbags, and effectively resists the impact of the flood.

6. Flood control and water purification sandbag evaluation

6.1. Ergonomic evaluation

The ergonomics module of CATIA software is used to simulate the user's operating posture of sandbag handling and to analyze and evaluate the comfort of the user's posture. Firstly, it determined that the human body model of a Chinese man was selected as the simulated operation object, and the range of motion of each joint of the human body model was adjusted according to the definition of joint range of motion and the operation mode of the product. The range of motion of the relevant parts of the human body is divided into five levels: green for a comfortable setting of 90 points, yellow for a sub-comfortable setting of 80 points, and red for an uncomfortable setting of 60 points, as shown in Figure 6. After completing the activity angle setting of human body parts, the posture comfort evaluation data was generated; the higher the score indicates that the human body posture is more comfortable, as can be seen from Figure 7, the average comfort score of the corresponding parts of the human body is higher than 80, indicating that the user's joints are more comfortable in their activities. Then, the sandbag 3D model is imported to quickly analyze the safety risk coefficient of the upper limbs of the user during operation, and the final assessment level is 4. 3-4 points indicate that the product needs to be restudied and changed in that posture after a more extended period of use. As the sandbag is an emergency rescue product used for a short period, the user will not use it for a long time, so the upper limb is safer during operation, as shown in Figure 8. Comprehensive posture and upper limb operation risk assessment data indicate that the dimensions of the flood control and water purification sandbags meet the design requirements, and the user operating posture is comfortable with good man-machine performance and safety.

Figure 6. Diagram of the preferred angle of the arm area

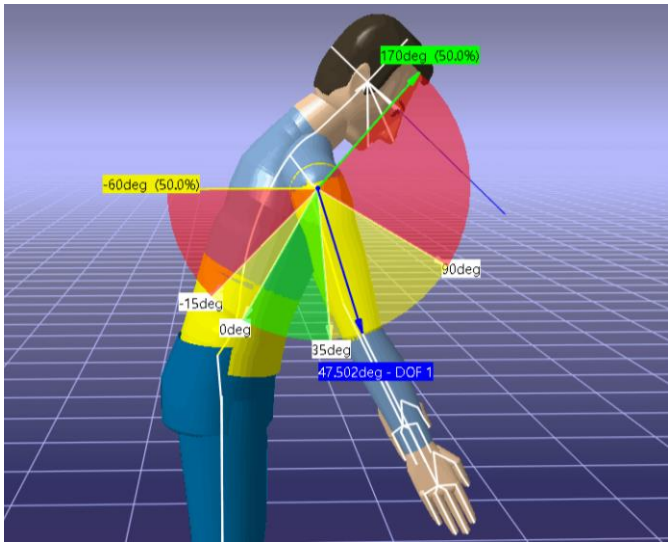


Figure 7. Posture comfort assessment score

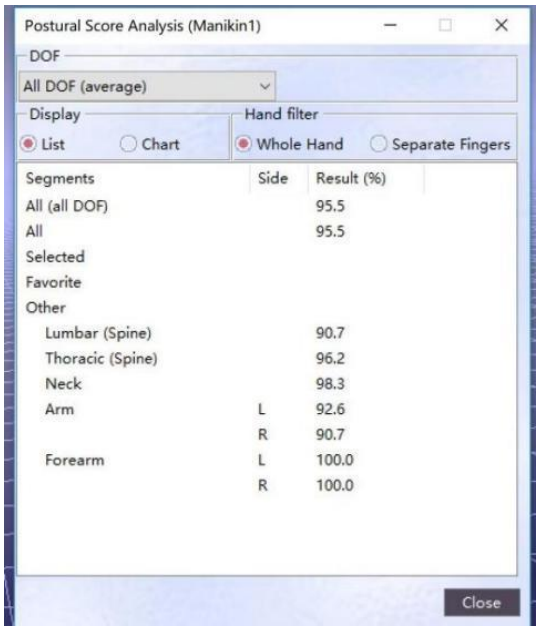
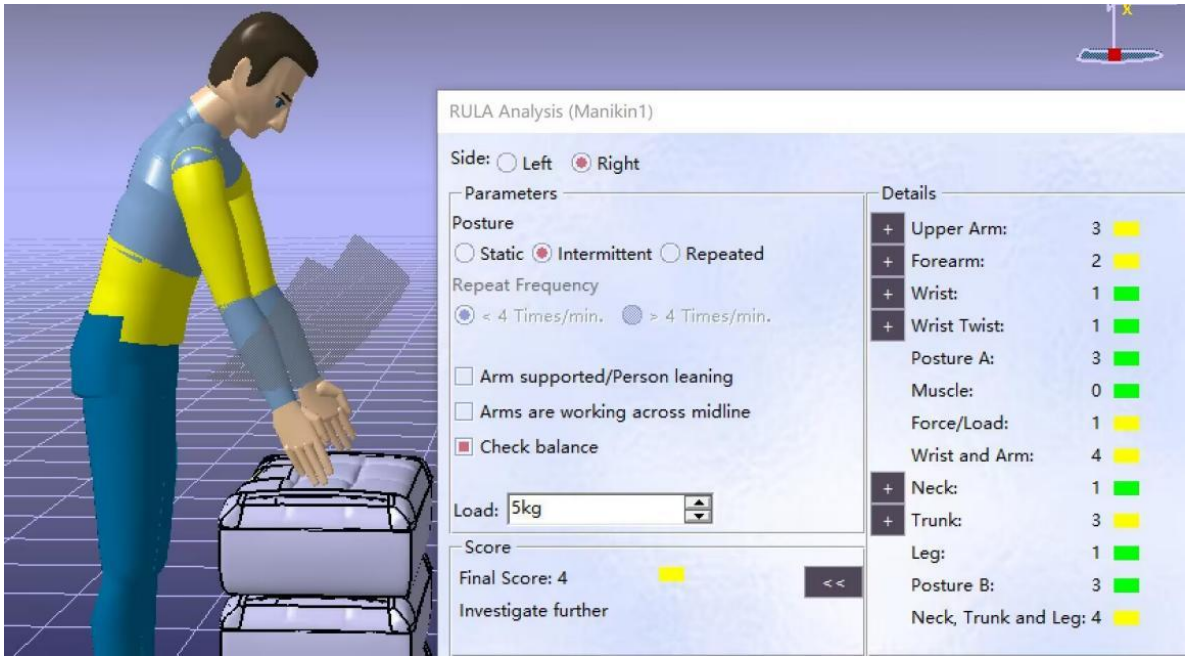


Figure 8. Fast analysis of user upper limb operation risk



6.2. Evaluation of flood control and water purification sandbag design

The updated product was tested and verified using the design walk-through method, and relevant designers, engineers, and firefighters were organized to evaluate the flood prevention and water purification sandbag product. The product was evaluated and scored according to a five-point system, and suggestions for product improvement were obtained through expert interviews to improve the relevant functions of the product further. From the perspective of the needs of the affected users, the five points of water purification efficiency, ergonomics, aesthetics and quality, functional innovation, and humanized design were used as design evaluation points, and the design evaluation of the product is shown in Table 3.

Design evaluation of the product, through the perspective of experts and designers, to quickly find the defects in product design; according to the results of the design evaluation, an iterative design of the water purification system was required to rearrange the holes in the intake piping and to realize the functional

requirements of the filtration system for rapid suction and discharge of water by designing new piping with internal and external double-walled pipes. Further improve the flood emergency products in this paper, to enhance their functional usability and maximize the satisfaction of user needs, the improved design of flood water purification sandbags, as shown in Figure 9.

Table 3. Product design evaluation

Evaluation result	Water purification efficiency	Ergonomics	Aesthetics and quality	Functional innovation	Humanized design
Designer A	4.5	4.8	4.8	4.9	4.7
Designer B	4.6	4.7	4.9	4.9	4.6
Firefighter C	4.5	4.8	4.8	4.9	4.8
Structural engineer D	4.7	4.8	4.8	4.7	4.7
Average value	4.6	4.8	4.8	4.9	4.7

Figure 9. Improved design of sandbags for flood control and water purification

7. Conclusion

The KJ/FAST/CATIA model can synthesize users' objective needs and designers' subjective initiative to ensure both the core requirements of the product and design innovation and establish a design creation model that unites the subject and the object. This design model can start from user needs, regrouping and integrating demand attributes according to the correlation between needs, and extracting the core elements that benefit product functional innovation. The designer can systematically probe the real needs of users, input the requirements into the FAST model to output the innovative functions of the product and its principle explanation, and establish mapping relationships with relevant design tools to improve the existing flood control sandbags and other problems of functionality and ergonomics. According to the hierarchical relationship between functions, different functional modules are combined, diverse design solutions are proposed, and the optimal functional solution is selected under the evaluation and analysis system. Through the modular design of the appearance and function of the flood control sandbags, it is verified that KJ/FAST/CATIA can provide new design ideas for flood control sandbags with a specific reference value. In the future design of emergency, rescue products need to think more deeply about users' emotional needs, highlighting the product's humanity and affinity.

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Research on the application of service design in the cultivation of rural environmental awareness: A case study of rural garbage disposal system in eastern coastal areas of China

Wenbo Wang[1], Hanxiao Mao[2]

[1] China Jiliang Universtity, Hangzhou, China wenbo88@163.com
[2] Se Zhejiang University of Science and Technology, Hangzhou, China
hanxiao.mao@network.rca.ac.uk

Abstract.
The cultivation of rural environmental awareness is extremely important for sustainable str ategy. Cultivating environmental protection thinking and consciousness can not only imple ment environmental protection measures better, but also be an important basis for realizing sustainable development. When environmental awareness is developing from bottom to top , villagers will be able to actively participate in the construction of environmental protectio n in the villages, thus achieving the goal of sustainable development in the future.
Service design is a relatively new design discipline, which meets the needs of technology a nd economic development in these years. Different from individual design, service design e xpand the category to social hirarchy, and provides full-cycle and full-coverage design strategies and contents for specific groups or communities.
Aiming at the public service system, the service design creates a human-centered service system by focusing on the connection between users and touchpoints in th e service, and at the same time potentially affects people's awareness, consciousness, and b ehaviors.
The research on the cultivation of environmental awareness from the perspective of service design intervention can enter into the system process from different roles, and evaluate the effect of each touchpoint in the process on the cultivation of environmental awareness mor e accurately and effectively.

1. Introduction

With the increasingly severe environmental problems, the sustainable development of human society is seriously threatened. The solution to environmental problems can not only rely on technology, it is more important to deal with the events related to people(Otto, et al., 2019).

The cultivation of rural environmental awareness is crucial to the strategy of sustainable development. Environmental awareness can not only significantly promote environmental behavior, but also help to enhance environmental behavior(Du and Zhang, 2019; Gun, Yuenan, et al., 2018). Training environmental protection thinking and awareness can not only better implement environmental protection measures, but also is an important basis for sustainable development (Rauwald, Kimberly S., and Colleen F. , 2002; Sharpe, Elliot J., et al. , 2021). When villagers have a higher awareness of environmental protection, they can establish a better sense of identity and harmonious cooperative relationship among individuals, society and the environment, so as to actively participate in the process of environmental protection of the village and achieve the goal of sustainable development in the future.

Service design is a relatively new design subject in recent years to adapt to the needs of technology and economic development. Unlike product design, service design extends its scope to the social level, considering human well-being, sustainability and limited resources (Zomerdijk, Leonieke G., and Christopher A. Voss, 2010), and provides design strategies and content for specific groups or communities throughout the lifecycle. In addition, service design focuses on service quality and user experience, providing new development opportunities in many fields, so as to achieve development and innovation in various industries (Zhou, 2019). As an important part of service design, touch point builds a people-oriented service

system by focusing on the connection between users and touch points in the service, and at the same time subtly affects people's cognition, consciousness and behavior.

As a developing country in China, the problem of garbage classification has become increasingly prominent with the rapid economic growth. With the revitalization of the countryside, the urbanization of villagers' lifestyle and diversification of the consumption structure, the domestic garbage generated in the village is also increasing and become more complicated (Jia, Y-juan, et al, 2019). Chinese villagers produce 0.8 kg of garbage every day, and more than 0.7 tons of garbage can not be disposed of in a year (Yi, 2019), which causes pollution to the natural environment(Peng, Zhaodi, et al., 2016), and also threaten to the safety and health of villagers. Garbage, has caused serious damage to the ecology of the countryside. In recent years, in order to speed up the evolution of construction in rural areas, Chinese government has put forward higher goals for the villagers' living environment. In 2016, the Chinese government issued the *No. 1 Central Policy* document requiring all rural areas to conduct garbage sorting policies to promote people's garbage sorting. In addition, in 2017, 2018, and 2020(Wu, 2018), several rural garbage management policies have been released for villagers. The regulations were more detailed and more restrict. As a result, the garbage disposal service system in village was developed and revoluted rapidly, and the villagers' garbage classification behavior has been rapidly cultivated. Because of that, the big change challenges the villagers' environmental awareness. In order to realizing the sustainable development, villlagers' environmental awareness should be stressed, Therefore, exploring the impact of the reform of rural garbage classification service system on villagers' environmental awareness will help promote sustainable development.

China's eastern coastal area is one of the three economically developed deltas in China, and it is the earliest area for garbage sorting and recycling in China. The characteristics of the area are: large population density, small gap between urban and rural construction, strong environmental awareness, and the country's first rural waste treatment system reform pilot area. Therefore, the research on the rural waste treatment system in the eastern coastal areas of China has positive practical reference value for the vast underdeveloped areas in the central and western parts of China and even some developing countries in Southeast Asia.

This study attempts to explore: Can people-centered service design improve villagers' environmental awareness? Specifically, what processes or touch points can positively influence environmental awareness?

This paper will promote the research in the following ways:

First of all, this study will use a preliminary research analysis to compare the three-stage development of garbage sorting service from stakeholders, service blueprint and touch points, which are three key elements of service design. This will determine the basic content scope for subsequent research.

Then, with reference to the existing environmental awareness measurement scales, and combined with the village's garbage disposal service system, the dimension of assessing villagers' environmental awareness could be established. In addition, based on the research, we listed the specific corresponding ways in which each touch points in the three stages of the service process in the village affected cognition, attitude and action.

Third, based on the above three dimensions, we will investigate the environmental awareness of villagers in different stages of the garbage classification service system. In addition, we will also explore the change of environmental awareness and its influencing factors; At the same time, combined with the previous service design research and comparison of the impact of each contact point in the three-stage service process on the cultivation of environmental awareness, this study will conduct an overall descriptive analysis on the basis of questionnaire survey and semi-structured interview.

Finally, from the perspective of service design touchpoints, combined with questionnaire data and interview content, we will explore the interrelationship between awareness training and various touchpoints in the garbage sorting process. At the same time, by in-depth analysis of the contact points and the factors that affect residents' environmental awareness, we will summarize the contact design that helps villagers

form environmental factors in the service design, and put forward the optimization strategy and opinions of the village garbage classification service.

By exploring the impact of contact points in service design on the cultivation of environmental awareness and explaining their internal connections, a comprehensive perspective is provided for sustainable implementation: For service designers, this study provides a way to assess service design, which will help designers to better design public service system; For environmental policy makers, the change of villagers' behavior should not only be mandatory in policy, but also should be considered people-centered, and any policy formulation should be deeply understood.

2. Literature Reviews

2.1 Environmental awarenedd

2.1.1 Environmental awareness research

Environmental awareness is defined as "the degree to which people are aware of and support solutions to ecological and environmental problems or are willing to contribute to the solution of such problems" (FRANSSON, NIKLAS, and TOMMY GÄRLING,1999). Chinese scholar Yu proposed that environmental consciousness is the synthesis of social thought, theory, emotion, intuition and other ideological forms reflected in the relationship between human and natural environment (Yu, 1995). Wang believes that environmental awareness is a comprehensive concept, including the epistemological level, the ethical and moral level, the code of conduct, the policy and legal level and the behavioral strategy level (Wang, 2002).

2.1.2 Environmental awareness measurement

There has been no official measurement of environmental awareness. At present, scholars from all walks of life measure the degree of personal concern and attitude towards environmental issues through various environmental concern scales. Through the Environmental Concern Scale, researchers can understand individuals' cognitive and emotional responses to environmental issues, as well as their level of support and involvement in environmental protection and sustainable development. The Environmental Concern scale usually contains a series of statements or questions related to the environment, and the individual is asked to answer their level of agreement with these statements or their response to the question. These responses can be presented in the form of scores or grades for researchers to analyze and compare. We looked at the various scales and summarized the 4 most common scales:

Scale name	Introduction
New Ecological Paradigm Scale (NEP)	This scale was developed by Dunlap and Liere in 1978 and consists of 15 items that measure individuals' attitudes and beliefs towards the relationship between humans and the environment. The NEP scale has high reliability and validity, and is widely used.
Environmental Concern Scale (ECS)	Developed by Porter and Savory in 1997, this scale consists of 14 items that assess individuals' level of environmental concern and attitudes. The ECS scale has high reliability and validity, and is widely used.
Environmental Value Orientation Scale (ECOS)	This scale was developed by Krupnick in 1995 and consists of 36 items that measure individuals' environmental values and beliefs. The ECOS scale has high reliability and validity, and is widely used.
Ecological Behavior Scale (EBS)	Developed by Ward and Baade in 2001, this scale includes 15 items that assess individuals' environmental behavior and attitudes. The EBS scale has high reliability and validity, and is widely used.

Table 1. Four common environmental awareness scales

2.1.3Environmental awareness research in China

In terms of the research on the environmental awareness of urban and rural residents, Ouyang Bin analyzed the official data of urban residents in the 2010 China General Social Survey (CGSS) and found that: In the measurement of environmental awareness and environmental protection behavior of urban and rural residents in China, there is a significant positive relationship between residents' income level, environmental knowledge, environmental status and other factors and environmental protection behavior, while education level and political identity have no significant impact on environmental protection behavior (Ouyang, 2015). Therefore, to improve the environmental awareness of urban residents, we should pay more attention to the income of residents, environmental knowledge and environmental education. Urban high income earners have higher environmental awareness, but the effect of regions is opposite. Residents in the east pay more attention to living environment, while residents in the west pay more attention to the natural environment (Qiu, 2023).

In general, there are few studies on environmental awareness in developing countries, and most studies focus on the link between environmental protection and specific social attributes, such as region, education level, income, and so on, with little reference to improving public services and design. However, the shaping of environmental awareness is directly related to the participation of citizens in environmental action, and the design of public services related to environmental protection is to get people to participate in environmental action. Therefore, there is an urgent need to conduct empirical studies on the impact of environmental awareness in the design of environmental public services in developing countries.

2.2 Service System

2.2.1Rural garbage disposal system under service design

In 1982, G.Ynn Shostack, an American financier, proposed the theory of "service design", which believed that service design was a design combining tangible media and intangible services (G.Ynn Shostack, 1982). His research was not only limited to the business fields related to economy, but also extended to the public service fields such as medical treatment. Rural garbage classification belongs to the field of public service, with strong service, it pays attention to the interaction between multiple subjects, emphasizes the construction of service environment, and creates a sustainable garbage classification process through the interaction between multi-dimensional contact points and subjects. Service design is a kind of integration of multidisciplinary design thinking and methods (Chen, 2016), adhere to the principle of people-oriented (Luo, 2018), and use the method of user participation to analyze the service system.

2.2.2 Service Contact Theory

Xin and Wang, further proposed that service touch points are the constituent elements of the service interface where interaction between users and other stakeholders occurs in the service process (Xin, 2018), focusing on the analysis of the needs among stakeholders in the service system, so as to optimise the service process, and that the innovative design of the service touch points is the best innovation for the study of the dynamic interaction points between the users and the service system, and is the connection between the user's behaviour and the optimisation of the service process of the "critical moment".The service link refers to the key stage of service experience, which is triggered by multiple service touch points, forming a "service chain". Multiple "service chains" can build an integrated service system.

2.2.3Integrated design with multiple contacts

According to the garbage disposal process can be divided into classification, transportation, treatment, recycling four processes, the design of the contact includes classification garbage bin, classification garbage truck, collecting point and publicity. The user is in many scenarios, and the interaction touch points are complex. Service design can use the user journey map to clearly express the user's feelings and needs at each touch point, visualize invisible services, predict the relevant factors affecting the user experience at different contact points, and construct a complete and orderly garbage classification path for users through the integration of multi-contact points (Xin, 2018), so that garbage classification is more efficient and sustainable.

2.2.4 Environmental awareness in the garbage classification service design

At present, in the garbage classification service design, designers have begun to pay attention to the importance of enhancing environmental awareness in the service, so that users can more actively participate in environmental protection actions. XU,Zhang and Wang successively designed the online recycling service platform for Chinese universities, aiming to enhance the environmental awareness of college students by allowing them to feel the value of domestic waste and paper resources, so as to participate more actively in garbage sorting activities (Xu, 2014; Zhang 2020). In addition, Zhou and Zhu found that the original garbage classification could not clearly convey garbage classification information when designing a garbage classification and recycling service for a community in Wuhan, so they proposed classification guidance strategies, touch point coordination strategies and classification incentive strategies that were consistent with users' cognitive behaviors, so as to arouse users' participation enthusiasm in garbage classification at the source.

In short, the current service design of garbage sorting is oriented to the execution result of garbage sorting. They usually only conduct research and evaluation on the field garbage classification service system in the early stage of research, but seldom pay attention to the cultivation of users' environmental awareness, and no research focuses on the relationship between service design contact points and the shaping of environmental awareness. However, the participation of service design in the public service system should not only be to respond to the policy and implement garbage classification, but also to enhance the environmental awareness of users. Therefore, there is an urgent need to investigate the impact of the new garbage classification public service design on environmental awareness in order to: first, collect information and feedback, second, prove the effectiveness of garbage classification public service design, third, people-oriented, better garbage classification, improve environmental awareness, and achieve sustainability.

3. Methodology

This paper adopts a combination of qualitative research and quantitative research to investigate the change of environmental awareness of villagers in the three-stage garbage classification. The qualitative research is the main research, the quantitative research is the auxiliary research, and the literature research, questionnaire survey and interview are supplemented.

The case study in this paper is Huajia village, which is located in the east of Linpu Town, Xiaoshan District, Hangzhou City, Zhejiang Province, and is located in the central area of eastern coastal areas of China. It consists of two villages, Dahuajia and XiaoHuajia. The total area is 1.214 square kilometers and the total

population is 1760 people. In addition, Huajia Village is a village with a long history and rich cultural heritage. It is located in the east side of Linpu town, pleasant climate, convenient transportation, abundant agricultural resources, many enterprise units, is a suitable place for living and development.

The project started in October 2022, and as of now (end of June 2023), the project research is still continuing. During the project study, the project team visited huajia village for several times for investigation. Among them, in October 2022, the preliminary research on the rural waste classification system was carried out; Questionnaire survey and interview were conducted in February 2023. More in-depth interviews and communications were conducted with April 2023.

From the perspective of service design, with the help of service contact theory and reference environmental concern scale, this paper takes huajia village as an example to study the relationship between rural garbage classification and recycling system in eastern coastal areas of China and the shaping of villagers' environmental awareness.

(1) Literature research method

The method of literature research is to collect, distinguish and sort out the literature, and to know the facts scientifically through literature research. In this study, it is necessary to consult the relevant literature on the garbage classification service system in the region where the case is located, the relevant literature on the contact theory of service design, the relevant literature on environmental protection awareness, etc., and deeply learn the relevant knowledge.

(2) Systematic research method

The systematic research method takes the research target as a system and coordinates various internal factors that influence each other to produce an integrated effect (Zhu, 2020). This research mainly applies visualization tools such as stakeholder map, service contact model and service blueprint reasonably to the whole process of theoretical and practical research.

(3) Investigation and research method

The survey and research methods adopted in this paper are mainly through questionnaires and interviews, to investigate and study the impact of rural garbage classification and recycling system on rural residents' garbage classification from three perspectives: cognition, attitude and behavior, and to explore the impact between service contact points at different levels and various stakeholders.

By combing service design and service contact theory, this study will summarize and analyze the service blueprint, contact points and the constituent elements of the stakeholder map of the garbage sorting service in different stages of the village. Then, by referring to the existing environmental concern scale, the dimensions of consciousness measurement suitable for this study are summarized. Then, combined with dimension and touch points analysis, relevant questionnaire survey could be designed to measure the service touch points quality of different garbage classification systems, analyze the impact of service touch points on users, and explore the relationship between rural garbage disposal systems in eastern coastal areas of China and the cultivation of villagers' environmental awareness.

Because the study covered various areas of research on the links between environmental awareness, behaviour and service design touchpoints, it had to refer to key literature in each area. In addition, due to the technical limitations of rural information, many data cannot be obtained from many original sources and need to rely on participants' oral and recall. Despite these limitations, this study aims to demonstrate that a number of service design processes and touchpoints are directly or indirectly related to environmental awareness.

4. Results and Discussion (11pt Times New Roman)

4.1 Preliminary field research and analysis of three-stage garbage classification

This project will analyze the preliminary field research of three stages of garbage classification from four perspectives: basic investigation of garbage classification comparison, garbage classification process,

stakeholders, and service contacts. The result of analysis is mainly qualitative description. The preliminary field research mainly adopts the following steps: observation, participation and listening.

Through preliminary investigation, we learned that due to government policies and technological development and other reasons, the village garbage classification service system in huajia village has experienced two significant reforms in recent years. In this project, we will study the three versions before and after the two updates. The first stage is centered on the village garbage collecting point, and the start time of this stage is difficult to verify. The second phase began in June 2018. This stage revolves around the household sorting trash bin, which would be collected by the sorter at the door. The third version begins in August 2021. rewarded credits system was added to the public service system, and the relationships between the various stakeholders in the system were rewritten.

Figure 1. An overview of the garbage disposal service system in Huajia village from 2018 to 2023

4.1.1. Service blueprint and touch points

A service blueprint is a picture or map that describes the service system and process in detail. Service blueprint helps service enterprises to understand the nature of service process, control and evaluate service quality and manage customer experience reasonably. Design thinking considers three broad categories of touchpoints in services: physical, digital, and human touchpoints(Santos, Susana, and Helena Martins Gonçalves, 2022). They all play an important role in the service process and are an important indicator of service experience (Parikh, R. M., and S. Shrivastav, 2022). Through the process and contact analysis of different stages of garbage disposal service design, the service blueprint of different stages of garbage disposal system is summarized to help the project analyze the service process of each stage from the perspective of service thinking.

In the field investigation of garbage disposal in the village, this study focused on observing the rural residential areas, garbage collecting point, village committee offices, public activity area and other public areas, and took preliminary communication with the villagers. The results showed that compared with the old garbage sorting method, villagers were generally satisfied with the new garbage sorting method and process.

Figure 2. Garbage disposal flowchart in Version 3.0

The current garbage disposal service system version3.0 was implemented two years ago. The rewarded credits system is simple - each household uses a physical card to score points. If the villagers sort their garbage correctly, they will earn points that can then be redeemed for essential goods such as rice and oil at regular events organized by the village committee. Therefore, although the service system also causes some inconveniences, for example, because the garbage needs to be collected by a sorter at a fixed time, if the villagers have to go out, they need to adjust the garbage collection time or wait for the fixed time of the next day, and the way to adjust the time needs to be by telephone. However, under the rewarded point system, the villagers are generally more motivated, which could lead villagers classified garbage in an orderly manner.

(1) Rural garbage disposal service system version 1.0 service blueprint

The garbage disposal service system can be divided into four stages: Earliar Stage: Training, Before garbage classification, In garbage classification, and After garbage classification. In Version 1.0, the village garbage collection point is the center of the system.

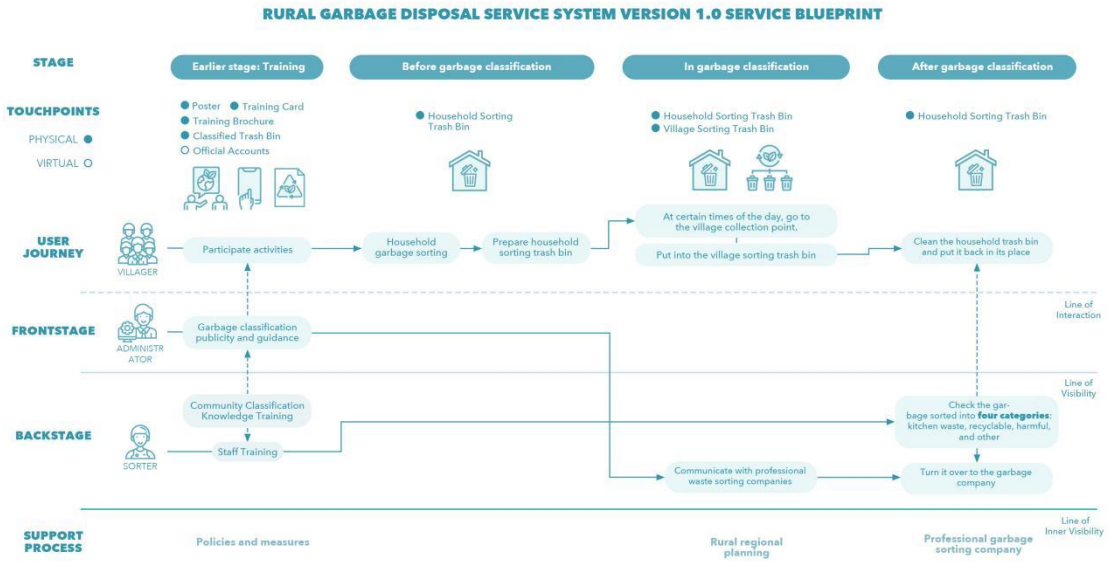

Figure 3. Rural garbage disposal service system version 1.0 service blueprint

(2) Rural garbage disposal service system version 2.0 service blueprint

In Version 2.0, the door-to-door collecting service is added to the system. The service design is guided by design thinking. After receiving the household sorting bin, villagers can sort their rubbish in two categories at home. The sorters will collect garbage from house to house in the village at fixed times of the day, driving garbage trucks playing specific music.

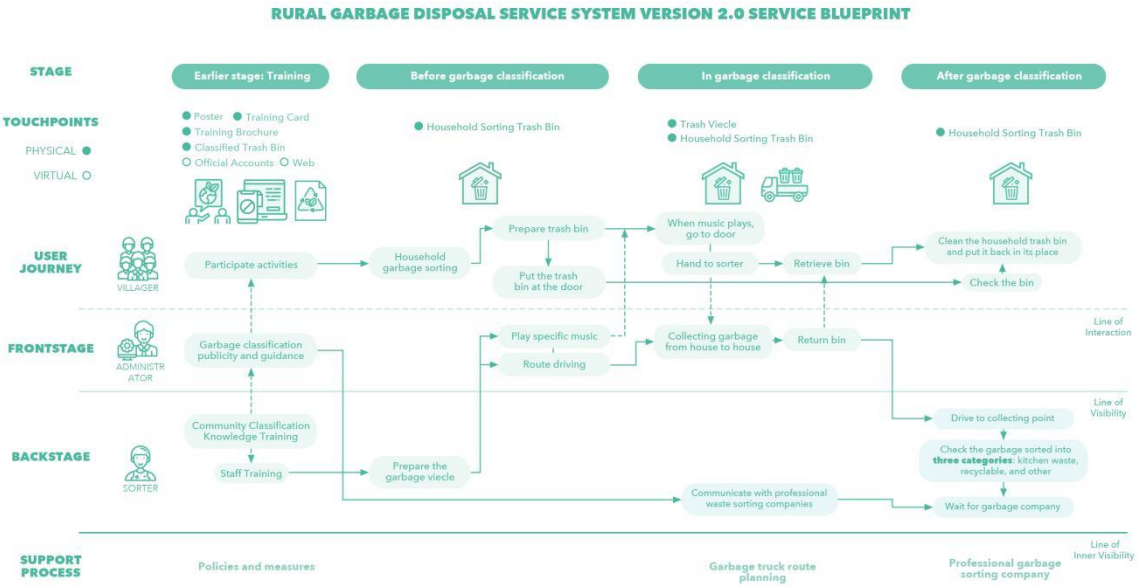

Figure 4. Rural garbage disposal service system version 2.0 service blueprint

(3) Rural garbage disposal service system version 3.0 service blueprint

In the third version, the rewarded points system is added to the garbage service system. In addition, the early propaganda methods adopted more propaganda methods, which can help villagers have a more comprehensive and profound understanding.

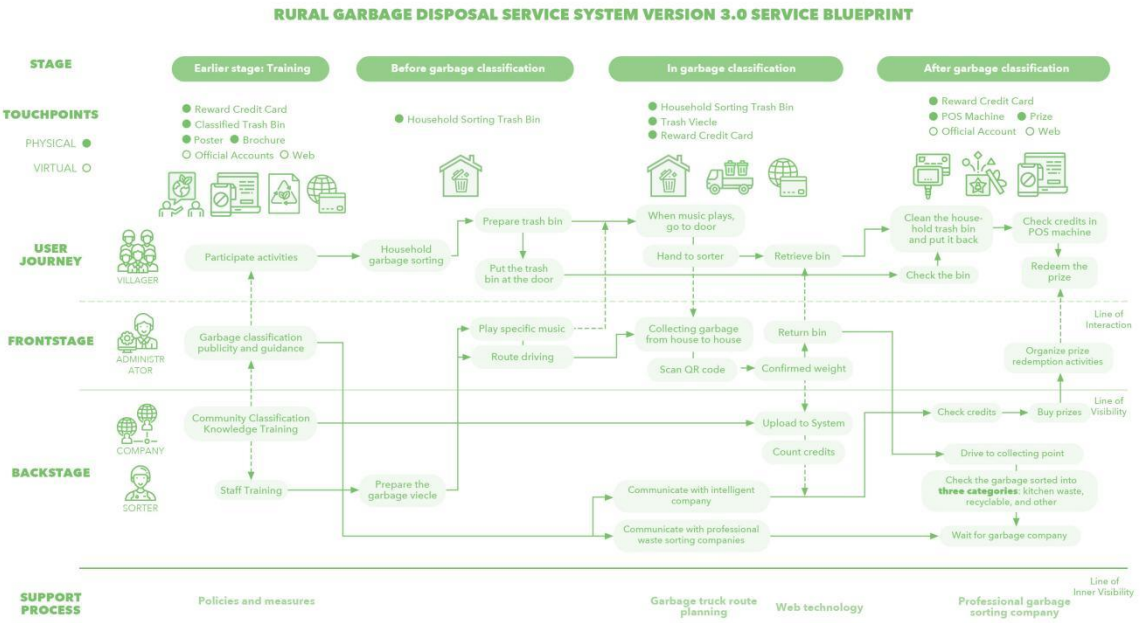

Figure 5. Rural garbage disposal service system version 3.0 service blueprint

4.1.2 Stakeholder analysis

In the village's garbage disposal service system version 1.0 and 2.0, stakeholders are divided into four groups: service recipients (villagers), service providers (sorter and waste disposal company), and organizers (village committee managers). Villagers and sorter are the main participants, who are the core stakeholders with closed connection and interactions.

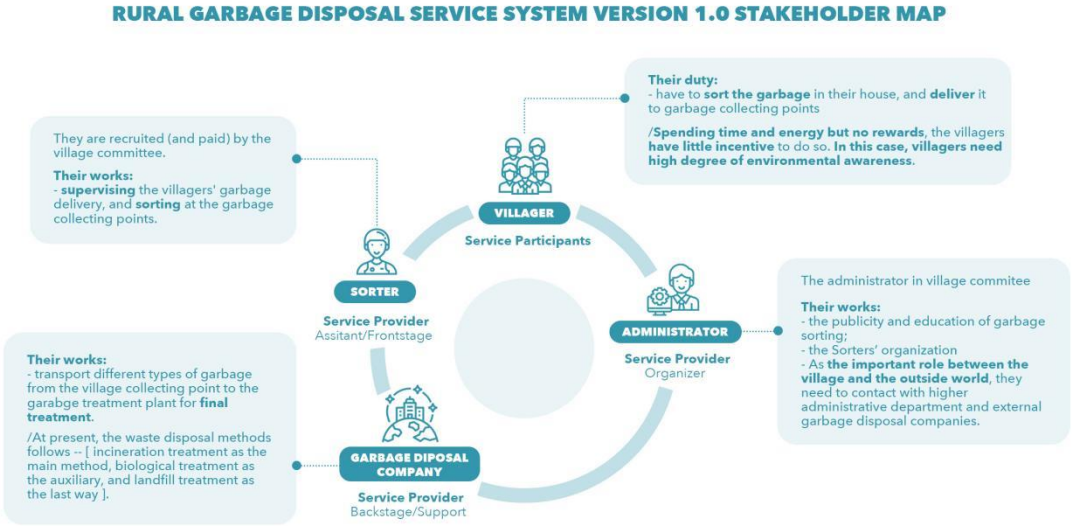

Figure 6. Rural garbage disposal service system version 1.0 stakeholder map

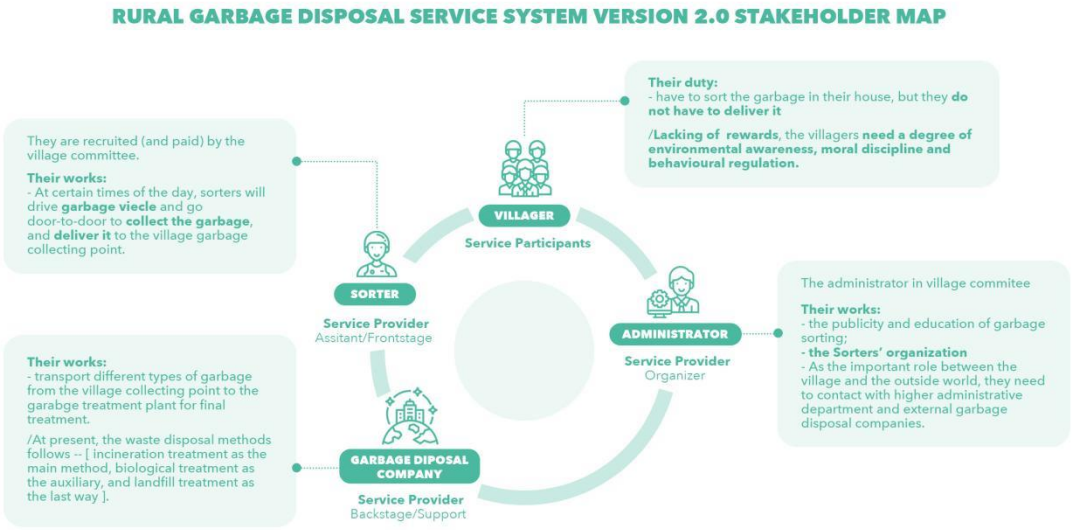

Figure 7. Rural garbage disposal service system version 2.0 stakeholder map

In the village's garbage disposal service system version 3.0 stakeholder map, stakeholders are divided into five parties: service recipients (villagers), service providers (recyclers, garbage sorting companies and intelligent service companies) and organizers (village committee managers). The corresponding responsibilities are shown in the figure. They all go through the corresponding service process.

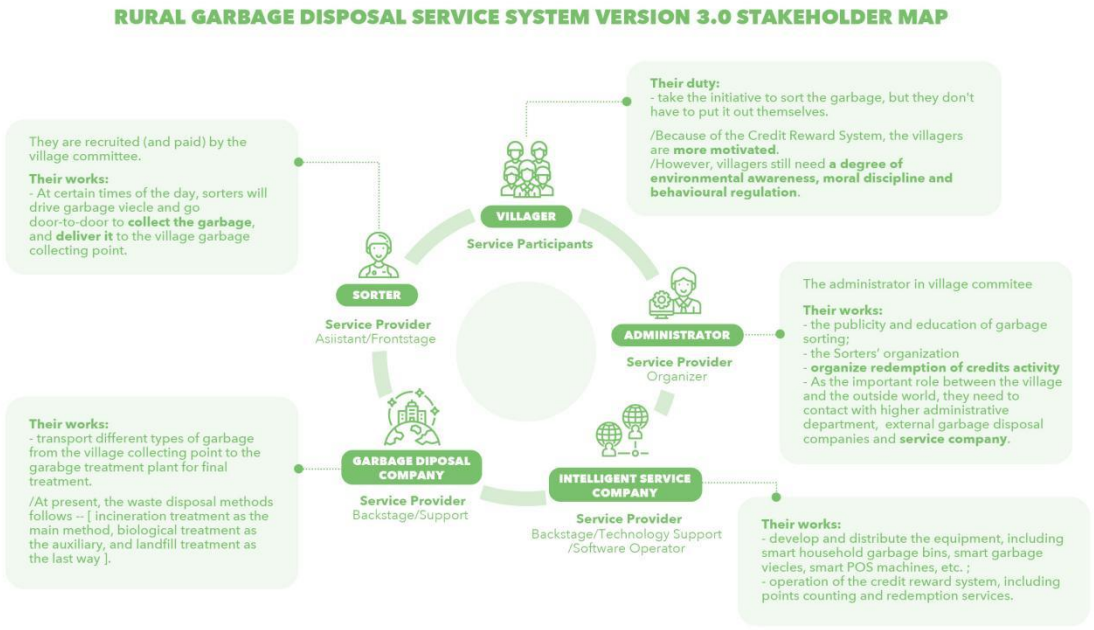

Figure 8. Rural garbage disposal service system version 2.0 stakeholder map

In the village's garbage disposal service system version 3.0 stakeholder map, stakeholders are divided into five parties: service recipients (villagers), service providers (recyclers, garbage sorting companies and intelligent service companies) and organizers (village committee managers). The corresponding responsibilities are shown in the figure. They all go through the corresponding service process.

4.2 Measurement of environmental awareness and questionnaire

There has been no accurate measurement of environmental awareness. The scale of environmental concern has its unique characteristics and scope of application, so it is necessary to choose the appropriate scale according to the specific situation. In addition, different scales may be applicable to different populations or study subjects, such as age, gender, occupation and other factors may have an impact on the degree of environmental concern. Therefore, the characteristics and needs of the research objects should be fully considered when using the environmental concern scale, and the appropriate scale should be selected for measurement. By investigating various environmental concern scales, we find that most of them are not suitable for our research.

First, the extent of environmental awareness measurement is broad. The existing environmental concern scale or environmental awareness questionnaire has a wide range of contents, involves a wide range of questions, and is not targeted. While our research focuses on waste classification, the measurement of environmental awareness should be centered on waste classification and extended to other environmental-related topics and actions.

Second, the general dimensions of environmental awareness could be concluded. As our research focuses on the changes that a new garbage sorting service system will bring to people's environmental awareness, its impact is more focused on the changes in people's thoughts and attitudes in the garbage sorting scene, and whether the new service is effective. In addition, combined with the main core of the environmental concern scale, we choose three dimensions of "cognition", "attitude" and "behavior" as the measurement standards to measure people. The relationship between the three is not only mutual influence and progress, but also independent. For example, under the strict environmental classification policy, people may also realize the garbage classification behavior in the shallow cognition and negative attitude to garbage classification.

Further, the dimension should be linked to the service design. According to the previous research on the three-version garbage disposal service system, the functions of the garbage include service system include publicity, staff guidance, various touch points, etc. Based on the previous exploration and combined with the garbage sorting process and information of the village, the questionnaire was designed for the villagers from three dimensions of cognition, attitude and behavior in 5 degree. The questionnaire for village is as follows:

Environmental awareness scale for service design of rural waste disposal system

Scale	Question				Evaluation criteria
	Earlier Stage: Training	Before Garbage Classification	In Garbage Classification	After Garbage Classification	
Cognition	1. Do you know the categories of garbage sorting?	1. Can you identify the categories of garbage?	1. Can you identify the music from garbage viecle?	1. Do you know where the garbage goes?	
	2. Do you understand the purpose of garbage sorting?	2. Can you identify the categories of trash bins?	2. Do you know what is next step when the sorter arrives?	2. Do you know garbage's final treatment?	
	3. Do you know what kind of effect garbage classification has on environmental protection?	3. Do you know when the sorters will come to collect the garbage?	3. Do you know how to use the village trash can?	3. Do you know where you can check the credits?	
	4. Do you know where to get household trash bins and rewards credit card?		4. Do you know how the points are counted?	4. Do you know how to redeem credits for prizes?	
Attitude	1. Are you willing to actively understand and learn the knowledge of garbage classification?	1. Do you find it troublesome when sorting garbage?	1. Are you willing to take the initiative to cooperate with the garbage collector?	1. Do you care about your credits?	1 2 3 4 5
	2. Are you willing to take the initiative to learn about environmental protection and sustainable development?	2. Do you feel disgust and revulsion at incorrect classification?	2. Are you willing to take the initiative to help other villagers with garbage recycling?	2. How motivated are you to redeem prizes?	
	3. Are you willing to take the initiative to publicize the knowledge of garbage classification to your friends	3. Does door-to-door collecting make you feel a lot more convenient than going to the garbage		3. Does the redeemed prize meet your needs?	
	4. After having Credit Reward System, are you more willing to take the initiative to learn and share?	4. After having Credit Reward System, are you more willing to take the initiative to sort garbage?		4. Are you more satisfied with the current garbage disposal service	
Behavior	1. Do you usually take the initiative to participate in the publicity and training activities of garbage	1. Do you usually sort garbage according to the sorting requirements?	1. Can you deliver the garbage to the sorter on time?	1. How often do you check credits?	
	2. Do you usually help promote such activities?	2. Do you usually guide and ask your family members to sort garbage?	2. After having Credit Reward System, will you be able to recycle on time every day?	2. How often do you redeem prizes?	
		3. Will you take the initiative to guide others when they do not classify garbage correctly?	3. How often do you complete garbage collection now?	3. What kind of prizes do you usually redeem?	
		4. After having Credit Reward System, have you improved your requirements for garbage sorting??			

Table 2. Environmental awareness scale for service design of rural waste disposal system

This survey focuses on the villagers of Huajia Village as the research participants. The data collection is conducted through offline distribution of paper questionnaires. A total of 105 questionnaires were distributed, with 75 questionnaires returned and 70 valid questionnaires after screening. Among them, there are 30 male

participants and 40 female participants, all of whom are villagers of Huajia Village. The questionnaire has a wide coverage, a balanced gender ratio, and high reliability.

The collected questionnaire data are as follows:

Environmental awareness scale for service design of rural waste disposal system

Scale	Stage	NO.	Content		Answer (70people)					Data
			Question	Choice (negetive-positive)	-2	-1	0	1	2	Average
Cognition	Earlier Stage: Training	C-1	Do you know the categories of garbage sorting?	Totally NO --- Very Well	1	13	25	27	4	0.29
		C-2	Do you understand the purpose of garbage sorting?	Totally NO --- Very Well	5	21	32	12	0	-0.27
		C-3	Do you know what kind of effect garbage classification has on environmental protection?	Totally NO --- Very Well	16	21	24	9	0	-0.63
		C-4	Do you know where to get household trash bins and rewards credit card?	Totally NO --- Very Well	4	8	15	29	14	0.59
	Before Garbage Classification	C-5	Can you identify the categories of garbage?	Totally NO --- Very Well	2	11	21	24	12	0.47
		C-6	Can you identify the categories of trash bins?	Totally NO --- Very Well	0	4	12	28	26	1.09
		C-7	Do you know when the sorters will come to collect the garbage?	Totally NO --- Very Well	2	7	18	25	18	0.71
	In Garbage Classification	C-8	Can you identify the music from garbage viecle?	Totally NO --- Very Well	0	1	10	27	32	1.29
		C-9	Do you know what is next step when the sorter arrives?	Totally NO --- Very Well	1	5	13	34	17	0.87
		C-10	Do you know how to use the village trash can?	Totally NO --- Very Well	0	6	10	35	19	0.96
		C-11	Do you know how the points are counted?	Totally NO --- Very Well	8	10	11	25	16	0.44
	After Garbage Classification	C-12	Do you know where the garbage goes?	Totally NO --- Very Well	5	23	22	18	2	-0.16
		C-13	Do you know garbage's final treatment?	Totally NO --- Very Well	12	17	23	18	0	-0.33
		C-14	Do you know where you can check the credits?	Totally NO --- Very Well	1	8	19	26	16	0.69
		C-15	Do you know how to redeem credits for prizes?	Totally NO --- Very Well	1	13	14	27	15	0.60
Attitude	Earlier Stage: Training	A-1	Are you willing to actively understand and learn the knowledge of garbage classification?	Totally NO --- Very Well	0	4	18	33	15	0.84
		A-2	Are you willing to take the initiative to learn about environmental protection and sustainable development?	Totally NO --- Very Well	0	9	23	24	14	0.61
		A-3	Are you willing to take the initiative to publicize the knowledge of garbage classification to your friends and relatives?	Totally NO --- Very Well	0	3	22	26	19	0.87
		A-4	After having Credit Reward System, are you more willing to take the initiative to learn and share?	Totally NO --- Very Well	0	2	15	30	23	1.06
	Before Garbage Classification	A-5	Do you find it troublesome when sorting garbage?	Very Troublesome -- Very Convenient	2	13	32	16	7	0.19
		A-6	Do you feel disgust and revulsion at incorrect classification?	Very Disgusting --- Totally No	3	17	14	31	5	0.26
		A-7	Does door-to-door collecting make you feel a lot more convenient than going to the garbage collecting point?	Totally NO --- Very Well	0	4	15	28	23	1.00
		A-8	After having Credit Reward System, are you more willing to take the initiative to sort garbage?	Totally NO --- Very Well	0	1	13	34	22	1.10
	In Garbage Classification	A-9	Are you willing to take the initiative to cooperate with the garbage collector?	Totally NO --- Very Well	0	2	8	35	25	1.19
		A-10	Are you willing to take the initiative to help other villagers with garbage recycling?	Totally NO --- Very Well	1	8	20	27	14	0.64
	After Garbage Classification	A-11	Do you care about your credits?	Totally NO --- Very Well	0	2	21	31	16	0.87
		A-12	How motivated are you to redeem prizes?	Totally NO --- Very Well	0	1	12	42	15	1.01
		A-13	Does the redeemed prize meet your needs?	Totally NO --- Very Well	2	7	11	32	18	0.81
		A-14	Are you more satisfied with the current garbage disposal service system?	Totally NO --- Very Well	1	10	14	33	12	0.64
Behavior	Earlier Stage: Training	B-1	Do you usually take the initiative to participate in the publicity and training activities of garbage classification?	Totally NO --- Very Well	4	10	26	22	8	0.29
		B-2	Do you usually help promote such activities?	Totally NO --- Very Well	8	12	28	18	4	-0.03
	Before Garbage Classification	B-3	Do you usually sort garbage according to the sorting requirements?	Totally NO --- Very Well	0	6	21	29	14	0.73
		B-4	Do you usually guide and ask your family members to sort garbage?	Totally NO --- Very Well	6	11	16	31	6	0.29
		B-5	Will you take the initiative to guide others when they do not classify garbage correctly?	Totally NO --- Very Well	7	21	24	13	5	-0.17
		B-6	After having Credit Reward System, have you improved your requirements for garbage sorting??	Totally NO --- Very Well	2	6	23	28	11	0.57
	In Garbage Classification	B-7	Can you deliver the garbage to the sorter on time?	Totally NO --- Very Well	1	11	19	26	13	0.56
		B-8	After having Credit Reward System, will you be able to recycle on time every day?	Totally NO --- Very Well	1	3	21	25	20	0.86
		B-9	How often do you complete garbage collection now?	Weekly, Once every 3 days and once every 2 days, everyday, 2 times a day	1	3	11	47	8	0.83
	After Garbage Classification	B-10	How often do you check credits?	Once in a year, once in a half year, once in a quarter, once in a month, once in a week	0	5	33	31	1	0.40
		B-11	How often do you redeem prizes?	e than 1 year, once a year, once in 3 quarters, once in 2 quarters, once in 1 quarter	0	5	21	32	12	0.73
		B-12	What kind of prizes do you usually redeem?	Daily necessities Food (essential) Condiments Toiletries	A 16	B 22		C 19	D 13	

Table 3. The data of Environmental awareness scale for service design of rural waste disposal system

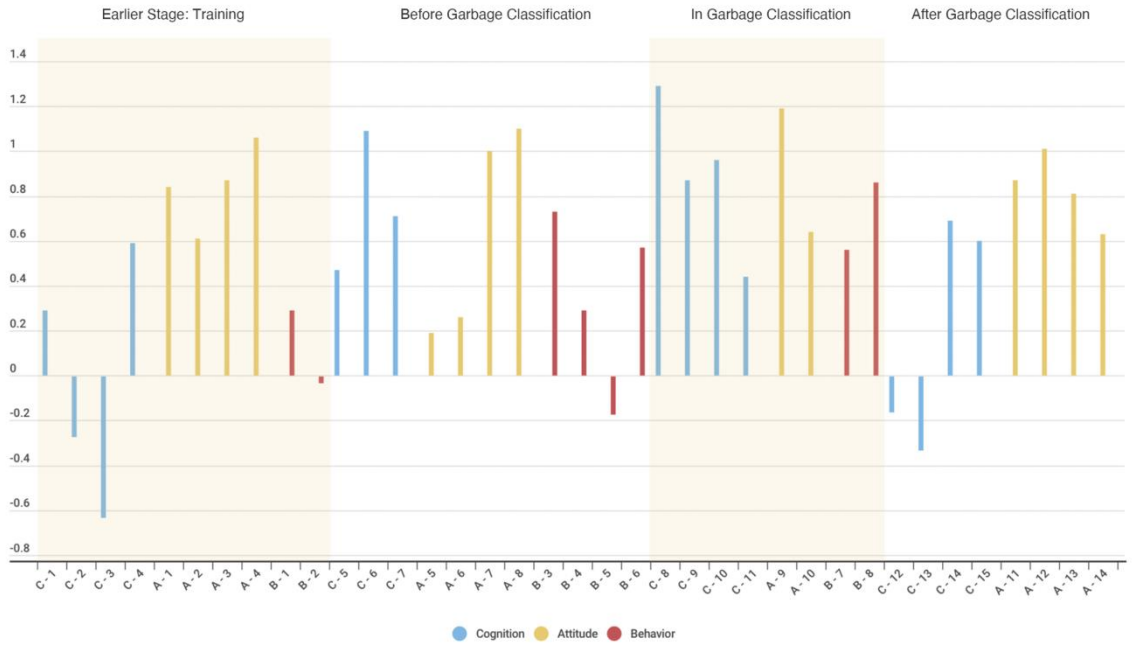

Table 4. Table of average scores of different dimensions in different stages

During the interview process, offline interviews will be conducted. Based on the previous analysis of the service blueprints, stakeholder maps, and contact points of the three versions of the waste disposal service system, different stakeholders will be interviewed, and interview questionnaires will be designed based on the interview outline of the impact of the Huajiacun waste classification service system on villagers' awareness. In the interview process, according to the feedback of the interviewees, targeted in-depth understanding will be conducted.

The main research object of the interview is the stakeholders related to huajiacun garbage classification system. Through field interviews, 13 different stakeholders from the service system are interviewed. Each interview lasts from 30 to 70 minutes.

No.	Name	F/M	Age	Occupation	Living time	Education	Stakeholder
1	HYQ	M	62	Retired	62	/	Villager
2	HL	F	47	Teacher	47	Undergraduate	Villager
3	JXY	F	57	House Wife	35	Primary School	Villager
4	HZY	M	42	Medicine Sales	42	Undergraduate	Villager
5	HLF	M	35	Farmer	35	Junior school	Villager
6	CXF	F	59	House Wife	38	/	Villager
7	HWW	F	29	Waiter	29	Undergraduate	Villager
8	HJY	M	54	Farmer	54	Primary School	Villager
9	HCH	F	38	Worker	38	High School	Villager
10	XLY	F	46	House Wife	22	Junior school	Villager
11	ZYJ	F	58	House Wife	35	/	Sorter
12	WXM	F	54	House Wife	32	Junior school	Sorter
13	HCD	F	31	Servant	31	Undergraduate	Administrator

Table 5. Information of interviewee

4.3 Data analysis and exploration

4.3.1 Cognitive level

a.The earliar stage helps to improve the villagers' understanding of garbage classification, but the reason and purpose behind it are still not easy to understand; Villagers are more inclined to understand and learn the intuitive or practical knowledge, rather than logical or theoretical knowledge.

b.In the stage of “before garbage classification”, villagers' awareness of garbage bins, garbage collection time, and garbage categories were all positive. This shows that on the whole, their awareness of such information was relatively positive. Especially in the awareness of garbage bins, because of the longer education cycle, the simple classification, and the intuitive color, the effect was quite positive. The garbage recycling time, because it was in line with the villagers' daily living habits, coupled with the use of auditory factors, so it also had a good cognitive effect. As for the category of garbage, because the specific categories of domestic garbage were too many and too complicated, it was still difficult to distinguish accurately. However, after simplifying the distinction into two categories, the effect was still improved a lot.

c. In the “In garbage classification” stage, the villagers' cognition of garbage recycling methods is positive on the whole, indicating that the cognitive effect of this kind of information is good. It shows that the use of smart trash bins does not form a cognitive burden for villagers, and the operation on the user side is relatively simple, but the methods of the front desk operation are slightly complicated.

d. In the “After garbage classification” stage, villagers have insufficient cognition of the background processing information that they cannot access, especially the information that is not directly related to their own interests. On the other hand, villagers are more sensitive and concerned about the information related to their own interests.

4.3.2 Attitude level

a. In the ealiar stage, the overall attitude of the villagers is relatively positive and cooperative. Among them, the willingness to learn independently and to guide relatives and friends around them is relatively strong.And even the latter is better, which reflects the stronger interpersonal connection in the countryside, but also reflects the population structure of the countryside--more elders and women, so they have more willingness to preach to their families.

Villagers are more willing to learn practical knowledge, rather than to learn theoretical knowledge.

b.With the rewarded credits, the villagers' initiative to learn and publicize environmental protection knowledge has been improved a lot, and most of them give a more positive evaluation.

c. Although the villagers have gradually adapted to and gotten used to garbage classification, most of them still find it troublesome. At the same time, villagers will feel strange by others' incorrect garbage sorting behavior, which is a psychological mechanism to pursue fairness. Because they have paid a certain amount of energy to carry out garbage sorting, if others do not do it correctly, they will feel that they are suffering losses. Therefore, the formation of a reward and punishment mechanism for the quality of garbage classification behavior can effectively improve the quality of garbage classification behavior. The mechanism of photo uploading, intelligent identification and supervision in version 3.0 can play a good guiding role by associating the quality of villagers' daily sorting behaviors with their rewarded credits.

d. Door-to-door clearance and rewarded credits mechanism both have highly positive evaluation. One is simplify the villagers' service process and improve the villagers' service experience. The two is guide and

regulate the villagers' behavior through material rewards. This positive guidance mechanism with actual benefits has more positive service evaluation and service effect than the moral rule constraint.

On the whole, the villagers' attitude and satisfaction towards garbage recycling service behavior are relatively positive. After entering the version 2.0 period, especially the version 3.0 period, the villagers' cooperation has been greatly improved. At the same time, they are also willing to actively assist other villagers in garbage recycling. This would have been unimaginable in phase 1.0. The overall satisfaction is also relatively positive. At present, the main shortcomings are that villagers are not satisfied with the recycling mechanism of recyclable garbage such as paper, glass, metal and plastic, and the reward mechanism of such products is not perfect. For the recycling of this kind of garbage, they are still more inclined to the traditional professional waste recycling personnel to recycle.

4.3.3 Behavior level

a. Villagers have good enthusiasm to participate in the publicity and training activities of garbage classification, but rarely take the initiative to publicize such activities.

b. In the garbage classification stage, the overall behavior of villagers is relatively positive.Particularly, the requirements for themselves and their families are relatively strict, and the completion quality of garbage sorting behavior is also high. On the other hand, the requirements for others other than family members are much lower, and they rarely take the initiative to interfere with other people's behavior.

c. Rewarded credits have a positive incentive for villagers' behavior.

d. In the garbage recycling stage, punctuality and cooperation of villagers are relatively high. And the rewarded credits also give a high positive incentive to the villagers' garbage recycling behavior.

e. The frequency of villagers' daily garbage is concentrated in once a day, and the sum of the frequency of once 2 day,once a day and twice a day reaches 94%. Most people will recycle garbage at least once every 2 days.

5. Conclusion

5.1 Design influences experience, experience influences attitude, attitude influences behavior, and behavior influences cognition

The setting of door-to-door recycling mechanism affects people's attitude towards active recycling;
The setting of the point reward mechanism affects people's attitude towards active classification;
The combination of the two can improve people's initiative to classify and recycle garbage;

In addition to the above two most basic mechanisms, there are the following points that can affect the enthusiasm of users:

a. A simpler and easier operation process; (for example, only need to give the bucket to the recycler, the subsequent operation is completed by professional service personnel;)

b. More concise and reasonable contact design; (for example, only need to submit a smart professional trash bins, and the size is more suitable for daily recycling of kitchen waste, other trash bins prepare by itself;)

5.2 The influence of family and neighborhood relationships on people's behavior and attitudes

a.The improvement of reward and punishment mechanism can urge family members to complete the garbage sorting and recycling behavior better;

b.The improvement of the overall environment can promote the supervision and mutual assistance among villagers to complete the garbage classification and recycling behavior;

c.The strengthening of publicity and training can improve the standardization of garbage classification and recycling behavior of villagers and their understanding and support;

5.3 Limited by age and education level, more intuitive and simple service design can be effectively promoted in rural areas

a. The use of QR codes; (on the trash bin, IC card, more convenient to scan the code query)
The use of music on the garbage cycling trucks; (more recognizable and easier to form behavioral inertia)
b. The design of the color and form of the trash bins; (more compact, more convenient to carry with handle)
.
c. IC card and POS machine use; (more convenient to query points).
d. The choice of reward goods; (more in line with the actual life needs of villagers).

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Making the case to revise the SDGs by creating a truly 'Responsible Living Economy' to resolve global Climate, Species and Inequality crises.

Greg Campbell[1], Cheryl Campbell[2]

[1] CEO, DesignOz / Chairman, Society for Responsible Design (SRD)
designoz@iinet.net.au
[2] Executive Officer, Society for Responsible Design (SRD) srd@srd.org.au

Abstract. The Sustainable Development Goals (SDGs) must be radically improved and prioritised to reflect the existential challenges to all life on earth. Global feedback and many reports have confirmed that the SDGs need to be better articulated, funded and supported, or they will continue to fail. When the global stakes are so high, can individual countries aim for real sustainability while the world's rich and powerful economies follow selfish agendas? The Paris Agreement overshadowed efforts made by the SDGs to empower global support for the common good. Why was Climate Change not prioritised better? We review more beneficial ideas and options, providing a framework of lenses to develop better strategies to deliver the 5Ps of People, Planet, Prosperity, Peace and Partnership for the long term. While prioritising Goal #13 Climate Action, the United Nations will better meet the world's needs by including the missing Goal #18, 'LifeBEAM RLE, care for all Life in the Biosphere, Earth, Air, and Microbes. When the SDGs are revised using 'Responsible Living Economy' (RLE) principles, they can be better optimised, encouraging environmentally positive shifts in every sector to meet planetary boundaries. Halfway through the UN Agenda 2030 is the perfect time for this revision.

1. Introduction

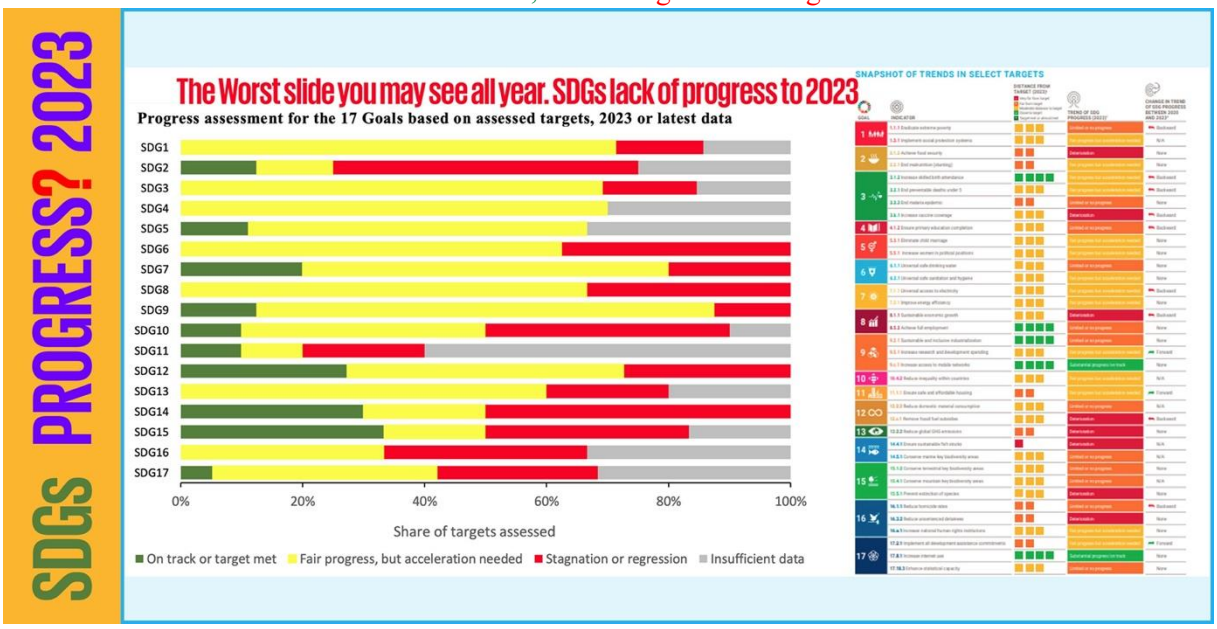
It is now both the best of times and the most challenging of times. [*Cue the music intro for Mission "Responsible" or similar* (*https://youtu.be/7alss3sDJdg*) *©Sony/ATV Melody*, *Voice over with some sense of urgency*] Will the dominant species make the 2030 timeline to put in place some workable form of a truly 'Responsible Living Economy' or will the current ruling elite continue to cause declines in global health and safety, homeland dispossession, species extinction and runaway Climate Change? We need to revitalise the SDGs by adding accountable common sense thinking to enable the significant evolution required "to align socioeconomic development with environmental sustainability" (Hametner, 2022), and the response needs to be global.

Multiple indicators from the aptly called "Great Acceleration" (Thunberg, 2022, p. 39; Head *et al.*, 2022) show that humanity continues to be capable with technology and culpable in its consequences. We must upgrade our processes to keep the good and lose the bad. Being 'fully responsible and accountable' needs to be the new catchphrase to reverse the trends of past practices driven by 'profit at any cost'. These nature-negative practices need to be curbed by everyone across society (Readfearn, 2023). Through their reach, acceptance and understanding, the SDGs are the perfect framework for implementing these changes, but their priorities and lack of progress are very concerning. Many opportunities exist for radical improvement and a deeper understanding of the options and directions needed to create what is essentially a 'responsibility revolution'. Much more than just ethics, it means getting right what scientific consensus deems necessary and putting in place measures to ensure it gets done. We have initiated and accessed global input on this movement to accelerate the practice of developing prevention over cure.

The idea of a truly 'Responsible Living Economy'(RLE) allows a positive and easily understood phrase to adjust directions to allow all life to thrive. By dynamically combining and employing the excellent ideas of Regeneration (Hawken, 2021; Figueres and Rivett-Carnac, 2020), Circular Economy (Friant, Vermeulen and Salomone, 2020; 2021) and Responsible Design thinking (Fridman, Meron and Roberts, 2022), these processes can assist in reversing many current concerning trends. They go beyond the Precautionary Principle to account for ever-increasing industrialisation with the ideas of caring for the environment and species by increasing integrity, accountability, stewardship, long-term thinking and appropriate action. These ideas have been significantly growing trends in business, travel, financing, and design and have made good progress in

many avenues since our earlier paper (Campbell and Campbell, 2021; Jonas, 1985). Beyond Apex Design Mode, it is time to be the Apex Predator 'in reverse' using our tools, guile, memory, communication and cooperation for good. We need to enhance and grow this direction in all we do to support the RLE, in a perpetual loop, like a Mobius strip, an infinite symbol of positive action, improvement and revision. We aim to launch a new strategic concept to kick-start and further develop this method with related cooperative initiatives and invite others to follow suit.

Table 1. SDGs lack of progress to 2023, graphs from UN reports.
Green is Good, Red = stagnation or regression.



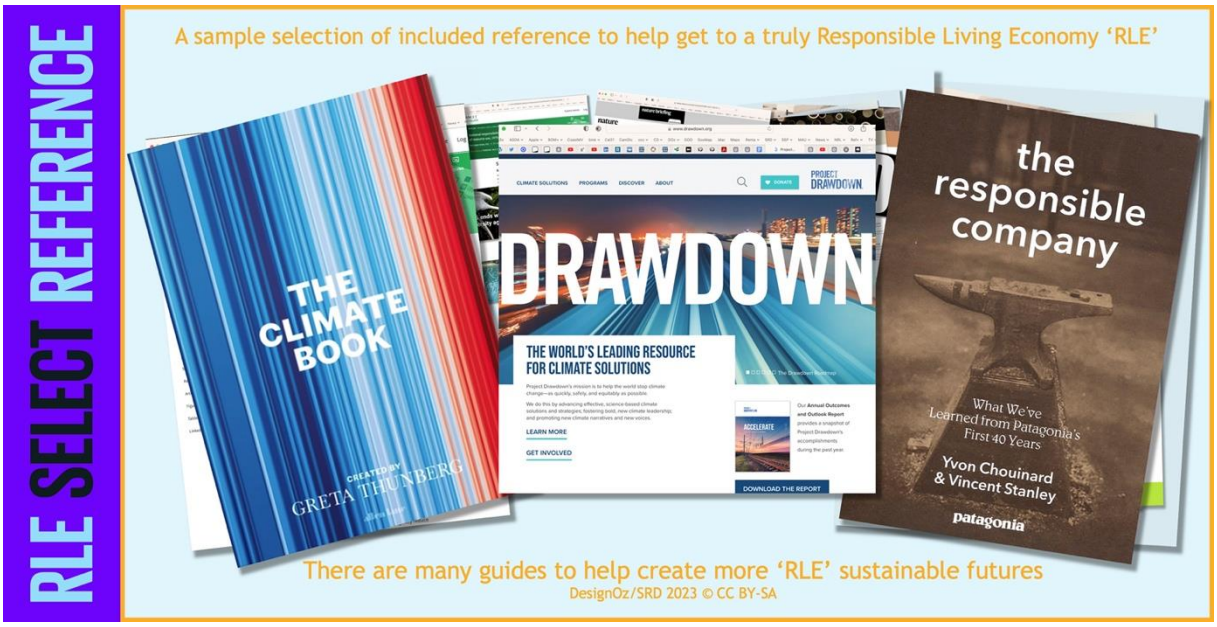
2. Literature Reviews

Early in 2023, the UN Secretary-General released the report "Progress towards the Sustainable Development Goals: Towards a Rescue Plan for People and Planet" (May 2023, final version available in Sept. 2023). It urgently advised that at the mid-way point towards 2030, most SDGs are moderately to severely off-track. It highlighted prime areas for renewed progress, starting with Climate Change, financial and economic systems, followed by numerous other necessary actions.

While frank and broad reaching, we note that the report is limited by several critical factors, mainly the original goals descriptions, areas of focus and their inherent contradictions. We briefly analyse the broader issues covered and compare them with recent papers to show why this has limited their success. The UN report says that going beyond Gross Domestic Product (GDP) is a new direction. We agree; the Doughnut Economics paper (Ross 2020) and *Doughnut Economics Action Lab* (DEAL, 2020) show that increasing GDP will exacerbate current dilemmas, ignoring the 'planetary boundaries'. We add that exchanging SEEA (*System of Environmental-Economic Accounting*, 2012) wherever appropriate is a significant step worthy of expansion.

To show more positive trends, we highlight several areas deserving greater clarity, acceptance, focus and understanding across the community. Authoritative works such as *The Climate Book* (Thunberg, 2022) and *The Responsible Company* (Chouinard and Stanley, 2016) confirm that empty rhetoric needs to be replaced with genuine action that is proven to work (Jones and Fowler, 2022) and a major climate response website (Project Drawdown: Carbon reduction plan) gives clear instructions on what to do for this major issue (Singh *et al.*, 2021; Mauerhofer, 2021; Keitsch and Vermeulen, 2020).

Figure 1. A selection of authoritative reference.



While the SDGs' progress is too slow, working to reverse inequalities holds much promise for enabling more equitable changes and carbon-positive effects with inclusive economic development (Humpenöder et al., 2022; Ashford et al., 2020; Motesharrei, Rivas and Kalnay, 2014) and regeneration (Project Regeneration, 2023). Oxfam has good suggestions on how to pay for these changes, "How we must tax the super-rich now to fight inequality", (Christensen et al., 2023) to which we add the suggestion that the proceeds of all gambling and a percentage of military budgets should also be redirected to similar SDG priorities. There is room for additional "outside-the-box" elements to accelerate success in these critical subjects. We explain an outline for the proposed new Goal#18 which includes integrating the RLE concept in practice. Reviews of some more recent trends in energy, AI and greenwashing are shown for comparisons, antidotes and unrealised benefits to the goals.

Issues of ever-increasing populations engaged in massive over-consumption (*Somebody Else's Problem*, Crocker, 2017) and increasing resource extraction (Ahmed *et al.*, 2020; Baloch, Mahmood and Zhang, 2019) place many dangerous tipping points under immediate threat (McKay *et al.*, 2022). This combination requiring increasing extractive processes demands massive and positive change along with reassessing old habits that serve no good future purpose.

Figure 2. A small selection of reference to help form a truly 'RLE'.

3. Methodology

Over some decades, an emerging theme around how challenging it was to promote Responsible Design thinking and action began to match similar difficulties with lack of traction that the UN SDGs were experiencing. Our earlier papers and feedback confirmed that responsible EcoDesign (*Enabling design for environmental good*, 2022) applied across industry, everyday living and the SDGs, holds the greatest capacity to increase global benefits. Developing these ideas of combining earlier regenerative methods and global ecological best practice with ethical realities should continue. To increase uptake, we cast a wide net, reaching conference attendees, designers and LinkedIn connections around the world with the message to "think global, act local, share your successes widely and repeat".

We structured open and direct questions to explore in an international survey: Do you think sustainability is an important concept? Is reducing carbon emissions an important issue and who should be responsible for doing this? Could being more targeted in caring for the Biosphere better explain its key value and importance? What is your awareness of SDGs and what relevance do you think they hold? This ongoing qualitative survey was conducted via digital, telephone and live interviews. Survey participants included 18yrs - 70yrs within a cross-section of varied ethnicity and working sectors in industry, business and community. Research was conducted over 1.5 yrs.

Surveys and interviews were undertaken. Indications from the findings of ongoing global qualitative research confirmed our earlier paper's direction that an advanced assemblage of these ideas and approaches is essential to improve SDGs success levels. Further recent and related peer-reviewed papers suggest two significant points of note: the world may not be getting less morally proactive, *The illusion of moral decline* (Mastroianni and Gilbert, 2023), and the global North (Hickel, Dorninger, *et al.*, 2022; Horner, R. et al. 2018) has a lot to answer for after centuries of inequity that must be more accountable and rebalanced. We can succeed much more with the SDGs by working with these considerations.

Our method includes analysing complex and open questions from a series of emails, digital media requests, telephone and live interviews. We received 126 responses after asking 2,367 colleagues, connections and associates to review our earlier paper for reference and respond to this question, "How may we help nurture a genuinely 'Responsible Living Economy'?" We received an insightful variety of thoughtful responses and additions for which we have included a summary and interpretation in our paper and discussion. The common theme of being equitable, accountable and conserving the complete variety of life became clear.

4. Results and Discussion

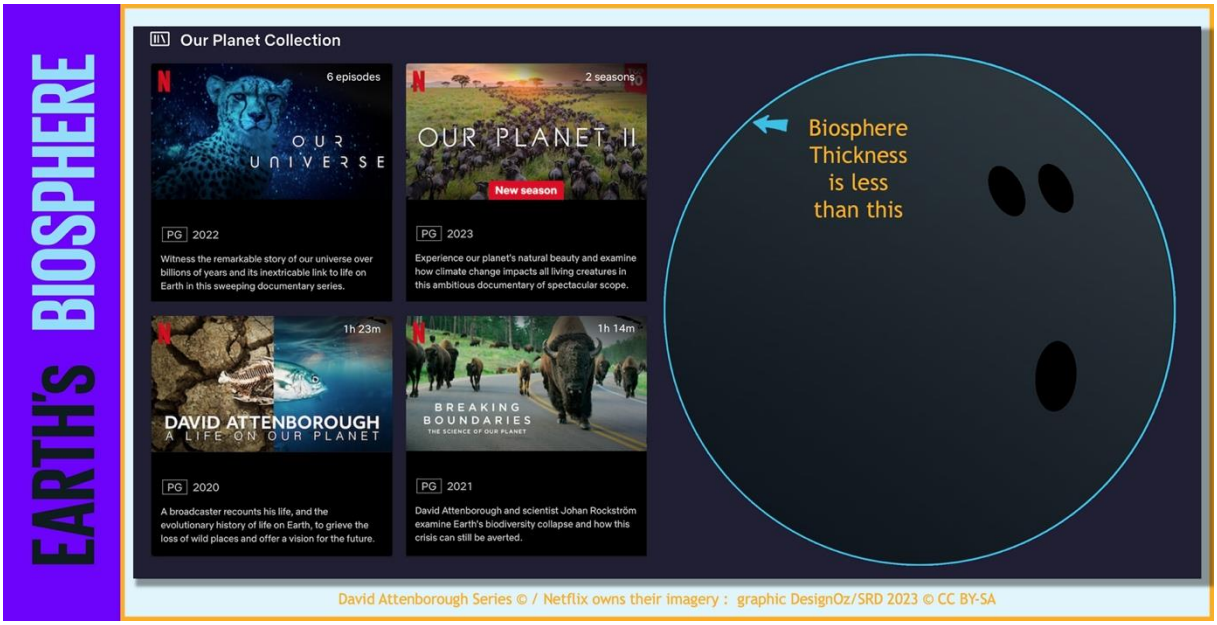
One significant insight stood out in the survey responses relating to the use of the Hippocratic Oath. An innovation and technical consultant in Switzerland reminded us that doctors have a Hippocratic Oath, where they swear to protect life. Valuable insights (Askitopoulou and Vgontzas, 2018; Oxtoby, 2016) show that in the revised forms, the oath still holds relevance, value and good ethical grounding for physicians. We also agreed that working within a fully functioning RLE, such practices should already be incorporated into the fabric of the whole society. This paper is a 'best possible effort' aimed at covering the significant issues, the better options and getting support in all forms available to progress these essential developments. It is more aspirational than directional.

Emerging themes from survey participant discussions confirmed the need for more scope and capacity for the UN to drive countries to achieve identified targets and goals within the SDG categories. This resulted in further consideration of options and actions to manage the accelerating climate change crisis and related existential threats. After time, several ideas became obvious; one specifically resonated that it may be better to think of the earth's biosphere as just one single entity, so that caring for it would become the primary goal of a truly 'Responsible Living Economy'. The supplementary questions are now about how we deal with the entirely too careless and destructively dangerous actions of economies where "more than 50% of excess consumption in rich nations is net appropriated from poorer nations in the Global South" (Hickel *et al*., 2022). The further discussion is to prioritise climate change reversal with goal #13 while advancing #14, #15, #10 and the newly suggested #18, all to urgently reduce global existential threats.

Our world is filled with life in many forms in amazing and complex symbiotic relationships. Many documentaries show its stunning beauty and diversity. David Attenborough's series (Wikipedia contributors, 2023) exemplifies this genre. A vital component of an RLE is ensuring that our actions will likely benefit all life for the long term and quickly slow or stop all activities and practices that are detrimental to life. Individual responsibility is fundamental but increases for corporations, countries and the world as a collective. We all

share these excellent resources and the dire consequences of not properly looking after them. We shall work to explain the issues, relationships, and possibilities for this process to be well-supported, and we request more significant input and development of this concept.

Figure 3. Life exists in a relatively thin zone encasing our planet, often called the biosphere.



To assist a simple visualisation of the biosphere, if the Earth were the size of a bowling ball, say 22cm dia. (8.6in), the biosphere would be roughly equivalent in thickness to a coat of paint. Within this, nearly all life exists. It is valuable to see it from this perspective as the Earth is massive at around 12,734 km in diameter, whereas the biosphere is only around 20 km thick (12.4 miles). The 'life-zone' is even thinner and varies 3 to 7 km (1.8 to 4.4 miles). We need to refocus global thinking to protect this thin, precious layer of life, not the planet, which is primarily rock in various forms that would likely survive without us again as it has before.

To refocus on life, we add "the missing Goal 18", LifeBEAM for all Life in the Biosphere, Earth, Air and Microbes, to balance and complete the world's priorities. We add the first part of BIOSPHERE with its Targets and Indicators to focus on the main area in dire need of attention. It contains all life; while large, it is also quite fragile.

We add the second part of EARTH, as in ecology and soil, to highlight that two areas here also need more care. The carbon sink in the earth is massive; it breathes, and farmers can systematically increase the carbon content by several means for better returns and more fertile soil. Fungi are nature's master recyclers, and the network of mycelium underground is as vast as it is incredible (Hawkins *et al.*, 2023).

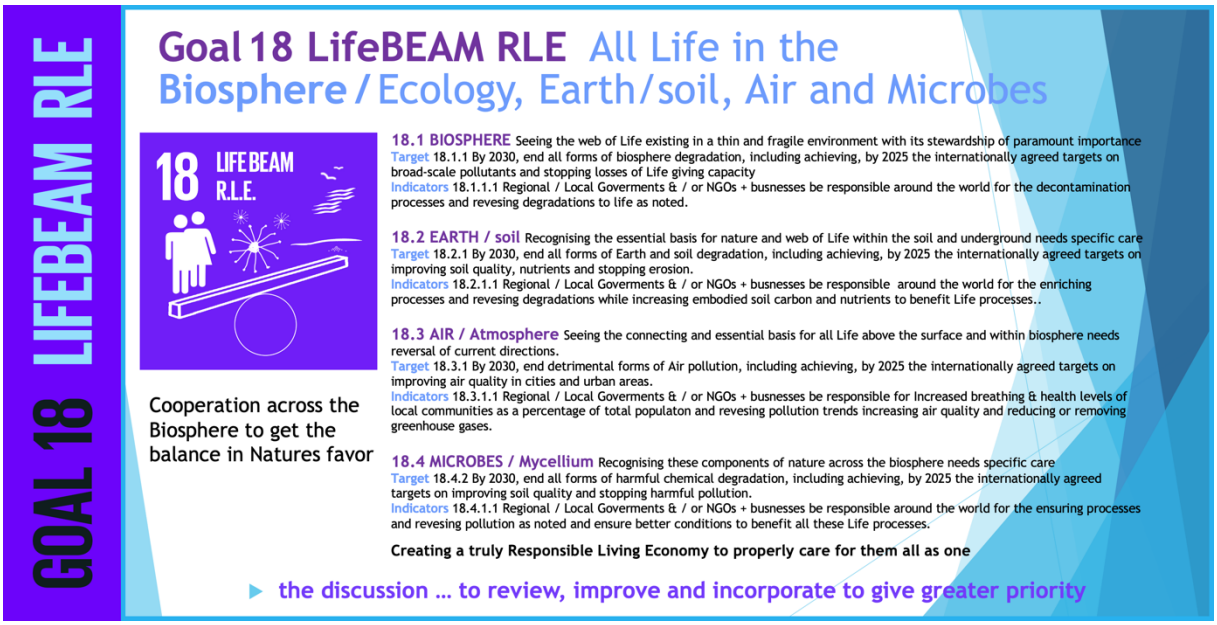
We add the third part for AIR as it covers the globe and unites us as we all share it. Some write songs about it (Muranty, 2020). It holds much of the pollution humans create, causing Climate Change and gives or takes life depending on the pollution levels we allow (Glencross *et al.*, 2020; Pope, 2004).

Figure 4. SDGs "missing Goal" #18 LifeBEAM RLE. For all Life in the Biosphere/Ecology, Earth/soil, Air and Microbes to prioritise the whole Biosphere.

We add the fourth part of MICROBES as they are everywhere and need care too (Haavisto, 2023; *The Microbiota Vault*, 2018). Over half a human's body weight comprises microbes (in the gut, mouth, bowel, skin, blood, and more), so in some ways, we are each more microbes than we are human. This intricate symbiotic relationship bears many similarities with the world. All four of these parts need and deserve our care and protection from harmful chemicals, pesticides and other artificial toxins; otherwise, they will not function or survive. The acronym for this 'omnibus goal' is LifeBEAM; it is a balancing act. Making a goal of these four vital for Life elements embodies the Responsible Living Economy concept and encourages collaborative, responsible thinking to achieve more robust solutions for their care. Together Goal #18 is LifeBEAM RLE to properly care for them all as one. We would welcome the inclusion of other Goals as and where deemed appropriate for the major issues not yet covered and edit Goal #13 logo to add the 'circle' representing the biosphere we need to protect.

An often ignored or undervalued issue is that of perspective. Most people and departments are comfortable when dealing with their standard terms of reference and areas of familiarity. In today's climate, they need to become used to seeing the more comprehensive picture(s). They will often say that it's "someone else's department". This response is one of the traps of "silo thinking", quite common in many areas, from education and academia to industry and party politics. Why this is important can be realised when multiple issues need to be addressed, especially in the global context. Those within their 'silo' may say, "We're already doing all we can", unable to recognise that different processes, connections or interrelations may be necessary to affect needed changes elsewhere. One such primary change is the perspective of the whole set of life on earth. Each silo is only one part, and unlikely to recognise how many essential symbiotic relationships exist from microbes to insects plus all animals, especially humans. Yes, most people realise there are relationships. Still, too few are comfortable with the concept that one event can have much effect elsewhere, such as the fact that soil from a windstorm in Africa or pollution from a wildfire in Canada can travel in the upper atmosphere across continents. The intention is for individuals to grow the concept of respect and effect for other places, animals, people and life so that we may make more informed decisions now (Cribb, 2023), ensuring that 'shared responsibilities' are covered – balancing the BEAM.

Figure 5. SDGs "missing Goal" #18 LifeBEAM RLE Targets & Indicators.



A truly Responsible Living Economy (RLE) would be evident when the world community practises active self-awareness and assesses its actions, processes and directions using prioritised SDGs as a benchmark. It thrives on the cooperation and coopetition efforts of all participants, working across communities and businesses, with a reflective mutual arbitration process built into problem-solving to affect change and innovation, creating ideal solutions through applying responsible Design Thinking lenses (both "traditional Ethical" and "expanded Responsible" Tables 2 and 3). The RLE differs from the SDGs by taking into closer consideration the consensus views of the world on priorities, inequities, targets, funding and directions. We encourage this process at multiple levels with a model option for organisations such as the Wentworth Group of concerned Scientists (2002) appointed by arbitrators or as part of a Board of Review (or similar collectives that are not politically, single-idea or direction entrenched) – independent, non-government, solution-based policy reforms for the broader interest. The intent is to rebuild trust by being more accountable and responsible for every country, corporation and person's actions. The overriding purpose is to aim for a more equitable future for all countries and share more fairly the abundant wealth and significant hardships the world faces. The UN Sustainable Development Solutions Networks (SDSN) is an official example. We see the benefits of a more informal collective that is more representative and inclusive of the greater society. Included would be “A Participatory Downscaling of Global Goals” (Moallemi et al., 2022; 2020) or similar themes to get better understanding and local uptake of the Goals.

Active community participation by its citizens enhances the commitment and sense of belonging within the RLE. Some suggestions would be participation in extracurricular learnings from universities to appropriate international conferences to local councils on a wide variety of subjects. Evidence of this trend of populations supporting climate action and sustainability-focused initiatives around the world is growing as people seek solutions to resolve major problems that confront us all. A good example is Greta Thunberg (2022) motivating youth and others to action. We now know we need to inspire and to act on positive initiatives worldwide as a matter of urgency, as we witness the UN admit that most goals and targets are stagnating or failing.

The world is already progressing towards this model. We seek to affirm this with a more appropriate name. The proposed model encourages and expands to a wider net of engaging and inspiring our whole community to work/live in a truly Responsible Living Economy. This is a change of mindset, thinking and living towards our future continuation and survival as we would like it. Yes, changes are needed but it is a 'move toward a consciousness of survival’ that is the positive goal. Simple actions netting bigger corrections and changes are required to steer life back into the longer-term survival pathway. Local communities are proving the possibilities of change. World-wide examples are continuing; one of the authors was invited to participate in an international round table of designers (*Design for Planet - Design Council*, 2022) to workshop active methods for change in design at multiple levels; this is just one of many similar examples worth progressing.

In Australia, the Society for Responsible Design (*SRD*, 2023), a non-profit group, has recently been approved as a full charity to advance education, culture and innovation. Over time members continue to work to advance changes in local communities toward transitioning to renewables and electrification; distributed energy resources and more efficient housing; participation in world webinars on sustainable initiatives in banking, superannuation and investments; agricultural soil and land management improvements; and in focus groups improving design and education to information events empowering sustainable multi-disciplinary initiatives by the youth of the world. An early, prominent figure of the EcoDesign Foundation (which merged with *SRD* in 2003) suggests in his *Defuturing* book that "we must take responsibility for our world unmaking by placing sustain-ability at the forefront of our conduct, not just personally but through Design" (Fry, 2020).

At our local and national levels, community members are joining events to raise their voices of concern on multiple sustainable issues affecting them. These events ask participants to act on vital issues of concern and motivate together for change. The concept of a RLE is receiving very high positive survey responses from community members, which suggests it is also worthy of being introduced on a broader scale. With the experience of Covid-19 we are all realising what can be done at local, regional, national and international levels to activate solutions and improvements across many areas. Let us not lose this opportunity to advance.

We would like to see RLE with annual independent reviews by humanity of the combined effects of all our actions on global health. At least Goals #10, 13, 14 ,15 & 18 need to be mandated in some form. Assisting the greater collective with a wide range of intelligent options to select and practise their own considered actions, assess their responses, and adjust their processes accordingly is our goal. For generations, the world has been subject to indoctrinations from 'populate or perish', never-ending growth, to rampant consumerism and 'natural gas' only to find the reality is anything but long-term viable. To highlight just one, many realise that so-called 'Natural Gas' is *not* natural. Consisting mostly of methane, it has been forcibly pumped from deep underground, processed, scrubbed, filtered, then combined with smelly trace gases to give a slightly safer result. How would you market such a poisonous, climate-harming substance? In Australia, in the 1970s, it was promoted as "the living flame", complete with young women in blue leotards dancing pirouettes in a circle and backed with a huge marketing campaign. Some companies continue to make massive profits from the results. Traditionally we've relied on time to get the message out to review the facts that more people die in Australia from the unhealthy effects of air pollution than in the road toll of traffic accidents (Morton, 2023; *Mortality rate globally by energy source | Statista*, 2023).

In parallel with the start of the SDGs, the Paris Agreement soon followed to better address Climate Change. Recently *The Kunming-Montreal Global Biodiversity Framework* (2022) has been agreed upon by 188 governments (95% of all 196 Parties). It stands to have a profound impact with an ambitious pathway to achieve the global vision of a world living in harmony with nature by 2050. Key elements of the Framework are 23 targets for 2030 and 4 goals for 2050. These two significant initiatives show that further global cooperation can significantly enhance the SDGs. This process may need to continue for other goals, such as #10 Inequality if we want them to succeed by 2030 and gain the flow-on effects such efforts would bring to the greater population.

On international, national and local scales we have experimented over decades, working to better assist sustainability outcomes in several industries and communities. Notable initiatives include a first national website on Eco-Papers, public environmental information and film evenings, speaking at regional eco events and local Climate Soapbox days, support for related charities and tour visits plus interviews with eco-sites and design firms.

It is noted that Artificial Intelligence (AI) is another technology that has been released for general usage without a complete understanding of its capabilities and possible negative consequences (Hagendorff, 2020; Jobin and Vayena, 2019). While AI benefits are likely, particularly with repetitive work, some of which will benefit environmental efforts with sensor monitoring and data processing, many challenges are apparent for undesired outcomes. It appears "time will tell" on this though we may ask again, Was it worth it? Where are the checks and balances in place globally? (Mittelstadt, 2019). Going beyond the Precautionary Principle should be a base, with intelligent development and technology reviews mandatory. Any new technology should only be used at a significant scale or commercially once it is proven safe.

The consequences of greenwashing and continuing "business as usual" are many and becoming better understood. Some lacking creativity in corporations and advertising devised this form of misinformation and exaggeration. Now there is more impetus for bad examples to be exposed as punitive responses are starting to increase (Maks, 2023), and loss of market share is likely to follow. Closely related are Transparency and

Integrity (Kretser et al., 2019), which is translating to the new currency of high-ranking corporates in many new and established guides (Corporate Knights, 2023; S&P Global, 2023) with nascent ecosystems (Schillebeeckx, 2022) and economy templates designed to put these concepts into global practice (*What is ECG*, 2021). These examples will form the language of an RLE and as a means of reviewing to reprioritise the SDGs.

4.1. Best practice examples:

Our research and interviews warranted that we should better discuss current options and directions.

Project Drawdown - Global Carbon Reduction

Looking for exemplars to follow, we see the work of Project Drawdown (2023) as a well-researched, logical, scientific and clearly presented example of Global Ecological Best Practice. Its mission: "To help the world stop climate change—as quickly, safely, and equitably as possible." Their methodology: "by advancing effective, science-based climate solutions and strategies; fostering bold, new climate leadership; and promoting new climate narratives and voices." The project highlights ten sectors holding solutions and actions for implementation.

We use the "Food, Agriculture, and Land Use" sector as an example with three major points: 1. Shifting diets and addressing food waste can significantly reduce the global demand for food. Eating lower on the food chain and ensuring what is grown gets eaten lowers farming inputs, land clearing, and associated emissions. 2. Deliberately protecting land and ecosystems stops activities that release carbon from vegetation and soil before they start. 3. Better agriculture practices can lower emissions from cropland and pastures, including methane generated by growing rice and raising ruminants, nitrous oxide emitted from manure and overusing fertilisers, and carbon dioxide released by disturbing soils

The nine other sections of their website are equally insightful. They combine these data reviews to reveal the most efficient and cost-effective methods to reduce carbon emissions globally. Greater access to education for girls is one direction with many benefits, from inequality and population to health and opportunity. Their timeline reviews, prioritising protocols and Return on Investment analyses make their work substantive and easy to implement. All indicators and directions from Project Drawdown are worthy of inclusion within an operating RLE.

The Climate Book (Thunberg, 2022)

A book with this depth deserves its own review paper. It covers well the salient issues globally that need addressing. The authors often show the continuing problem of empty political and related promises, missed milestones and renewed rhetoric to placate the public with an all too short memory and a penchant for personality over substance or performance. The book skillfully casts a broad net to show many interrelated issues that individual countries will only solve when collaboration and innovation to succeed are engineered. Too many loopholes exist to explain away missed carbon targets, such as the "Biofuels are renewable fuels" when the result is the burning of forests, including old-growth carbon sinks.

The Great Acceleration in using our earth's limited resources, while increasing toxic chemical loads, is sobering reading itself. When accompanied by statistics identifying species loss, habitat destruction and changing seasons, it is all the more challenging. The list of global experts the authors call upon is a testament to the messages they deliver as an authoritative group concerned with encouraging positive change now. Their wake-up call is missed at our peril. We are reminded that the insects, microbes, and soil need our help. Numerous ideas are raised to assist. A new awakening is required. The original SDGs are barely covered; presumably they think they are doomed to fail?

'the responsible company'

A recent article from Change Inc. (Hidde Middelweerd, 23 May 2023) in the EU leads with, "Patagonia prefers not to talk about sustainability: 'Responsibility makes much more impact'." We recommend referencing the book, *the responsible company* (Chouinard and Stanley, 2016, p. 27-31 - updating late 2023). They give numerous examples of their successful company, writing books about their leading practice and difference. "a responsible company owes a return to their shareholders and stakeholders", and "there are four key stakeholders: employees, customers, communities, and nature", and "As customers learn more about the consequences of ravaging the natural world at our current pace, they will pressure companies to do far more quickly to reduce the damage they cause." The Precautionary Principle they mention as a critical concept to

advance. They note consistently giving to small agile charities that others would not touch as regularly as possible. They saw this as a cost of business, not a tax, but as their gift for being in business. They add, "In the face of Nature's silence, we have to honour the Precautionary Principle, now embedded into law in the European Union and other countries, that in the absence of scientific certainty, the burden of proof that a new product or technology is safe, now falls on business." This reverses the trend in place since the Industrial Revolution to "act now and deal with the consequences later." They encourage extra steps to closely follow supply chains, creating circular economy practices and not using GDP as the only barometer of social health and wealth. These all resonate as worthy principles for a thriving living economy.

The framework for a truly RLE

To better explain the foundations of an RLE, we submit two tables of lenses for use. Table 2 is the more traditionally applied concepts of 'Responsible' which were all that was needed up to around the turn of the 20th Century. Table 3 shows how these are required to be expanded to try to keep pace with the amazing phenomena of our time, the Industrial and Technological revolutions.

Table 2. Ethical Design Lens considerations to create more 'RLE' sustainable futures.

TRADITIONAL ETHICAL

Traditional Ethical aspects, a basis for progressing towards a truly Responsible Living Economy 'RLE'

Ethical standards	Aspects fairly well covered by most design processes	Really key for developing method & coverage	Examples & ideas
Consider accountability	Understanding all actions have repercussions in what you create	Exploring or developing global ecological best practice (GEBP)	Raise the bar, past ways may be based on old thinking
Consider costs v benefits	Applies brief to all pillars of Society, Economy & Biosphere	Assesses long-term strategies to support all nature, economy & society	Rebalancing priorities & outcomes
Consider Health aspects	Include all known consequences & work to address them all	Utilise current data & best practice devising strategies to resolve	Review & utilise consumer associations and reports
Care for less fortunate	Enhance the access for those with low income or restricted abilities	Assess how you may respond when confronted with similar situations	Find solutions that work for people in other situations
Consider culture	Ensure indigenous knowledge is sought, implemented and respected	Connect with indigenous elders to add insights to current project	Using traditional knowledge such as fire-stick practices
Consider past + future	Find classic examples to compare with recent to looking for real advances	Becoming aware of multiple standards & selecting best fit	Consider exceeding current standards & promoting that
Define need for product or service	Considers current initiatives & service provided	Is you brief adequate or may a rethought version of it achieve better results	Design, iterate, improve, reassess, repeat
Consider other	Check all perspectives are covered	Review trends beyond traditional	Look global and to other cultures & solutions as well

Responsible Ethical Design lens considerations to create more 'RLE' sustainable futures

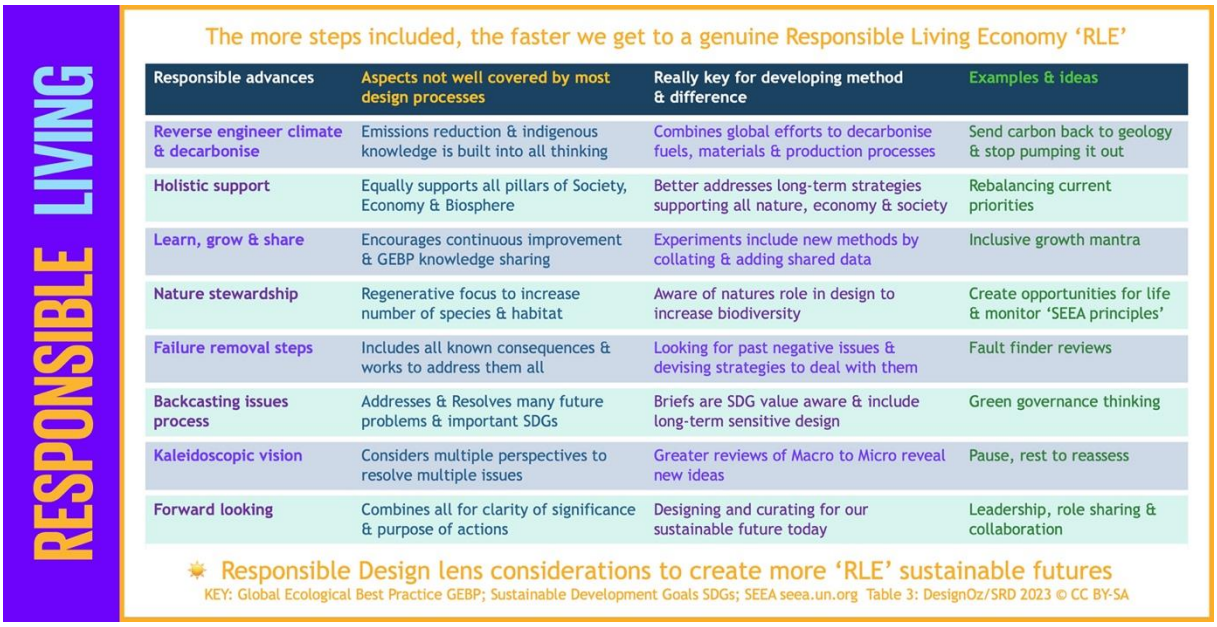
KEY: Global Ecological Best Practice GEBP; Sustainable Development Goals SDGs; Table 2: DesignOz/SRD 2023 © CC BY-SA

Using an Ethical Lens and a more advanced Responsible Lens

Our updated table for using a responsible lens includes many methods to utilise accountable and responsible thinking that goes way beyond ethics. Many opportunities exist to put these in place though there is a general reluctance to install unproven measures that were not required before. These steps are precisely where honesty, integrity and transparency are essential to advance beyond the past practice of not discussing or intentionally hiding externalities. Obscuring the inevitable still requires you to face up to it at some point. Addressing it now creates better long-term results, satisfaction and comfort in knowing you've done your best. Yes, there are many things to consider, largely as too many bad habits are common, requiring concerted encouragement for positive change.

Our definition of GEBP aligns with this process. This is a continuing process of following the best available references and ongoing improvements that include known environmental factors for carbon, climate and environment to achieve the best result: Respect embodied energy, advance green walls and roofs, and ensure adequate green spaces; use as many facets of the RLE diagram as possible assists to gain the optimum result.

Table 3. Responsible Lens considerations to create more 'RLE' sustainable futures.



Electrify Everywhere: energy

Easy-to-follow steps are available for homeowners to plan for future energy purchases to be electrical and enjoy significant savings over time. This process has been endorsed by the American and some Australian governments. It's a great example of responsible thinking and actions combined (Griffith, 2022). We practise this in our local electorate with visions to grow globally (*Electrify Mackellar*, 2023; *Rewiring Australia*, 2023).

A few leading buildings examples

The Sydney Opera House is well known for its distinctive sail shape, beauty and history, yet few know it is a leading example of designing and employing new technology to air-conditioning and current events as well (Pitt, 2023).

On a similar best practice track, with its innovative, interlocking, bolt-together building system, Buildonix has also fused its ethos with its business model: "To embed responsible and sustainable practices in daily life, engagement, adaptability, and intertwined approaches are necessary. Incentivising responsible behaviour, circular distribution, and community engagement are crucial … Sustainability should be engaging, adaptable, and enjoyable, fostering broad participation. Incentives should be utilised to encourage responsible approaches to materials and activities, including incentivised programs for circular distribution and community engagement," says their director in response to RLE (*Buildonix*, 2023). Their system and thinking have numerous beneficial components to build upon, that are recyclable and particularly easy to modify as needs change. This suits ever-changing climate, conditions and requirements.

RLE Connex benefits and challenges

RLE is a fusion of awareness, discussion, education, development, adoption, legislation, monitoring and annual reviews. The greater collective needs to rationalise the whole situation, recognise scientific consensus and avoid stranded asset biases to formulate and follow their agendas, to support the common good with truly positive solutions. We know full well that many opinions and challenges exist (Boehnert, Sinclair and Dewberry, 2022; Bradshaw *et al.*, 2021). They may encounter many obstacles, but ensuring your actions have long-term benefits for all life is the easy benchmark for future success. Keep it local, yet share good progress widely.

5. Conclusion

It is reassuring to see that the opportunities to progress outweigh the negatives. Implementation, accountability and monitoring them can then be inspiring. We still need better transparency and integrity in politics and business, which is, thankfully, trending this way. The UN created the SDGs to cover many, but not all, of the inequalities and advances society needs. Literature reviews, research answers, and discussions have informed these conclusions. We have suggested one new omnibus Goal that fully incorporates the Responsible Living Economy and follows global ecological best practices confirming the biosphere's health is our shared wealth.

The Millennium Development Goals (MDGs) suggested governments take responsibility for pressing global issues. They made some progress. The SDGs realised the shortcomings of the MDGs and expanded the responsibility to Governments plus Industry and Business. Yet, there is still the explicit requirement to address major complex topics of runaway consumerism, population and the total costs of wars. If not, all the excellent progress will yield little return. At the halfway point, with the stakes so high, the SDGs will benefit from collaborative input and exigent actions from the entire global community. Positive action reduces climate anxiety.

Focusing on Goal #13 should remain the priority. If we are to create any genuinely liveable future and avoid existential threats, the closely interrelated Goals #10, 14, 15 and 18 deserve similar following, implementation and resolution. As stated, some "prefer not to talk about sustainability: 'Responsibility makes much more impact'." UN chief said, 27th July, 2023, The era of global warming has ended & “the era of global boiling has arrived” https://news.un.org/en/story/2023/07/1139162.

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Sustainable development of plant dyed garment products in the context of digital media

Fangfang Deng[1], Wen Zhu[2] and Shujia Heng[3 4]

[1] Beijing Institute Of Fashion Technology
[2] Beijing Institute Of Fashion Technology
[3] Beijing Institute Of Fashion Technology

[4] Corresponding author's e-mail address：1012147979@qq.com

Abstract. This study aims to analyze the communication value of digital media in promoting plant-dyed apparel products and to further argue for the sustainability of plant dyeing in the textile field by sorting out the research progress in recent years in the international textile field in terms of the types of dyeing materials, dyeing performance, additional functions, and dyeing technology. Apply the theories of design and fashion communication. Taking two types of plant-dyed clothing brands, commercial brands, and traditional craft brands, as cases, we analyze their development problems and propose optimization solutions based on digital media using the SICAS model. The research demonstrates that: 1) plant dyeing is in line with the trend of an environmentally friendly and healthy lifestyle and green and sustainable development of the textile and garment industry, and the sustainable development of plant-dyed garments is one of the important trends in the current fashion industry. 2) the communication value of digital media in plant-dyed garment products cannot be ignored. 3) different types of plant-dyed garment brands face their problems and challenges in the development process, and through the optimization strategy of digital media promotion mode, it is possible to optimize the development of plant-dyed garment brands. Through the optimization strategy of digital media promotion mode, we can effectively deal with and promote the benign development of plant-dyed clothing brands.

1. Introduction

With the increasingly serious situation of global resources, energy consumption, and environmental damage, the issue of sustainable development of mankind has become crucial, and how to rationally recycle limited resources to achieve ecological balance is a question worthy of people's consideration. In recent years, the world's "back to nature" "green consumption" wave, "clean production" "green products In recent years, the worldwide wave of "back to nature" and "green consumption", "clean production", "green products", "eco-textiles", "sustainable fashion" and other concepts have entered the field of international trade in textiles and clothing on a wide scale, and many countries and regions have put forward strict environmental requirements for the textile production process and production methods. The status quo of trade and industrial development requires that we must fully foresee the development trend of the industry, give full play to our advantages, make up for our shortcomings, and improve the level of the industry in terms of technology, production, and products, to break down the technical barriers and green trade barriers. (Wang et al., 2023, pp. 34-40) In the textile and apparel industry, industrial wastewater generated by chemical dyes has become one of the most important sources of water pollution. Chemical dyes are diverse, structurally complex, and mostly toxic, with carcinogenic, teratogenic, and mutagenic effects, and the wastewater discharges are large and stable, easily destroying the ecosystem (Chen et al. 2019, pp. 449-456). With the rise of the concept of sustainable fashion, plant dyes are favored by practitioners and consumers in the global apparel industry for their environmental characteristics such as regeneration, biodegradability, and healthcare functions. The natural characteristics of plant dyes are in line with the human pursuit of an environmentally friendly and healthy lifestyle, and also with the development trend of ecological greening in the textile and apparel industry. Along with the deepening of consumers' knowledge of the hazards of azo and benzidine synthetic dyes, the application of plant dyeing in the field of apparel will have a better prospect. The sustainable and healthy development of plant-dyed clothing products in the international market can bring more economic benefits to the producers

and enhance consumers' recognition and willingness to buy plant-dyed green clothing, thus promoting the virtuous cycle of the plant-dyed clothing industry. (Wang et al., 2021, pp.1-4)

With the rapid development of digital technology, digital media plays an increasingly important role in information dissemination and market promotion. The new media promotion of plant-dyed clothing, conforming to the general trend of the Internet industry, accelerating the new media transformation of plant-dyed clothing brands, with the development trajectory of open integration, civilization interoperability, and emphasis on the value of innovation, makes clothing enterprises need to pay attention to their brand positioning, follow the trend of the times, do a good job of product innovation, and write a good brand story, to enhance the brand influence (Sun and Luo, 2022, pp. Sun and Luo, 2022, pp. 58-64). At this stage, commercial designer brands and traditional craftsmen brands are facing problems and challenges in promoting plant-dyed clothing products. This study will analyze the development problems of different brand types and propose an optimization plan based on digital media using the SICAS model to promote the sustainable development of plant-dyed clothing products.

2. Literature Reviews

there has been a growing interest in exploring the indigenous knowledge of plants used for textile dyeing in various communities, aiming to provide a foundation for sustainable development (Fan et al., 2018, pp. 1-11). Researchers have sought to evaluate the biotoxic effects of dye wastewater and screen toxic substances (Chen et al., 2019, pp. 449-456). Additionally, studies have focused on documenting traditional dyeing processes and the plant species employed for specific dyeing practices (Li et al., 2019, pp.1-14).

To identify cotton fabrics dyed with plant and chemical dyes, near-infrared (NIR) spectroscopy combined with pattern recognition methods, such as soft independent modeling of class analogy (SIMCA), partial least squares (PLS) regression, and principal component regression (PCR), have been utilized (Li et al., 2020, pp. 2275-2283). Traditional knowledge of plant dyeing, sustainable practices, and potential techniques for improvement have also been investigated in various regions, including Tibet, China (Yangzi, China). Traditional knowledge of plant dyeing, sustainable practices, and potential techniques for improvement have also been investigated in various regions, including Tibet, China (Yang et al., 2020).

Field research has been conducted to record indigenous madder dyeing practices among specific communities, utilizing natural and artificial mordants (Bhandari et al., 2020, p. 012039). Field research has been conducted to record indigenous madder dyeing practices among specific communities, utilizing natural and artificial mordants (Bhandari et al., 2020, p. 012039). Furthermore, studies have explored the dyeing properties of cashmere fiber dyed with gardenia blue pigment (Fangbin et al., 2021,p.012007). Research progress has also been made in the extraction method and dyeing application technology of violet plant dye, considering safety, environmental protection, extraction methods, and practical use. Research progress has also been made in the extraction method and dyeing application technology of violet plant dye, considering safety, environmental protection, extraction methods, and practical use for protein fiber dyeing (Wang, 2022, pp. 442-446).

While there is existing literature on plant dyeing, Kohler et al. (2023,p.1482) provide additional details on dyeing traditions in Eastern Europe, offering a broader perspective on the subject. Another influential work by Retnowati et al. (2020) has contributed to the field as well. these studies, Liu et al. (2023, pp.10-15) summarize the properties, classification, extraction methods, and application of plant dyes in fabric dyeing, highlighting their non-toxicity, and their use in dyeing. In addition to these studies, Liu et al. (2023, pp.10-15) summarize the properties, classification, extraction methods, and application of plant dyes in fabric dyeing, highlighting their non-toxic, renewable, and environmentally friendly characteristics. Wang et al. (2021, pp.1-4) propose sustainable development measures for plant-dyed garments, including craft inheritance, integration into the green garment industry chain, and unique design aspects. Moreover, Sun and Luo (2022, pp.58-64) explore the application of plant dye in clothing innovation design and new media promotion strategies, offering design ideas and reference value. Moreover, Sun and Luo (2022, pp.58-64) explore the application of plant dye in clothing innovation design and new media promotion strategies, offering design ideas and reference value. Gu et al. (2023, pp.103-111) interpret the symbols in Wa brocade patterns and explore the revitalization of traditional weaving techniques, providing insights Lastly, Wang et al. (2023, pp.34-40) advocate the use of traditional weaving techniques, providing insights for the inheritance, innovation, and marketing of traditional culture. Lastly, Wang et al. (2023, pp.34-40) advocate

for the sustainable development of China's textile industry through the establishment of the plant dyeing industry as a new value chain, suggesting comprehensive evaluation and research. Lastly, Wang et al.
Overall, the literature reviewed demonstrates the multifaceted aspects of plant dyeing, encompassing indigenous knowledge, biotoxicity assessment, traditional practices, identification techniques, dyeing properties, and the potential for sustainable development and innovation in the textile industry. The literature reviewed demonstrates the multifaceted aspects of plant dyeing, encompassing indigenous knowledge, biotoxicity assessment, traditional practices, identification techniques, dyeing properties, and the potential for sustainable development and innovation in the textile industry. The potential for sustainable development and innovation in the textile industry.

3. Methodology

This study aims to analyze the communication value of digital media in promoting plant-dyed apparel products and explore the sustainability of plant dyeing in the textile field. The research methodology is to review and sort out the research progress in recent years on the types of dyeing materials, dyeing performance, additional functions, and dyeing technology of plant dyeing in the international textile field, to obtain the theoretical foundation and empirical research results in the related fields; and to apply the theoretical frameworks of design and fashion communication to explore the communication value and impact of digital media in promoting plant-dyed apparel products. Commercial brands and traditional craft brands are selected as cases of plant-dyed garments, and their development problems are analyzed in depth. And based on the SICAS model, an optimization scheme is proposed to provide specific methods and suggestions for the digital media promotion of commercial brands of plant-dyed garments and brands of traditional craftsmen.
Literature review: To summarize and sort out the research progress in recent years on the types of dyeing materials, dyeing performance, additional functions, and dyeing technology of plant dyeing in the international textile field, to obtain the theoretical basis and empirical research results in the related fields.
Theoretical framework: Using the theoretical frameworks of design and fashion communication, we explore the communication value and impact of digital media in promoting plant-dyed clothing products.
Case study: Commercial brands and traditional craft brands are selected as cases of plant-dyed garments, and their development issues are analyzed in depth. Relevant data and information can be obtained through data collection, interviews, and observation of the brands.
Application of SICAS model: Apply the SICAS model (Experience-Sense, Interest&Interactive, Connect&Communication, Purchase-Action, Share) to propose optimization solutions for the promotion of plant-dyed garment commercial brands and traditional craftsmen brands. We propose optimization solutions to provide specific methods and suggestions for the digital media promotion of plant-dyed clothing commercial brands and traditional craftsmen brands.

4. Results and Discussion (11pt Times New Roman)

4.1 Sustainability of plant-dyed garments

4.1.1 Sustainability Features and Advantages of plant-dyed garments

Plant dyes are dyes extracted from natural plant roots, stems, leaves, flowers, fruits, etc. The solid wastes after pigment extraction and utilization can be utilized for resource utilization through anaerobic fermentation and other treatments, and can be used as organic fertilizers, production of biogas, and breeding fertilizers, etc., and then acted on the plants or ecosystems, which are degradable and renewable, and the natural resources can be recycled to avoid the serious pollution problems of chemical dyes.
Plant dyeing mainly consists of direct dyeing, mordant dyeing, or multiple dyes compound dyeing methods, in the dye extraction, dyeing, product processing links do not add toxic and harmful organic dyes and auxiliaries, no need to use harmful heavy metal salts, the resulting wastewater does not have tritiated toxicity, easy to achieve harmless treatment through natural degradation, etc., with low environmental risks, reducing the waste and pollution of water resources.
Most of the plant dyes are herbs, in the dyeing process, pigments and other active ingredients are combined with fibers, so the dyed fabrics also have health care functions such as anti-bacterial and anti-inflammatory, anti-ultraviolet ray, anti-insects, moths and deodorization, etc. Due to the good adhesion between the plant pigment macromolecules and the cellulose or proteins, the current plant dyeing is mostly applied to the

natural or man-made fibers in the fabrics, so in the process of the plant dyeing products use Therefore, during the use of plant-dyed products, the dyes can be degraded naturally, which is less harmful to the environment.

4.1.2 Research Progress and Innovations in Plant Dyeing in the International Textile Sector

In recent years, in the international textile field, the research progress and innovation of plant dyeing have made important breakthroughs. The kinds of dyeing materials of plant dyeing have been expanded, and new dyeing materials with dyeing potential, such as violet, gardenia, ginkgo biloba, Hebei wood blue, camphor leaf, acacia, etc., also extend a new concept of "no waste dyeing materials", such as walnut skin, onion skin, lotus seed shells, shea kernels, etc. In-depth research on the dyeing properties of plant dyes, improve the dyeing effect and color fastness, such as the use of onion skin pigment for dyeing silk fabrics, the color fastness to soap washing reached 4, dry, wet friction color fastness to 5, respectively, 4.5 level. Make plant dyeing more feasible in practical application. Plant dyeing technology has also been innovated, including new methods of dye extraction: ethanol impregnation, ultrasonic extraction, microwave extraction, supercritical CO2 extraction, etc., and in-depth research in optimizing the dyeing process and the control of the dyeing effect, which further promotes the development of plant dyeing. This research progresses and innovations provide technical support and innovative ideas for the sustainable development of plant-dyed clothing products.

4.2 Communication value of digital media in plant-dyed clothing products

4.2.1 Changes in Consumer Behavior Patterns

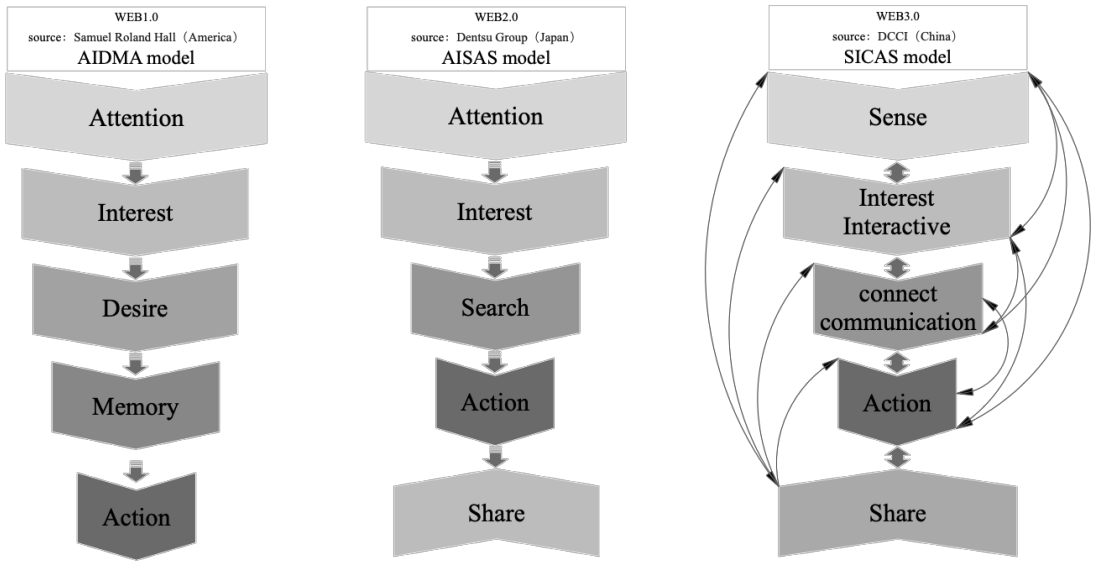
The emergence and development of the mobile Internet have greatly promoted the change of information media, the rise of social networks so that users gradually become the main body of sharing and publishing information, information dissemination pathway from the enterprise and the media one-way output to the user, the enterprise, the platform multi-dimensional interaction. In the process of consumption, changes in the way of information acquisition will inevitably lead to changes in user consumption behavior. In 1898, the American advertising scholar Arias Lewis In 1898, American advertising scholar Arias Lewis proposed the consumer action model called "AIDA", and in the 1920s, American marketing and advertising expert Samuel Roland Hall extended it into the AIDMA model in his writings, and the process of purchasing action is as follows: Attention - Interest - Desire - Memory - Action. - In 2005, Dentsu Japan proposed the AISAS model, which consists of Attention - Interest - Search - Action - Share. In 2011, China's DCCI proposed a digital consumption model for the mobile Internet era, the SICAS model, which consists of Sense - Interest&Interactive&Connect&Communication - Action - Share. - In 2011, China's DCCI proposed a digital consumption model for the mobile Internet era, the SICAS model, which consists of Sense - Interest&Interactive - Connect&Communication - Action - Share.

The traditional AIDMA model and AISAS model is a linear unidirectional marketing communication and consumption process driven by advertisements, while the SICAS model realizes bidirectional multi-dimensional real-time connection at all stages, so the autonomy and information processing ability of consumers are greatly improved, and enterprises can more accurately obtain the needs of consumers to provide better products and services; the change of the consumer behavior pattern highlights more The change of consumer behavior pattern highlights the main position of consumers.

SICAS Consumer Behavior Model is characterized by its user-centered approach, which meets users' diversified and personalized needs through the two-way flow of information; Sense - shaping brand image to attract users, and real-time sensing of users' demand orientation, according to which the business model can be adjusted; Interest&Interactive Interest&Interactive- Starting from the consumer experience, enterprises match or generate user interest through design to form effective interaction; Connect & Communication- Connecting enterprises, platforms, new and old users through the Internet to improve user retention; Action- Attracting users, satisfying experience and generating consumer interest through the Internet. Attract users, satisfy the experience to generate consumer willingness, tap the user's purchasing power; Share-let the user as the main body of the communication, through word of mouth to improve the experience process, expand the scope of users, forming a closed loop. The SICAS model focuses on the user experience process and interaction and sharing to form word of mouth, which makes consumers more active, real-time access to information and sharing with others, and enterprises can get timely feedback and share with others. The SICAS model focuses on the user experience process and interactive sharing to form word-of-mouth communication, which enables consumers to be more active, obtain information in real-time and share it with others, and enterprises can get feedback in time and optimize the communication process with users through product design and marketing. Applying this "multi-dimensional interaction" approach to the

marketing strategy of plant dyeing apparel brands will help to strengthen the public's understanding of plant dyeing and thus stimulate the endogenous motivation of sustainable fashion.

Figure 1. Consumer Behavior Model Variation Diagram



4.2.2 Digital media to promote the dissemination of plant-dyed garments

Digital media has a widespread influence in today's society and plays an important role in the promotion of plant-dyed clothing products. Through the digital media platform, brands and designers can communicate and interact with the target audience more directly and show the characteristics, advantages, and innovations of plant dyeing. The wide coverage and immediacy of digital media enable plant-dyed apparel brands to quickly disseminate information, attract users' attention, and provide more opportunities for display and promotion. In addition, through digital media, plant-dyed apparel brands can directly interact with consumers, for example, through social media platforms to carry out user participation activities, user-generated content, etc., to enhance the interaction and participation between users and brands.

There are rich sustainable concepts and traditional cultures behind plant-dyed garments, and digital media provides a platform for plant-dyed brands to display and spread their concepts and cultures. Through the diversity and interactivity of digital media, plant-dyed brands can use visual, textual, and audio forms to vividly demonstrate the historical origin, craftsmanship, environmental protection concepts, and the lifestyle of integrating with nature.

Digital media have had a significant impact on consumer awareness and purchasing behavior. Through rich information and interactive methods, it enables consumers to gain a deeper understanding of brands and products, including traceability of information on the production process, the origin of materials, and social responsibility. It stimulates consumers' empathy and identification, which in turn influences their purchasing decisions. In addition, through online shopping and user evaluation, and other functions, it collects user consumption habits and precise data information to further promote the sales and dissemination of plant-dyed clothing products.

4.3 Issues of design presentation and development of plant-dyed garments

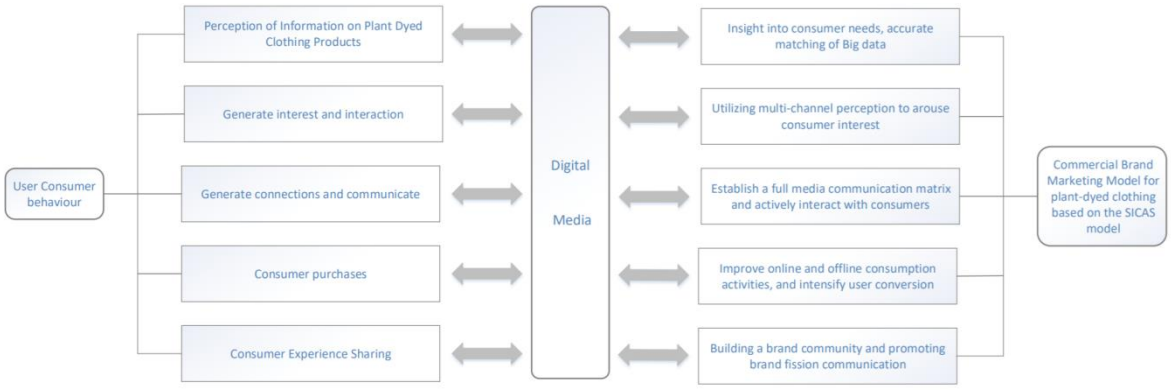
Commercial brands: apparel enterprises of a certain scale; with the prevalence of sustainable fashion, many brands and designers have started to focus on plant dyeing process with environmental protection characteristics; well-known apparel commercial brands offer plant dyeing series of garments: e.g., Dior 2020 spring/summer series uses plant heat transfer process to present plant texture patterns; Gaia Legend 2023 spring/summer series adopts handmade gradient plant dyeing process; designer brands with plant dyeing as the main line: e.g. Fragmentario, Uma Wang, Peng Tai, etc. The spring/summer 2023 collection of Gaia Legend adopts a handmade gradient plant dyeing process; Designer brands with plant dyeing as their main line, such as Fragmentario, Uma Wang, Peng Tai, and so on.

Existing development issues: Commercial brands are facing challenges in scaling up production and managing the supply chain, which is crucial to ensure the sustainability and quality of plant dyeing. They

need to highlight their uniqueness in the market competition, so brand positioning and differentiation strategies are issues that need to be addressed in development. There is also a need to face the impact of consumers' price perception and consumption habits on plant-dyed garments.
Traditional Handicrafts Brands: The core of traditional plant dyeing non-heritage artisan clothing brands is the inheritance and development of traditional plant dyeing techniques. These brands are usually founded by craftsmen with rich experience and professional skills, who are committed to preserving and passing on the traditional craft of plant dyeing and applying it to garment design and production. Examples include Ninghang Batik Museum, which is concentrated in Guizhou, China; Dingding Tie-Dye Art Museum in Zigong, Sichuan; and Puzhen Tie-Dye Museum in Zhoucheng, Yunnan.
Existing development issues: Traditional craft brands face the problem of balancing heritage and innovation in the digital media era. There is a need to keep up with consumer demands and market trends while maintaining traditional skills. They also need to face the challenges of supply chain stability and scale-up to ensure product quality and sustainability.

4.4 Optimization scheme based on the use of the SICAS model for digital media
4.4.1 Optimization of commercial brands for plant-dyed garments
Based on digital media, helps to expand brand awareness and exposure; the brand can interact directly with the target audience, share the brand's creative ideas, design concepts, and values, establish an emotional connection and brand identity; and attract the attention of potential customers and convert them into actual sales, thus increasing sales performance and market share.

Figure 2. Marketing strategy for a commercial brand of plant-dyed clothing based on the SICAS model

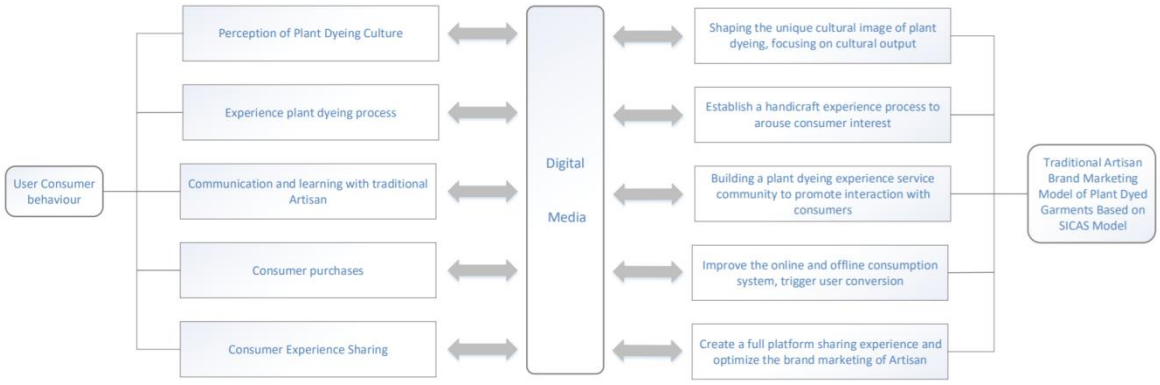


(1) sense-insight into consumer demand, big data precision matching: the basic principle of "user-centric", clear brand target audience groups, and through data analysis and market research and other means, to understand the user's interests, preferences, needs, and consumption behavior, and to establish labeled information management, to achieve personalized push.
(2) Interest&Interactive--Use multi-channel perception to arouse consumers' interest: Share the creation process of plant-dyed garments, interpretation of fashion trends, characteristics of plant-dyeing technology, brand concepts, etc. through digital media to attract the attention and interest of target audiences.
(3) Connect & Communication - Establishing an all-media communication matrix and actively interacting with consumers: Delivering the brand's story and image through digital media, emphasizing the uniqueness, quality assurance, and sustainability of plant-dyed garments, and utilizing social media platforms to interact with fans and potential customers, answering questions, and resolving doubts, to build emotional resonance with consumers. to build emotional resonance with consumers.
(4) Action-improve online and offline consumption activities to stimulate user conversion: actively develop online and offline activities to strengthen cultural and emotional exchanges between the brand and users, and improve the brand information on the official webpage: links to online and offline store addresses, business hours, and synchronization of promotional mechanisms, etc., to trigger user conversion.
(5) Share-Build brand community, promote brand fission communication: flexible use of social media, to build cross-platform brand community, is to encourage users to share and set up incentive mechanisms, timely discovery and use of key opinion leaders, to expand the brand influence and dissemination range; flexible use of consumer's private traffic, the second fission dissemination of brand concepts

4.4.2 Optimization of digital media for traditional handicraft signs

Based on digital media, helps to spread the cultural value of plant dyeing, to protect the traditional craft, and attract more young people to pay attention to and participate in the inheritance and development of the traditional craft of plant dyeing; it can break through the restrictions of the traditional sales channels to push the products to a wider market and expand the sales performance and influence.

Figure 3. Marketing strategy for traditional handicraft brand of plant-dyed garments based on the SICAS model



(1) sense- shaping the characteristic cultural image of plant dyeing and focusing on cultural output: telling the historical background behind the plant dyeing process, the experience of traditional craftsmen, and the uniqueness and sustainability of the product; a distinctive national brand image can enable consumers to obtain the national cultural heritage more quickly and clearly, and form a fixed cultural symbol.

(2) Interest&Interactive-establish craft experience process to arouse consumers' interest: share the teaching of craft skills, analysis of the production process and practical experience through digital media, and establish a complete online and offline experience process to attract users' interest in learning and practical participation.

(3) Connect & Communication-Build a community of plant dyeing experience services to promote interaction with consumers: Organize online or offline craft experience activities, exhibitions, and lectures through digital media, and build a community of experienced services to realize real-time communication between traditional craftsmen and users, and between users and users, so that consumers can more intuitively understand and experience the charm of traditional handicrafts.

(4) Action-improve the online and offline consumption system, trigger user conversion: establish dye color cards and pattern manuals, improve the design system of user DIY, and open up the product production and online and offline sales channels.

(5) Share-create a full-platform sharing experience and optimize brand marketing for craftsmen: actively broaden the user feedback platform through digital media and interact with users in real-time, motivate users to share the whole process of experience, improve the experience process through word-of-mouth dissemination, and secondly expand the exposure and influence of the brand, forming a closed loop.

5. Conclusion

Write your content here. This study examines the sustainability of a plant-dyed clothing product and analyzes the communication value of digital media in promoting this product. Based on the results of the study, the following conclusions and outlook can be drawn:

Plant-dyed garments are in line with the trend of environmentally friendly and healthy lifestyles and green and sustainable development of the textile and garment industry, and their sustainable development is one of the important trends in the current fashion industry. Digital media has great application prospects in plant-dyed clothing products. Through digital media, brands can more widely communicate the sustainability features and cultural values of plant dyeing, and effectively interact and communicate with target audiences. Digital media promotion can increase consumers' awareness and willingness to buy plant-dyed garments, thus promoting the growth of market demand and the benign development of brands.

In future research, the sustainable development of plant-dyed garments and the application of digital media promotion can be explored in depth in the following aspects: 1. Innovation of plant-dyed materials and technologies: research on the development and optimization of new plant-dyed materials, and exploration of more efficient and environmentally friendly plant-dyed technologies to improve the productivity and quality of plant-dyed garments. 2. Innovation of digital media promotion strategies: further research and exploration of Innovative strategies of digital media promotion in the field of plant-dyed garments, combined with emerging digital media technologies and trends, such as digital garments, meta-universe, etc. 3. Research on consumer behavior and awareness: To deeply understand consumer's knowledge, attitude and purchase behavior towards plant-dyed garments, and to explore the mechanism of digital media's influence on consumer's awareness and purchasing decision, to provide the basis for the brand to formulate a more accurate promotional strategy. 4. Interdisciplinary Interdisciplinary and cross-border cooperation: Promote interdisciplinary cooperation among design, fashion communication, environmental science, and other disciplines, as well as cross-border cooperation among brands, designers, and scientific research institutes, to promote the sustainable development of plant-dyed garments and the comprehensive innovation of digital media promotion.

Through in-depth exploration and practice of the above research directions, we can further promote the sustainability of plant-dyed clothing products and give full play to the role of digital media in the promotion, to make positive contributions to the green transformation and sustainable development of the fashion industry.

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Sustainable design of a plastic toothbrush: a case study of design for disassembling and materials recycling

Jacopo Mascitti[1] and Alessio D'Angelo[2]

[1] School of Architecture and Design, University of Camerino
[2] School of Architecture and Design, University of Camerino

[3] jacopo.mascitti@unicam.it

Abstract. Toothbrush is one of the most widely used oral care items in the world. Growing awareness of the environmental implications in the use of disposable toothbrushes has prompted all major manufacturers to develop "eco-friendly" products, whose approach is based on three different strategies: the use of biopolymers; the use of natural materials such as bamboo; or the use of replaceable heads. However, each of these solutions hides critical issues: most bamboo toothbrushes have mechanically anchored nylon bristles that cannot be disassembled and are vulnerable to early aesthetic degradation; biopolymer toothbrushes do not show significant lifecycle environmental benefits when compared to their traditional polymer equivalents; and toothbrushes with replaceable heads are often abandoned in use due to a perception of poor hygiene, which grows with time. Based on previous LCA analyses that highlight the potential environmental benefits of a fully recyclable toothbrush embedded within an economic scheme of recovery and reuse of its materials, the paper aims to describe the environmental redesign process of a plastic disposable toothbrush made through the multi-shot injection moulding process. The project is characterized by innovative technical and formal solutions that can improve the environmental performance of the product through the strategy of design for disassembling.

1. Introduction

Throughout history, various tools have been used to maintain personal oral hygiene. The toothbrush is one of the most used oral hygiene items, helping to remove debris from the mouth and keep it free of germs. The earliest toothbrush we have evidence of, used for more than 3,000 years, is the miswak or siwak, a tooth-cleaning stick made mainly from the root of the Salvadora persica tree. (Shirzaiy, Sarani and Bagheri 2016). The toothbrush as we know it is thought to have been invented in northern China in the 15th century and later imported to Europe by travellers. It consisted of a bamboo handle with boar hair attached to one end. However, the invention of the modern toothbrush is generally credited to an English merchant named William Addis, who made a bone and horsehair toothbrush in 1780. The first American patent for a toothbrush was filed by H.N. Wadsworth in 1857. In 1938, the introduction of nylon made it possible to produce the first toothbrush with plastic bristles: the Doctor West's Miracle Toothbrush. Since then, the formal and material evolution of this simple but essential product has basically come to a standstill. In fact, since 1954, the year in which the Broxodent mechanical wall brush was created, the evolution of the product's design has focused mainly on its mechanisation and, more recently, on its digital extension in the form of an information service (Bellis, 2021).

More than 3.5 billion toothbrushes are purchased each year. This market was worth USD 6.90 billion in 2022, with an estimated annual growth rate of 4.1% until 2029. Currently, the toothbrush market can be divided into two macro-types: the first is the manual toothbrush, with its typological and formal variations, which accounts for approximately 75% of the market share of toothbrushes sold each year (Fortune Business Insights, 2022); the second is the electric toothbrush, with all its functional variables and peculiarities.

Manual toothbrushes can be distinguished by five factors: shape of the brush head (rectangular, elliptical, and diamond-shaped); replaceability of the brush head (fixed or removable); hardness of the bristles (soft, medium, and hard); bristle layout (flat, slanted, wavy, and bunk); shape of the handle (straight, angled, offset, and angled offset). In addition, the handle may have silicone moulded parts to increase grip. Handles with grips are usually more ergonomically shaped to give a firmer grip when brushing and less wrist fatigue. Electric toothbrushes can be divided by: head shape (round or elliptical); type of movement (rotary,

oscillating, or pulsating); and speed of movement (sonic 200-400 Hz and ultrasonic up to 2,000 Hz). All have a large body to house the motor and batteries, and all have the possibility of changing heads. In addition to being larger, the handle is never different or more ergonomic in shape (Hovliaras et al., 2015).

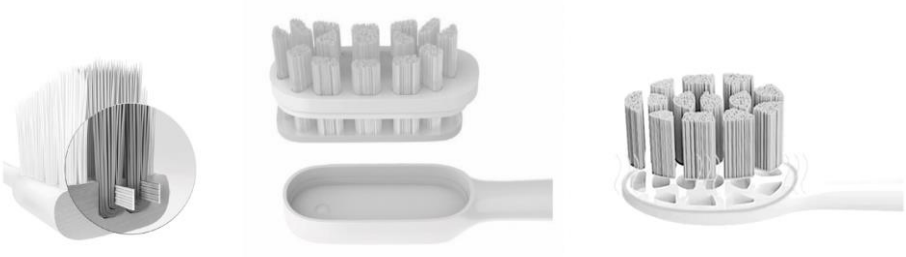
Toothbrushes can be further divided into three product categories: household, travel, and special purpose. Household manual toothbrushes are the most common on the market, aimed at users of all ages and used exclusively in domestic context. Their lifespan is closely linked to bristle wear and is generally around three months. Almost all electric toothbrushes fall into this category. Most toothbrushes in this category can be considered disposable, except for electric toothbrushes and manual toothbrushes with interchangeable heads, which allow the handle to be reused. Travel toothbrushes are formally and functionally related to the household typology but are characterised by their small size due to the use of compacting and folding strategies.

Often this type of product comes in kits with a basic amount of toothpaste for use while travelling. In some versions, the heads are pre-impregnated with toothpaste and do not need to be rinsed to meet the necessity of travellers who do not have access to a bathroom. Finally, special toothbrushes refer to specific contexts or categories of users, such as fingerbrushes for certain forms of disability, 360° bristles, for maximum security prisons, etc.

In terms of production, and considering only manual toothbrushes at this stage, there are two main aspects to consider: the material and production technology of the body, and the material and attachment technology of the bristles. The choice of material for the body is mainly determined by the type of product (disposable or with interchangeable heads), the expected duration of use and the area of application. Polypropylene (PP), polyethylene (PE), bamboo and silicone are the most used materials. Aluminium is also used for toothbrushes with only replaceable heads. Nylon is mainly used to produce toothbrush bristles and is currently the only alternative considering the basic factors of durability, stiffness control and production costs. However, there are alternatives such as boar hair, PBT and PLA, which are used for small market shares and niche products. Wild boar hair has been abandoned in favour of nylon, which is better at preventing bacterial proliferation and is less rigid, an essential factor in preventing corrosion of dental enamel and possible injury to gum tissue with consequent recession. PBT and PLA, on the other hand, show an accelerated loss of performance, reducing the product's service life.

In today's toothbrush manufacturing, the most common method used to anchor the bristles to the brush head is a technology called Traditional Tufting (TT). This process, which is usually fully automated to maintain a high standard of hygiene, consists of inserting the nylon bristles into the holes in the brush head and then clamping them with metal staples. In some of the most advanced processes, the tufting machine can fill 900 holes per minute, working with great precision. It is representing one of the most difficult and crucial steps in the innovation of this type of product. In addition to the TT technology, new bristle anchoring technologies are being optimised with the aim of eliminating metal staples, the critical aspects of the process. Over time, toothpaste creeps into the holes and meets the metal component, leading to increased bacterial growth and premature corrosion. This established technology has been joined in recent years by two others: Anchor-Free Tufting (AFT) and Pressure Tufting (PT). In AFT technology, the bristles are attached to a plate without metal staples. The plate is then joined to the body of the toothbrush. In this way, the product consists of two macro-components. PT technology is more recent and allows the bristles to be anchored to the toothbrush without the use of metal staples or plates. The steps in this process are to melt the end of the filament assemblies, insert them into the holes and press them in. The fused section is locked into the hole by expansion due to the pressure applied.

Figure 1. From left to right: TT, AFT and PT technologies.

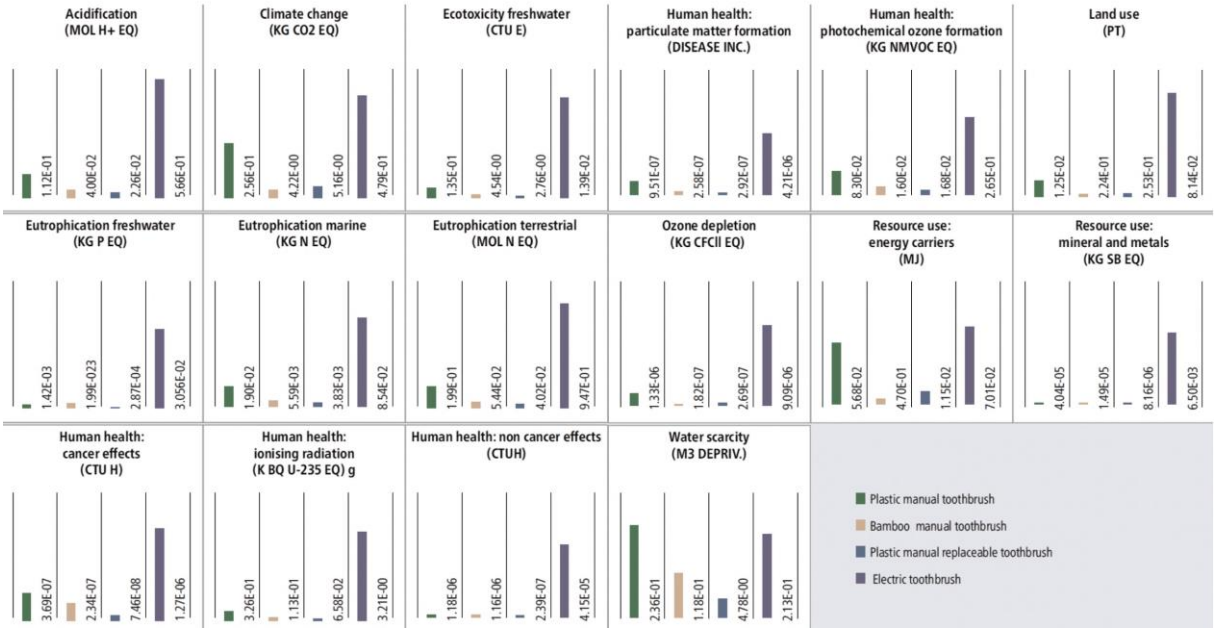


The growing awareness of the environmental impact of the use of disposable toothbrushes has led all major manufacturers to develop "eco-friendly" products based on three main strategies: the use of biopolymers, the use of natural materials such as bamboo, or the use of replaceable brush heads. However, each of these solutions hides critical issues and a Life Cycle Assessment (LCA) approach is required to consciously assess the environmental performance of the toothbrush.

2. Literature Reviews

Although the toothbrush is a widely recommended health care device worldwide, there is still little quantitative data available on its environmental impact. Two life cycle assessments (LCAs) of this type of product have now been carried out, funded by the Eastman Dental Institute of University College London (UK) in partnership with the Dental University Hospital of Trinity College Dublin (Ireland). The first study (Lyne et al., 2020) considered four types of toothbrushes: plastic manual, bamboo manual, plastic manual with replaceable head, and electric. The LCA was conducted from cradle to grave, i.e. from production to disposal. The functional unit was defined as the individual use of a toothbrush over a time of five years, the usual battery life of an electric toothbrush.

Figure 2. LCIA results (Lyne et al., 2020).

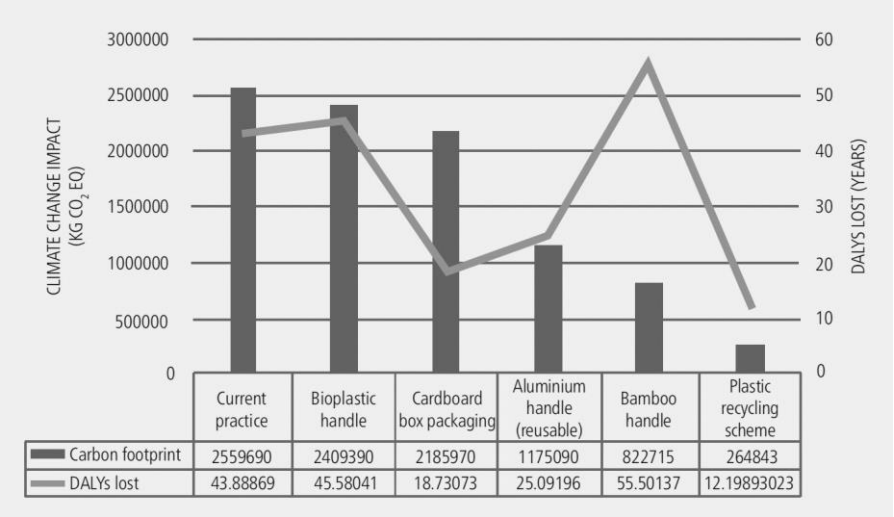


The results of the study show that the electric toothbrush has the highest impact in all categories except water scarcity. The plastic toothbrush with replaceable head and the bamboo toothbrush have the lowest impacts in 11 and 5 of the impact categories respectively. The material used is the main contributor to the environmental impact of the plastic manual toothbrush and the one with replaceable brush heads. PP, used for the handles, was the largest contributor for these two types of toothbrush (37% and 33% respectively). The electric toothbrush was the heaviest product at 1.42 kg. The largest contributor to the total impact was transport (47%), followed by materials (46%).

This comparative LCA showed that a plastic replaceable head manual toothbrush and a bamboo manual toothbrush perform better than both traditional plastic manual toothbrushes and electric toothbrushes in each of the impact areas considered in this study. The study shows that the best environmental performance is currently achieved by the toothbrush that rationalises the use of material, i.e. the toothbrush with a replaceable head, or changes the origin of the material, i.e. the bamboo toothbrush. The electric toothbrush has the highest impact, as the impact of the numerous components must be added to the impact of the battery and the use phase. However, the study makes some assumptions that should give us pause for thought. The first is that the motorised body of the electric toothbrush is used by a single user and is disposed of after five years. Instead, the possibility of sharing the motorised handle should be considered and a reduced battery life due to increased recharging cycles should be evaluated. The second assumes that the nylon bristles of the brush head and the associated metal staples are removed from the bamboo brush. This seems impractical in real life, as the authors themselves state.

In the same year, the authors carried out another interesting study that highlighted and deepened specific aspects of the previous work (Duane et al., 2020). The same LCA methodology was used, following the EU Product Environmental Footprint guidelines. The aim was to model the best possible toothbrush using two assessment parameters: DALYs (disability-adjusted life years) and carbon footprint. One DALY represents the loss of the equivalent of one year of full health. DALYs for a disease or health condition are the sum of the years of life lost to due to premature mortality (YLLs) and the years lived with a disability (YLDs) due to prevalent cases of the disease or health condition in a population. (World Health Organization, 2023). Starting with the standard manual toothbrush, the study considered four types of handle material: bioplastic, bamboo, aluminium, and recycled plastic. Only for the aluminium toothbrush was the possibility of replacing the brush heads with bristles considered.

Figure 3. Toothbrush modelling results for climate change impact and DALYs (Dune et al., 2020).



All scenarios considered show an overall improvement in the carbon footprint compared to current production, but the results for DALYs vary widely. Using bioplastics instead of PP only improves the carbon footprint by 6% and increases DALYs by 4%. Using bamboo handles reduces the carbon footprint by 68% while increasing DALYs by 26%. The optimal balance between the two values is expressed by the fourth, ideal model, which uses a plastic recycling scheme and expresses a 90% and 72% improvement respectively. In this model, the nylon bristles have the greatest impact, accounting for 90% of the carbon footprint. However, the toothbrush with the recycled plastic handle requires the manufacturer to take responsibility for the recovery and recycling of the toothbrush.

This study shows how a toothbrush made from recycled plastic in a circular system is the environmentally preferable option that results in the least loss of DALYs. In the win-win scenario, the manufacturer would have to provide a logistical facility to collect used toothbrushes and their packaging. Nylon bristles, for which there are no marketable alternatives, and degraded plastic would be removed and disposed of and replaced with an estimated 10% virgin plastic.

The LCA, which complements the first one, shows how the bamboo toothbrush loses effectiveness when considering DALYs together with the classic environmental impacts. This is due to its high water consumption, which drastically increases its DALY. The best compromise is therefore a toothbrush that uses a circular material scheme, assuming that it is possible to collect most of the used toothbrushes. Furthermore, in this LCA, the plastic toothbrush with replaceable head, which performed well in the first LCA, is replaced by a toothbrush with replaceable head and aluminium handle, which has a higher production impact than PP. It is assumed that the reason for analysing such a brush, which is not explicitly stated by the authors, is probably due to less aesthetic degradation of the aluminium handle. Less aesthetic degradation also means a greater likelihood that the user will not feel the need to replace it soon. In fact, the aluminium handle was assumed to have a lifespan of 20 years, which is highly unlikely in actual use conditions.

To conclude the reflections suggested by the two studies mentioned above, and to extend the analysis also to the perceptual and cultural aspects that condition the use of toothbrushes, we can state that:

- common bamboo toothbrushes employ nylon bristles attached by staples that prevent their disassembly and material recovery; they are subject to early aesthetic degradation due to the biological nature of the material, more easily attacked by fungi and bacteria, which can be limited with additional finishing processes whose impact is, however, to be assessed; the shape of the toothbrush is almost always very simplified in order to optimise the use of the material and reduce production time, with a consequent reduction in the ergonomics of the product;
- biopolymer toothbrushes do not show significant lifecycle environmental benefits when compared to their traditional polymer equivalents;
- toothbrushes with replaceable heads perform well overall, but in real-life use have shorter replacement times than expected and are often abandoned due to a perceived lack of hygiene, which increases over time; within the life cycle environmental assessment, the impact due to the necessary handle sanitisation processes that are required each time the brush head is replaced should also be considered;
- the electric toothbrush is the product type with the highest impact, without demonstrating significant benefits in terms of dental caries or periodontal disease prevention compared to its manual counterparts (Lyne et al., 2020).

3. Phases and Method of Design Research

Based on the results proposed by the above-mentioned LCA studies, which highlight the potential environmental benefits of a fully recyclable disposable toothbrush placed in an economic scheme of recovery and reuse of its materials (Ellen MacArthur Foundation, 2017), this paper describes the environmental redesign process of one of the most widespread and pervasive mass market products: the plastic disposable toothbrush made by the multi-shot process.

The project, developed within the School of Architecture and Design of the University of Camerino (Italy) as the final work of the student Alessio D'Angelo (supervisor Prof. Jacopo Mascitti), is characterised by technical-formal solutions capable of improving the environmental performance of the product through the DfS strategy of disassembly. The solution developed maintains the functional, aesthetic, and ergonomic qualities of the traditional product, but at the same time allows the end user to disassemble the toothbrush easily and intuitively at the end of its life, solving the key problem of removing the nylon bristles.

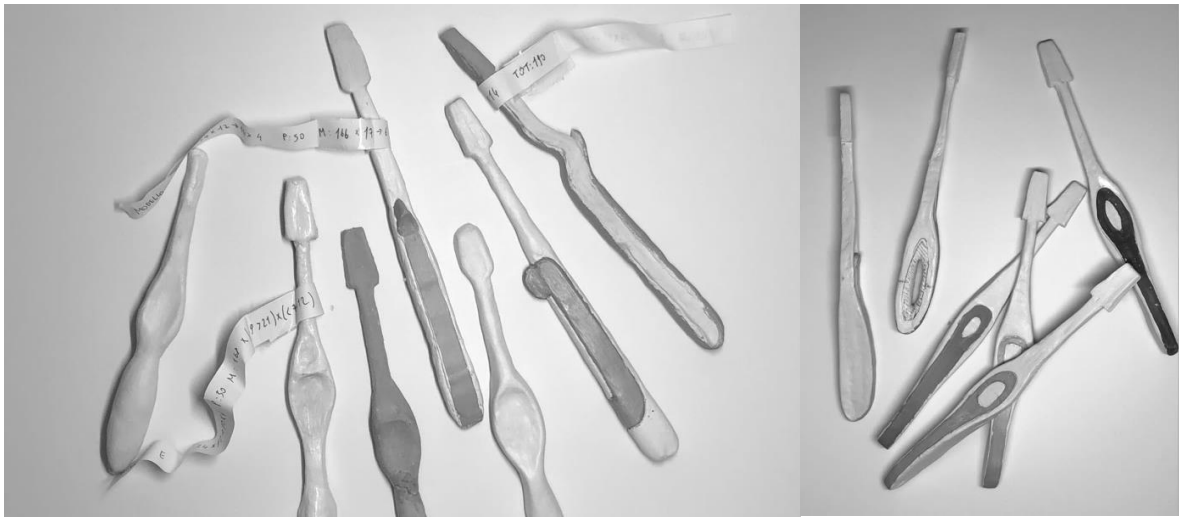
The methodology adopted to achieve the intended objective consisted of six macro-phases: (i) morphological and ergonomic analysis of a representative group of manual toothbrushes; (ii) definition of priority criteria for design development in response to the objective of increasing the environmental sustainability of the product and the circularity of materials; (iii) development of product concepts and production of study and verification models; (iv) identification of materials and production processes (body and bristles) in line with the project objectives; v) design development through the creation of virtual models of the product and production moulds; vi) final prototyping. In the first phase, ten toothbrushes were considered, selected on the basis of specific characteristics such as overall size, shape and angle of the handle, shape of the head, and ergonomics of the grip points.

Figure 4. The ten toothbrushes considered in the first phase of the research.

The first phase of research helped to define the optimal product size, handle shape, and head angle and shape. At the same time, the knowledge gained from this phase is being used to investigate priority design intervention strategies to improve product performance in terms of material circularity.

In the second phase, priority design development criteria were defined on which to base the development of the plastic disposable toothbrush concept capable of optimising the disposal and recycling phases. The main strategy considered was Design for Disassembling (Vezzoli and Manzini, 2008, p. 181). At the same time, it was decided to enable the end user to separate the components and eliminate the equivalent industrial process. Particular attention was paid to reducing the material used and rationalising the shape while maintaining correct ergonomics. The industrial processes considered were Pressure Tufting bristle anchoring technology without metal staples and co-moulding for the entire toothbrush.

Figure 5. Study models made during the third phase of the project.



The third phase led to the creation of seven different concepts which, thanks to different technical solutions, made it possible to disassemble a traditional plastic toothbrush into its different material components and to separate the handle from the bristles. The design phase of the new product was supported by the creation of 15 study models, which allowed the optimisation and verification of the different design solutions that were hypothesised and then incorporated into the final solution.

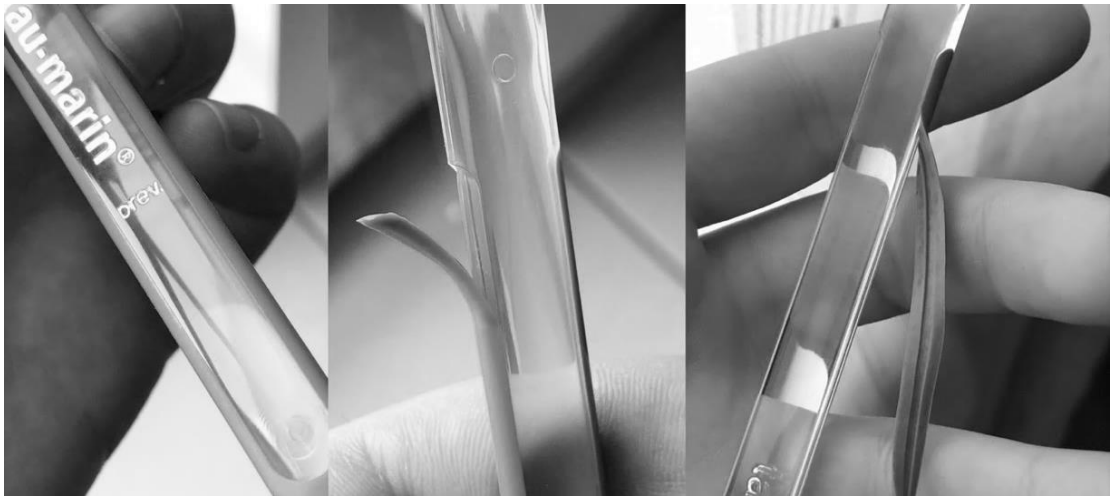
The choice of material and production technology in the fourth phase was influenced by one of the case studies investigated in the first phase of the project. In general, co-moulding is a production technique for plastic products that is avoided in the context of sustainable design because it creates a bond between two different materials, making any hypothesis of recycling futile, regardless of whether one or both are recyclable. In fact, once melted, they must be considered as a single material that cannot be recycled because the two basic materials, although compatible, do not have the same chemical properties, which has a negative impact on the disposal phase. It is not surprising that this technique is widely used in the world of toothbrushes, as most toothbrushes cannot be recycled because the bristles are attached to the head with metal grafts.

The toothbrush from the Italian company Tau-Marin was of particular interest. It was developed in the 1970s in collaboration with the designer Gabriele Stocchi. Its peculiarity lies in the scaled cut of the bristles. However, it was the co-molding of the toothbrush that attracted attention, as it exhibited a peculiar behaviour unlike any other toothbrush on the market. In fact, by applying moderate force to the soft flap on the side of the handle, it was possible to remove it without too much difficulty, without leaving any residue and without breaking the component. This dynamic was certainly not anticipated by the company or the designer, and was therefore not included in the product communication. On external analysis, the dynamics could be determined by a few concomitant factors:

- the mould used to produce the handle must have been highly polished to give the component a shiny finish and make the surface less rough;

- the materials used for co-moulding (probably cellulose acetate for the handle and EPDM for the grip part) have a poor chemical compatibility, so that a chemical bond cannot be established and the two parts can be separated.

Figure 6. Tau-marin toothbrush and the soft flap peeling defect.



The fifth and sixth phases of the project involved optimising the design idea with the help of the Italian toolmaker Meccaniche Broemi and producing the final prototype.

4. The disassemblable toothbrush Ri-Brush

Ri-Brush is a disassemblable and recyclable plastic toothbrush that is proposed as a simple and inexpensive solution to fit into today's still niche market of environmentally sustainable toothbrushes. The project is based on the idea of a product that can easily and effectively respond to a recycling scheme for its materials, which can be activated by the end user. The product is essentially made up of two parts: a rigid structural body and a soft cover in which the bristles are embedded.

Figure 7. The Ri-Brush toothbrush.

As seen in the Trinity College LCA study, a toothbrush that adopts a recycling scheme appears to perform better environmentally than all other types of toothbrushes. In that analysis, however, the ideal toothbrush using the recycling scheme did not have the possibility to be disassembled. This theoretically makes the developed design even more environmentally efficient than the toothbrush hypothesised by the research, as the industrial phase of product disassembly must be subtracted. Inspired by the dynamics observed in the Tau-Marin toothbrush, the product is made of two materials (PS and TPE-U) whose chemical compatibility

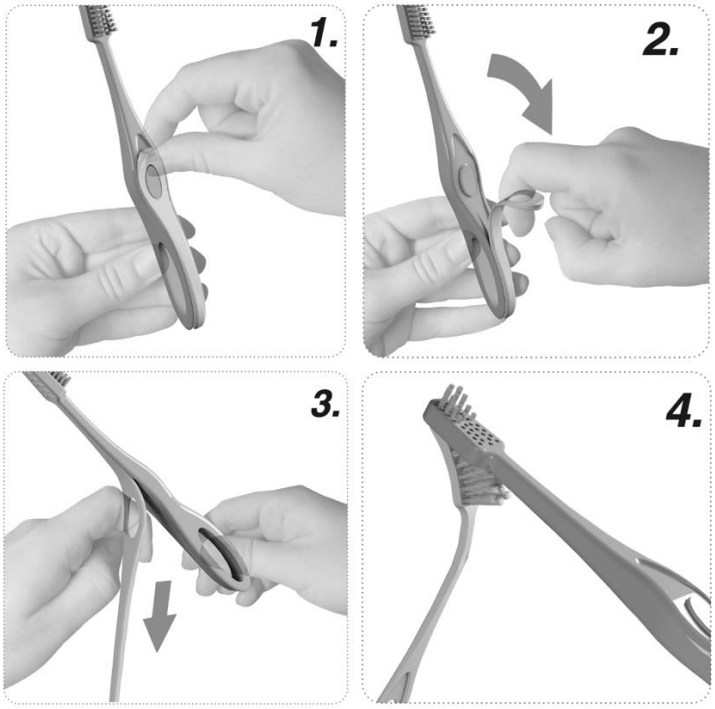
during co-moulding is limited and therefore reversible. The product has a total weight of 23 grams, including the nylon bristles.

The disassembly process can be divided into four steps:

- Insert the finger into the tab on the front of the product and peel it off;
- when the first ellipse is reached, use the hole to insert the finger and continue peeling with more force;
- Use the second hole to continue peeling the back soft part up to the head;
- once at the head, continue peeling until the handle comes off completely, taking the bristles with it.

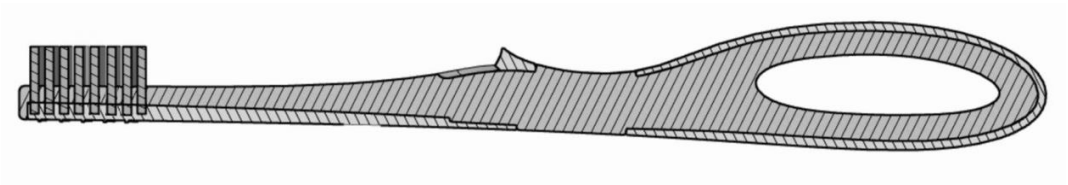
The hole in the handle has the dual function of reducing material consumption and providing a firm grip during the process of separating the handle from the body. Once the disassembly process is complete, the two components can be recycled separately.

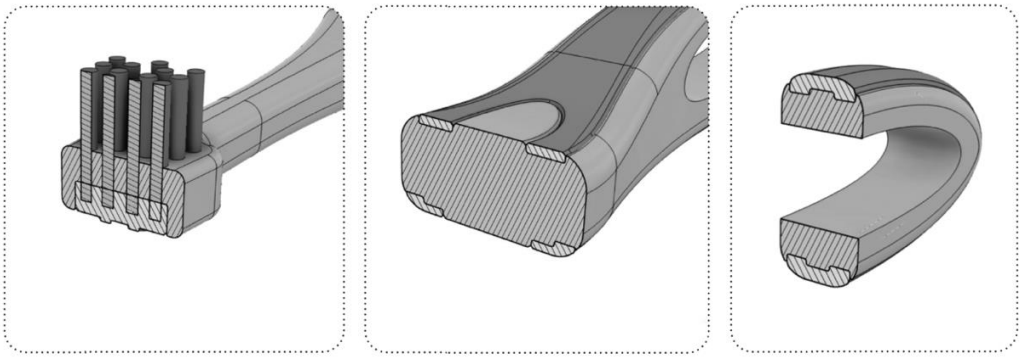
Figure 8. The four phases of disassembly process.



The PS handle, which accounts for about 80% (18 grams) of the product, can be disposed of in the plastics collection. The grip with the bristles undergoes a final process: the detachment of the head from the rest of the component. In this way, 3 of the 4 grams of TPE-U can be recovered and recycled. The remaining 2 grams of product material, i.e. the nylon bristles and the TPE-U they are anchored to, are discarded.

Figure 9. Longitudinal and cross section of the Ri-Brush toothbrush in which the TPE-U grip and welded nylon bristles are visible.





Ri-Brush has an ergonomic shape that easily adapts to the user's hand. Its development is based on the need to modulate the thickness of the handle and the soft grip according to the new feature of disassembly. The image above shows the longitudinal section of the toothbrush. In the areas where the brush becomes narrower, the thickness of the soft grip increases to prevent it from tearing during disassembly. The opposite occurs where the width increases and the thickness decreases.

In terms of bristle engagement technology, we opted for the PT discussed in the previous paragraphs. This is the only technology that meets the design requirements. The bristles are welded directly to the soft TPE-U part and become an integral part of it.

5. Conclusion

The paper presented the methodological process that, through the priority application of the Design for Disassembling strategy, typical of the Design for Sustainability (DfS) approach, led to the development of a new concept of a disposable and disassemblable plastic toothbrush, characterised by the use of co-moulding technology. The objective was to follow the design hypothesis proposed by Dune (2020) and his research group for a toothbrush that would adhere as closely as possible a pattern of recovery, recycling, and reuse of its materials. The decision to work on a plastic toothbrush produced using multi-shot moulding technology was driven by the desire to develop a product that could have a significant impact, in absolute terms of the number of products sold each year, on the issue of reducing the environmental impact of this common type of product. Based on what has been discussed and referring to similar commercial products, the advantages of Ri-Brush can be summarised as follows:

- the rationalisation of different polymer used for the production of the toothbrush, thanks to a new structural layout that allows the two main components of the product (body and soft grip + bristles) to be easily separated;
- the possibility of eliminating the critical component of the product (the bristles) in an extremely simplified way, allowing the recovery of more than 90% of the toothbrush material;
- a new, simple and effective strategy of user and product interaction allows the soft grip to be separate from the rigid body of the product at the end of the use phase;
- the possibility for the product to be returned directly to the plastics recycling chain by the end user, as an alternative to the costly product recovery and material reuse model proposed by the above study.

In conclusion, the methodological approach of the DfS, together with a design reinterpretation of the criticalities and opportunities offered by the consolidated technology of multi-shot plastic moulding, has allowed the development of a new concept of a more sustainable and circular disposable toothbrush. The main innovation driver of the new product is not the simple substitution of the polymer material with a natural one, whose technical specifications often require a reduction in the performance of the product, both in terms of ergonomics and hygiene, but an original approach to the initial problem (maintaining the co-moulding technology) and the consequent formal reinterpretation of the product. Once again, the significant results obtained demonstrate the innovative potential that DfS offers to designers and companies interested in developing products with high functional, environmental and economic performance, opening up the scenario for further promising development of this specific typology.

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Practice and Enlightenment of Built Heritage Conservation and Sustainable Reuse in Singapore

WEI Xintong[1 2 3], ZHOU Haoming[1 3], ZHANG Yao[1 3] and YANG Dazheng[4]

[1] Academy of Arts & Design, Tsinghua University, China
[2] Department of Architecture, National University of Singapore, Singapore
[3] Institute of Sustainable Design, Art and Science Research Centre of Tsinghua University, China
[4] School of Architecture, Yantai University, China
[1] weixt20@mails.tsinghua.edu.cn

Abstract. Built heritage is important for maintaining the identity of residents, sustaining social cohesion and promoting sustainable urban development. The experience behind Singapore's lack of a hinterland and its late start in heritage conservation is worth learning from its success in the sustainable reuse of built heritage. This study reviews the history of heritage conservation in Singapore since the 1960s, and unpacks its institutional policies, conservation framework and practices. It also uses the NUS ArClab, a built heritage site in the Blair Plains Conservation Area, as a case study to explore its key strategies for sustainable reuse, which include rational transformation of functions, enhancement of residents' identity, new technology-assisted renovation and climate-resilient adaptation. This study argues that the establishment of a multi-party collaborative built heritage management system framework, the promotion of public participation in heritage protection in historic districts, and the integration of tangible and intangible heritage are the keys for Singapore's built heritage to promote sustainable urban development.
Key words: built heritage, Singapore, heritage conservation, sustainable reuse, NUS ArClab

1. Introduction

Built heritage is the carrier of urban history, culture and social memory. The protection and reuse of built heritage is of great significance for maintaining residents' identity, maintaining social cohesion, and promoting sustainable urban development.

Due to the lack of hinterland, how to efficiently use land is particularly important for Singapore. Therefore, the Singapore government proposed a land use planning method combining low-density historical blocks and high-density development projects at the early stage of planning, creating today's urban regeneration approach that juxtaposes skyscrapers with historic conservation areas (Center for Liveable Cities Singapore [CLC], 2019). Despite the late start of heritage conservation in Singapore, which was not included at the national policy level until the 1980s, the system for heritage conservation in Singapore is mature, well-targeted and effective (Li et al., 2022). Today, Singapore has over 7,200 heritage buildings and 73 national monuments (Urban Redevelopment Authority [URA], 2019).

This study sorts out the different stages of Singapore's heritage protection work, relevant laws and regulations, strategies and experience, and uses NUS ArClab as a research case to explore its sustainable reuse methods, providing theoretical reference for urban heritage protection and sustainable development.

2. Theoretical foundations

2.1 The concept of built heritage and sustainable reuse

As part of the tangible cultural heritage, 'built heritage' refers to monuments, groups of buildings and sites that are of outstanding universal value from a historical, artistic or scientific point of view as cultural heritage (United Nations Educational, Scientific and Cultural Organization [UNESCO], 1972). Built heritage defines a sense of place, a community identity, and promotes a sense of belonging and national pride among its inhabitants.

With the development of society, when the original functions of the built heritage no longer adapt to the new situation, it needs to be revitalized and utilized to promote urban renewal and development. Today, it is

internationally recognized that the reuse of built heritage must follow the following 3 principles. (1) Integrity: not only to protect the architectural cultural heritage itself but also to protect its overall environment, so as to reflect the original features of history (UNESCO, 1977). (2) Authenticity: on the premise of protecting the safety of the ontology, the degree of intervention on the heritage should be reduced as much as possible, and the creation of the scene atmosphere should restore the real history (International Council on Monuments and Sites [ICOMOS], 1994). (3) Sustainability: Combining regional characteristics and human environment, formulate innovative revitalization and utilization schemes so that they can continue to function in today's society (UNESCO, 2005).

2.2 General theory of sustainable development

Despite the fact that sustainable development is an integrated issue involving complex economic, social and environmental elements, two key principles are recognized in mainstream research today: the use of holistic planning processes and the active involvement of multiple stakeholders in the planning process (Landorf, 2009). The heritage field has struggled to embrace the concept of sustainable development since the World Heritage Convention in 1972 (UNESCO, 1972). With the attention of governments, the awakening of public participation and the improvement of multidisciplinary research systems, built heritage has begun to focus on the reconciliation of multiple interests, the holistic conservation of tangible and intangible heritage, and the integration of urban regeneration with urban economic, social and environmental objectives in the pursuit of sustainable development. The guiding principles of sustainable heritage development include: putting people first (ICOMOS, 1987), cultural heritage integrity (UNESCO, 1996), multi-stakeholder participation, and encouraging public participation (TICCIH, 2012).

2.3 How built heritage contributes to sustainable urban development

Specifically, in today's urban development process, heritage is seen as an engine and catalyst for socio-economic development and a link between the cultural, social and economic environment (Loulanski, 2006). According to Graham's theoretical framework (Graham et al., 2000), heritage contributes to sustainable urban development in terms of spatial use, economic growth and cultural image. Specifically, tangible heritage (buildings, landscapes) can act as a catalyst for urban regeneration, leading to tourism and economic benefits for the whole area, in addition, built heritage can be an important force for social development by providing opportunities for heritage education for citizens as a venue for public events. Intangible heritage, on the other hand, can form cultural and creative industries that shape the name of the city (Shi, 2022). Heritage festivals and large-scale artistic events often play an integral role in the development of cities as a means of developing civic identity and shaping a positive image of place.

3. Experiences and practices of heritage protection in Singapore

3.1 History of heritage protection in Singapore

From the early days of national monuments, to the preservation of regional and historic sites, to the emphasis on identity, built heritage conservation has become an integral part of Singapore's urban planning. From the 1960s to the present, heritage conservation practice in Singapore has gone through various stages.

3.1.1 Origins: 1960s-1970s, why conservation

In the 1960s, Singapore was faced with a severe shortage of housing and office space, and the need to 'build and renew' the city was pressing. To address this, urban regeneration efforts at the time focused on slum clearance, housing development and the complete redevelopment of central Singapore to transform the city into a modern commercial, financial and tourist center.

Long before the regeneration, when Erik Lorange, a UN urban planning expert, was invited to review Singapore's first master plan in 1963, he spoke to the Urban Renewal Team about the need to preserve the city's heritage and suggested that the principles of urban renewal in Singapore could be summarized as Conservation, Rehabilitation and Rebuilding (CLC, 2019). In 1971, the Preservation of Monuments Board (PMB) was established, reflecting a growing awareness of the value of conservation. Through the Preservation of Monuments Act, the government recognized the need to preserve buildings of historical and architectural significance in Singapore, while the PMB was appointed as the authority to recommend to the Ministry of National Development (MND) sites and monuments in need of conservation. 1970 saw the renovation of a number of old buildings for re-use by the Singapore government.

3.1.2 Formative Years: 1980s, both development and protection

In the 1980s, Singapore began to try to propose protection measures on a larger scale, and took the following actions. (1) Formulating a protected area plan after comprehensive research. After years of strategic planning, the URA launched its first exhibition of the Central Area Structure Plan in 1986. The Plan, which became the first Conservation Master Plan, spanned seven conservation areas and about 3,200 shophouses were conserved under it, marking the beginning of a new stage of Singapore's conservation efforts, one that would progress hand in hand with urban development (CLC, 2019). (2) Implementing demonstration projects. In 1987, with the assistance of French experts, URA promoted 9 Neil Road and 53 Armenian Street as demonstration projects for the restoration of shophouses, and their successful restoration has inspired people in the Tanjong Pagar area to take up conservation. (3) Stimulating the tourism value of urban heritage. In the 1980s, the Singapore government came to recognize the potential value of heritage conservation in building a unique national identity and its contribution to tourism, and actively built consensus to promote heritage for urban tourism. (4) Working with property owners to allow adaptive reuse and a mix of old and new. During the 1980s, the URA has gradually moved from being a direct implementer of redevelopment projects to being a planner and facilitator of urban renewal, supporting the efforts of private owners, maintaining partnerships with them and gaining wider political and community support for conservation.

3.1.3 Turning point: 1990s, more detailed conservation

Throughout the 1990s, the focus of urban regeneration in Singapore has been on deepening the conservation of conservation areas that meet international standards. In addition to historic districts, conservation efforts were extended to other areas, including bungalows and secondary residential areas (CLC, 2019). In addition, with the development of tourism and to meet the demands of modernization, extensive infrastructure work has been carried out in the historic districts. Specific measures include (1) mixing the high and the low: allowing high-intensity and high-rise development around the district, and a different set of guidelines for the conservation of buildings outside the city center. (2) Flexibility in conservation policy: the Conservation Master Plan consists of five phases, each focusing on a different area and building type. (3) Motivation of the private sector: URA gives the private sector a leading role in conservation efforts, raises public awareness of conservation, and develops guidebooks and provides the necessary infrastructure.

To raise the quality of restoration and the standard of conservation work, the URA established the Architectural Heritage Award (AHA) in 1995 to recognize excellence in restoration work (CLC, 2019). To date, the AHA remains an important platform for inspiring professionals and communities to take an interest in restoring buildings.

3.1.4 New development: 2000s, development of necessary infrastructure

As the URA entered the new century, it embarked on the improvement of the living environment. The two main measures included the following (1) Modernization of the infrastructure to modernize the historic district, including the construction of back alleys, securing water supply and fire escapes, the creation of carparks and incentives for businesses to set up shop. (2) In order to balance 'fire code safety' with 'maintaining the integrity of historic buildings', the URA has adopted a compromise approach by setting different guidelines for protected buildings in historic districts and secondary residential areas, with the former having stricter guidelines.

One of the more successful examples is the Clarke Quay renovation project. Once a warehouse district, Clarke Quay was transformed into a commercial area as it entered the new century. To attract the public, conservation planners improved basic transport facilities to enhance accessibility and introduced modern shading structures to eliminate the adverse effects of the hot climate, eventually transforming the historic district into a lively nightlife area on the Singapore River. The infrastructure improvements went beyond the preservation of individual buildings to drive the development of the entire historic district, while also building private sector confidence in heritage conservation.

3.1.5 Public Engagement: 2010s-: Intangible Heritage and Greater Public Engagement

As a large number of historic buildings have been conserved, restored and adapted for modern use, public attention to heritage conservation has shifted to the cultural dimension. In 2010s, heritage conservation in Singapore began to focus on the important value of landmarks to the identity of local residents and collaborated with local communities to organize various cultural heritage related arts and cultural outreach activities.

Another notable feature is the changing expectations of the public, who are increasingly interested in participating in heritage conservation efforts. As early as the Concept Plan Review exercise in 2000, the URA invited interest groups, academics, businesses, students and grassroots people to participate in discussions on land use issues in Singapore. Into the 2010s, the URA stepped up public education on heritage conservation, promoting public participation and strengthening collaboration with individual property owners. Community engagement has grown to become an important force in heritage conservation efforts.

3.2 The Institutional Framework for Heritage Conservation in Singapore

3.2.1 Types and distribution of heritage in Singapore

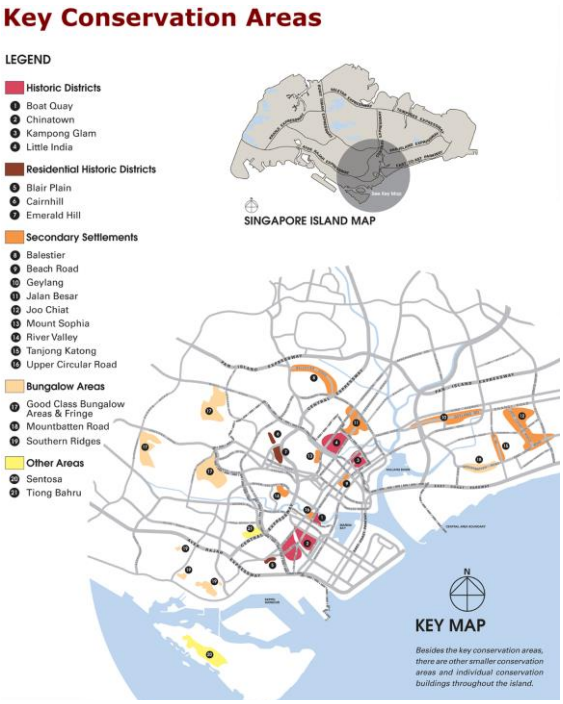
At this stage, Singapore's built heritage area group is divided into the following four main components (URA, n.d.). (1) Historic Districts. This includes Barge Quay, Chinatown, Kampong Glam and Little India. The buildings of the Historic District, with their diverse facades, rich ornamentation and varied architectural styles, have shaped a unique regional setting for which the URA has designated strict conservation guidelines to maintain the overall low-rise scale and fine-grained urban fabric. The buildings within these historic districts can be used for a variety of purposes, including commercial and residential. (2) Residential Historic Districts. Including Blair Plain, Cairnhill and Emerald Hill, the historic buildings in this area are predominantly two and three storey shophouses with a low urban form that contrasts with the new modern high-rise buildings that surround them. Conservation work in this area is based on the '3R' principle of maximum Retention, sensitive Restoration and careful Repair (URA, n.d.). (3) Secondary Settlements. Including Jalan Besar, Beach Road, River Valley, Geylang and Joo Chiat. (4) The Good Class Bungalow Areas and the Mountbatten Road Conservation Area. The Singapore Bungalow was built by the British in the 1830s and is usually a one- or two-storey detached dwelling unit located away from the hustle and bustle of the city or in a wooded environment.

3.2.2 Singapore's heritage conservation laws and regulations

Singapore's built heritage is protected by two laws: the Planning Act (1998) and the Preservation of Monuments Act (2009), which covers over 7,200 heritage buildings in Singapore (ICOMOS SG & URA, 2017).

The vast majority of Singapore's built heritage consists of shophouses and bungalows, which are classified as protected buildings under the Planning Act. The Act sets out the rules for all construction, renovation and demolition work in the city-state, while the URA has issued 'conservation guidelines' to provide guidance. Under the Preservation of Monuments Act, sites of greater social, historical or religious significance are classified as national monuments, and there is currently a cumulative list of 73 protected monuments in Singapore (ICOMOS SG & URA, 2017). In addition, the PSM also has a set of technical guidelines that serve as advisory notes relating to the conservation, repair, maintenance and management of monuments.

Figure 1. Key conservation areas



3.2.3 Tangible heritage: conservation systems, restoration guidelines

Following the government's decision that the conservation of built heritage should be supported, the URA was officially appointed as the national conservation authority (URA, 2019) in 1989.The main tasks of the URA in heritage conservation are: (1) Planning and research: the URA identifies and recommends buildings of historical, architectural and cultural value for conservation. (2) Promotion and coordination: the URA encourages the participation of the private sector in conservation schemes through pilot projects, site sale schemes and environmental

improvement works in conservation areas. (3) Regulations: URA provides the legal framework for conservation work and guides owners and professionals in their conservation efforts. (4) Consultation: URA consults professionals and owners of conserved buildings before formulating policies and guidelines. (5) Promotion: URA strives to promote conservation and ensure quality restoration by sharing appropriate restoration methods with professionals and owners of conserved buildings. in 2017, URA collaborated with ICOMOS to produce eight technical manuals to promote heritage conservation education efforts (ICOMOS SG & URA, 2017).

3.2.4 Intangible Heritage: Architectural Heritage Awards, Architectural Heritage Season

Figure 2. Location of the NUS ArClab

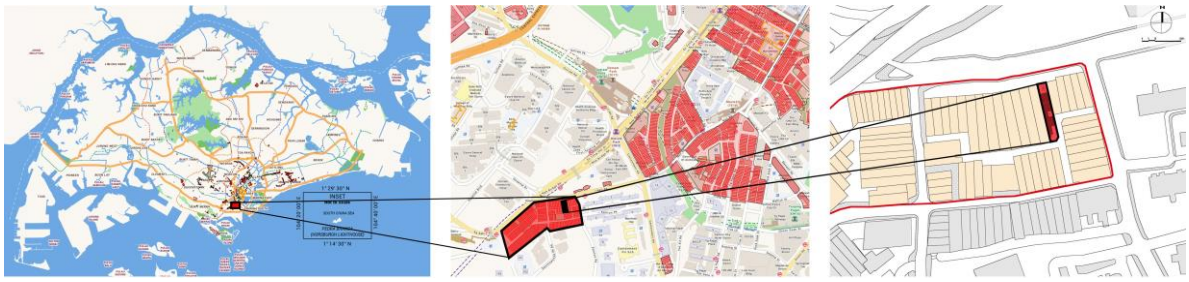


Figure 3. 141 Neil Road architectural details

After 2001, Singapore's conceptual plans not only protected built heritage, but also statues, gathering places and festivals in the everyday urban landscape, with heritage conservation increasingly conceptualized as part of the construction of community identity. To promote attention to intangible cultural heritage, the URA has created the Architectural Heritage Award (AHA) and the Architectural Heritage Season (AHS).

The AHA was launched in 1995 and revised in 2020. The revised AHA places greater emphasis on intangible outcomes that create long-term value for the community, is more inclusive and focuses on wider public engagement. AHS is an annual festival celebrating architectural heritage and well-restored buildings. As well as developing expertise in the field, it also fosters community awareness of the work of the URA, which engages with different groups and communities throughout the season, with regular lectures, workshops, field trips, etc. Some of the key events through AHA include the NTU-AHA film project as well as the Day Out which focuses on bringing people into heritage precincts (URA, n.d.).

4.Design strategy for sustainable reuse of the NUS ArCLab

141 Neal Road was built in the early 1880s as part of the Everton Estate. The Blair Plain Conservation Area, in which it is located, is a neighbourhood of traditional Straits townhouses, consisting of two and

three storey shophouses and terraced houses in a variety of architectural styles (URA, 2015). Apart from some commercial uses along Kampong Road and Neil Road, the area is primarily a quiet residential area and was gazetted for protection in 1991 by the URA. The shophouse is predominantly two storeys, with a partial three storeys. As a second transitional shophouse style, the overall style is relatively simple, with a partially ornate front façade with fine relief carving and auspicious Chinese character plaques at the entrance as well as hundreds of highly decorative tiles throughout the lower levels inside depicting Art Noveau and Chinese motifs.

Based on the 3R principle of 'maximum Retention, sensitive Restoration and careful Repair', the NUS ArClab has not been subjected to excessive interventions and its sustainable reuse application strategy is reflected in the following aspects (URA, n.d).

4.1 Space Reuse: Shaping Community Identity as an Educational Place

A good adaptive reuse project is one that is functionally appropriate to the history, architectural character, scale and internal layout of the original building in order to minimize intervention in the building's original structure and ensure optimum heritage value reserve. NUS ArClab did not carry out large-scale transformation of the original building space, but only carried out appropriate repairs and detailed repairs, and at the same time improved the performance of local structural nodes.

Today, for commercial and tourist reasons, more and more shophouses on Neil Road are being renovated with money in the ‘spirit of place’. The gentrification of the neighbourhoods, which has transformed the built heritage into shopping malls with a different appearance and a homogeneous interior, needs to be changed. After being transformed into NUS ArClab, 141 Neil Road is mainly used as a place for students to attend classes, learn and understand the maintenance works required to manage historical buildings, and open to the public, providing citizens with opportunities for heritage education and public communication. It is a model for the interpretation of space and heritage value, and provides a reference for the planning of residential, commercial and even service industries in the surrounding area (Ren & Han, 2021).

4.2 A living laboratory: enhancing the practical skills of architectural heritage conservators

Two of the main challenges facing heritage conservation in Singapore are the lack of trained artisans to restore historic buildings and the lack of traditional building materials. To address this challenge, the ArClab has been transformed into a 'living laboratory' for heritage conservation learners to practice repair, in addition to serving as a research and learning venue.

Most of the old buildings in Neil Street were built with porous materials when they were first constructed, and while traditional mortar slowly sets by absorbing carbon dioxide, allowing moisture to escape through the joints and allowing the walls to 'breathe', modern techniques for damp-proofing buildings keep water out of the structure (URA, 2019). Unfortunately, limestone, kilns and skilled craftsmen who used lime disappeared from Singapore around the mid-twentieth century (URA, 2019). In order to promote traditional building techniques, 141 Neal Road incorporated the proportioning of lime mortar in the process of carrying out restoration practices. Through careful proportioning, the optimum condition of the lime mixture was determined and applied to the old walls that had fallen off. In addition to plastering techniques, tile repair, stained glass repair and decorative finishing techniques are all incorporated into the practical process as a place of architectural conservation practice. A hands-on approach is used to develop practical skills for building conservators.

4.3 Restoration of old buildings: applying advanced technology to reproduce traditional craftsmanship

NUS ArClab restores the function of dilapidated historic buildings through careful repairs, while introducing new technologies to help recreate traditional craftsmanship. As the façade is the part of the building that is most prone to deterioration and damage due to its long exposure, façade restoration is also the most important part of the ArClab renovation process. During the restoration process, the restorers used advanced technologies such as 3D scanning, 3D modelling and 3D printing to document, study and restore architectural elements of all scales and materials within 141 Neil Road. In addition, the restorers have also explored the appropriate use of nano-coatings. Nano coatings are resistant to contamination, UV light and resilience, extending the life of 3D printed elements.

In the restoration of 141 Neil Road, the building conservators scanned and modelled the relief construction within the building using 3D scanning technology, subsequently printed and colored using 3D printing

technology and finally protected the building elements with nano-coating, the application of innovative technology has enhanced the effectiveness and efficiency of the conservation restoration.

4.4 Sustainable climate response: net-zero retrofitting and energy management systems for historic buildings

ArClab undertook a climate-resilient building heritage retrofit programme to meet Singapore's net-zero targets, supporting the achievement of net-zero emissions targets through the use of renewable energy and

Figure 4. Usage of the renovated NUS ArClab

improved climate resilience, while meeting the needs of building occupants.

(1) Application of passive energy efficiency measures. The conscious absence of air-conditioning in renovation and retrofitting to reduce damage to building walls, the use of airwell and through-air generated by north-south ventilation to increase indoor lighting and natural ventilation, and supplemented by mechanical ventilation to improve indoor living conditions. In terms of exploring materials for building conservation, the lime plastering of traditional brick walls will be restored to restore the 'breathing' function of the walls.

(2) ArClab uses an energy management system to monitor, analyze and manage the building's energy consumption. Three small weather stations are set up in the front and back yards of the building and on the patio to understand the hour-by-hour weather parameters of the neighbourhood, including temperature, relative humidity, wind speed, wind direction, cloud and rainfall, and to monitor the impact of vibrations from surrounding construction projects on ArClab. This enables the simulation of the outdoor thermal environment of the ArClab and helps professionals to understand how the high-density environment affects the microclimate of the historic district.

5. Conclusion

This study has reviewed the history, framework system and practices of built heritage conservation in Singapore, and used the NUS ArClab as a case study to describe its transformation from a residential shophouse to a heritage conservation laboratory and its design strategies for sustainable reuse. On the whole, heritage conservation in Singapore is holistically planned, pragmatic and dynamic.

The government has developed a conservation framework that goes hand in hand with conservation and development, constantly improving the legal framework and making timely adjustments in response to specific issues and trends, and in practice, from government demonstration projects to the designation of detailed guideline schemes and encouraging private In practice, this ranges from government demonstration projects to the designation of detailed guidelines and the encouragement of private sector participation. The heritage conservation model that Singapore has worked out in 40 years of practice is worth learning from.

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Potential in service design: engaging with knowledge sharing for sustainable innovation

LIU Tong[1], CAI Jun[2]

[1] Academy of Arts & Design, Tsinghua University, China
[2] Academy of Arts & Design, Tsinghua University, China

[1] t-liu17@mails.tsinghua.edu.cn

Abstract. Service design is a research field has been used into both government and commercial project. The outcomes mostly were based on the actual needs of tangible products and virtual interaction systems. In this paper, we present service design as a sustainable approach to promote change in the mindset within organization demanding that the actors being in a team go through multiple points of views. It also captures user's pain-point and expectation in the service journey, shares with different actors in order to understand empathy further. Methodology was service design method to discussed through a case study which reveals the advanced activities of sustainable insights to practical service goals, including methods such as interviews, observations and workshops. The research explores the potential of service design and the advantages of using design tools for empathy which figures a knowledge sharing purpose for actors to reach a consensus and image innovative future in holistic picture. The study argues that challenges and limitations of service design approaches and re-thinks the sustainable innovation.

1. Introduction

The capability of service design (SD) has been frequently discussed(Morelli, de Götzen and Simeone, 2021a) in recent years, and SD has been involved in both government and business, yielding products and systems. For some enterprises, SD is not just a means of innovation and also a core competence to build(Prahalad and Hamel, 1997; Yoo and Kim, 2015). The tools used in SD are also used by designers in organization management. Design thinking has become a frequently used management principle to servitize and innovate their business(Kolko, no date). However, for SD in the process of organization management, what kind of design behaviors influences inter-organizational knowledge sharing (KS), and what kind of KS achieves sharing for innovation?

Innovation is inextricably linked to organizational learning, of which KS is a very important part. The process of innovation involves the gaining, spreading and using of new knowledge, not only from external sources, but also from KS within the organization(Damanpour, 1991; Johnson *et al.*, 1997; Moorman and Miner, 1998; Verona, 1999). SD is linked to KS. Since SD places great importance on the collection of needs and knowledge from different actors during the whole research process, the service designer becomes a knowledge collector. In addition, since KS is important for innovation(Calantone, Cavusgil and Zhao, 2002), how SD facilitates innovation through KS becomes the main research question of this study. What types of design behaviors influences inter-organizational KS in the process of organization management, and what types of KS achieve sharing to innovation?

The present study investigates the general capability of SD and how SD works in KS to explore potential capability of SD through literature in design theory and knowledge management. The prediction of the capability of SD comes from the literature study to explore the key elements such as “empathy with users and co-creation, rapid prototyping and iterative learning”(Martinkenaite, Breunig and Fjuke, 2017).

2. Literature Reviews

2.1 General capability of Service design

The capability of SD extends from the capability of design. Some scholars(Service Design Network, 2016) have suggested that design competence need to be transmitted to students through educators and it is a form of tacit knowledge. Some researchers(Cross, 1982) want to define design knowledge clearly and distinguish

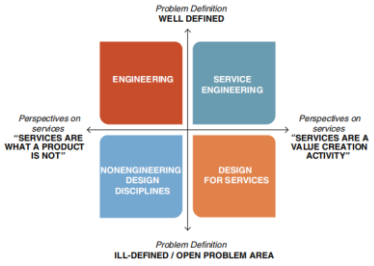
it from scientific knowledge and humanities. However, researchers (Bailey, 2012; Prestes Joly *et al.*, 2019; Morelli, de Götzen and Simeone, 2021a) have made a more systematic study on the definition of design competence and SD competence (figure 1).

Figure 1 Descriptions of design capabilities(Morelli, de Götzen and Simeone, 2021a)

Name of the capability	General description
Addressing the context	The capability to identify and respond to relationships between a solution and its context
Controlling experiential aspects	The capability to empathise with people and address experiential features of possible solutions
Modelling	The capability to simulate, visualise and experiment with possible solutions before all the information is available, using form to embody ideas and communicate values
Vision building	The capability to figure out coherent possible futures
Engaging stakeholders	The capability to initiate and facilitate participatory co-creation processes
Working across levels	The capability to work through different levels of abstraction
Building logical architecture	The capability to articulate or identify logical structures to frame problems and creative activities
Open problem solving	The capability to identify solutions across different logical domains and within uncertain and ambiguous contexts

The analysis of SD capability comes from two main tensions in the definition of SD(Kimbell, 2011): a) SD is an exploration of an open problem space involving different actors.
b) Services on the basis of how they differ from products or as an activity of value creation (figure 2).

Figure 2 Approaches to conceptualising service design(Kimbell, 2011)



Service is as a fundamental activity in an economic exchange(Morelli, de Götzen and Simeone, 2021a). Accordingly, when SD occurs in an organization, it is mostly needed to solve specific problems. But in the designer's practice, based on the process of SD, it is usually the case that the designer will have many interactions with the organization internally which generates different kinds of KS among the interactive activities. Based on service designer's role, it is necessary to balance the interests of different stakeholders, and not just to interface with a single actor. This also represents the fact that in SD, design innovation is not a direct result of a specific action, but rather the result of an ongoing negotiation between values, institutions and actors(Morelli, de Götzen and Simeone, 2021a). Thus, the service designer's role is similar to that of an orchestrator(Vargo and Lusch, 2004), in that he or she needs to understand the knowledge of multiple actors from multiple perspectives, and does not need to be sophisticated, but does need to understand(Altuntas Vural, 2017). For example, the designer needs to translate the service concepts of managers to better service delivery. At this point, the capabilities of SD are defined included(Morelli, de Götzen and Simeone, 2021b):

a) Open problem solving
b) Building logical architecture
c) Vision building and
d) Addressing the context.

2.2 Discovery of SD in KS

The emergence of KS comes from the need of contemporary organizations for learning orientation for competitive advantage(Calantone, Cavusgil and Zhao, 2002). Organizations need to innovate constantly, but innovation means change which is difficult. Innovating change and new practice take time and lead to frustration and complain from employees. KS is a very important component of organizational learning

orientation which refers to collective beliefs or behavioral routines among different units within an organization(Zaltman, Duncan and Holbek, 1973).

KS occurs in a variety of contexts, such as the background context of laws, cultures, technical or social knowledge, regulations, physical and technical constraints(Morelli, de Götzen and Simeone, 2021a). Sharing existing knowledge is crucial for product or service development(Nonaka, 2008). SD plays the role of knowledge collector in an organization, not only to deliver solution or new product/service, but also to balance the needs and interests of actors in the implementation of SD.

3. Methodology

3.1 Case study of a medical enterprise in China

This case study was based on an innovative medical enterprise X. It focuses on neuromodulation to provide new treatments for patients who suffer from neurological disorders such as Parkinson's disease and chronic pain (cited by official enterprise website). In this case, we focused on a specific therapy called deep brain stimulation (DBS), to understand the whole medical process including two parts of Parkinson's disease users—doctors and patients. Doctor implements the therapy and the patient receives the treatment of DBS. They both use the product and deeply involve into this medical journey.

3.2 Research process

For sustainable innovation, the difficulty in this project is a gap between enterprise vision and service practice delivery. The collaboration between different departments was not smooth enough and work knowledge was not shared in time. This research adopts a longitudinal and exploratory single case study approach to capture how knowledge from different departments can be transformed and shared through the SD method, so that a common understanding can be reached. In addition, innovation insights scenarios were fully discussed to reach a consensus on the insights within the organization. These organizational changes contributed to the better understanding and interaction between different departments and external users, thereby improved the efficiency of change and innovation.

Within the scope of this case, double diamond as a main research structure with 36 interviews (8 doctors, 15 patients and 13 employees), 2 medical observations (2 therapies), 3 daily user shadowings (1 doctor and 2 patients) was collected to understand the work flow among different actors and to analyze their behaviors and identifying needs. The study concentrated on the whole medical process of Parkinson's disease and collected data mostly from two main market of China—Beijing and Shanghai (figure 3).

Figure 3 Pictures of interviews, shadowings and observations

The specific co-design workshop was the key tool within the practice of SD that helps to build a channel combining different actors (figure 5) such as doctors, patients, employees and top managers to participate together in terms of working through the whole medical journey and sharing knowledge of their own experiences. The purpose of sharing knowledge based on two principles: empathy and vote. It means put users' shoes to walk their path and vote to achieve agreement. Co-design workshop was designed by 6 phases

(table 1, figure 4): introduction, persona and user journey map, role play, empathy map canvas, innovative insights and discussion.

Table 1 Co-design workshop agenda

Co-design workshop agenda	Time	Tools	Participators
Introduction	20min	Keynote speech	Service designers, scientists, doctors, patients, employees (marketing department, customer service department, medical R&D department) and decision maker
Persona and user journey map	20min	Visualized map	
Role play	10min	Name tag	
Empathy map canvas	10min	Visualized map	
Innovative insights	20min	Visualized map	
Discussion	30min	Vote on insights of future vision	

Figure 4 Tools from co-design workshop: persona, user journey map and empathy map canvas

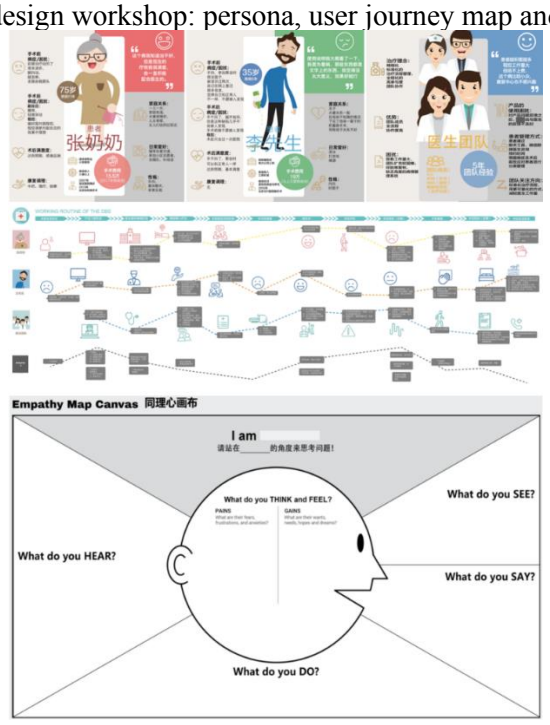


Figure 5 Pictures from co-design workshop process

4. Findings and Conclusion

In this study, the market data consists of real-time data and secondary data online gathered from 3-5 years. These data develop a holistic case narrative in order to systematic analysis theoretical insights and industry

market situation. The results showed strong market share and great brand potential in enterprise X and it means the innovation is an urgent goal in this phase. However, we found the management pain-point was low efficiency of KS among different departments, which resulted in difficulties in communicating and reaching consensus. Eventually it stalled the development of innovation within organization. There were tensions between different department. They triggered an end-to-end misunderstanding and irresponsibility.

The SD tools--workshop was a necessary facilitating tool. In co-design workshop, on the one hand, service designer added "empathy" as a key design principle into the process by guiding the participants to a holistic understanding of persona and user journey map. Then service designer engaged participants to use the "role play" to understand the users' pain-points and expectations in the medical journey as well as reflect the employees' work moment in the visualized journey. This role play approach allowed them to not only increase awareness of the criticality of user-centricity, but also to better understand the workflow and motivation of other departments, which led to a typical knowledge sharing activity. For example, the marketing department's experience with user closer may be valuable to the R&D department in developing products or services to fit user needs(Moorman and Miner, 1998). On the other hand, service designer used "vote" as a discussion implement to engage employees to picture their own vision of this brand/enterprise. At the last phase of workshop, service designers drew some possible insights of specific business direction (based on previous research), combined with previous findings in workshop to encourage employees to image possibilities. This activity inspired employees to be open-minded and to share personal knowledge willingly which built a better organizational climate(Bock *et al.*, 2005).

The finding about the main effect of KS extends the potential capability of SD and suggests that KS enhances specific future insights of innovation directly through a group activity. The analysis also proposes that SD activity is a possible approach to reach consensus and to shape individual leadership of employees with decision makers.

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Research on affordance-based product design from the perspective of sustainability

Jinzhuo Liu[1], Xiaobo Qian[2] and Guangming He[3]

[1] Jiangnan University, Wuxi Jiangsu, China
[2] Jiangnan University, Wuxi Jiangsu, China
[3] Jiangnan University, Wuxi Jiangsu, China

[4] 1422145825@qq.com

Abstract. Sustainable lifestyle and related product design are widely recognized as more and more people paid attention to the relationship between human and nature in the last decades. However, green and healthy lifestyle are difficult to be effectively carried out in the daily lives to most people. Therefore, this paper explores how to introduce the sustainable design concept into the product's affordance design strategy, so that the sustainable life concept contained in the product can be more accurately perceived by users, and users can unconsciously carry out sustainable behavior operations in the usage process of product, so as to guide users daily sustainable lifestyle. In this paper, product affordance is summarized into five types through comparative analysis of relevant research results on the concept of affordance: functional affordance, cognitive affordance, behavioral affordance, sensory affordance and emotional affordance. And then, the sustainable intervention points that can be provided in the product life cycle are screened and designed based on the environmental, economic and social considerations of sustainable design. These intervention points are paired with the previous five types of product affordance to build a logical framework for product affordance design based on a sustainable perspective. Finally, the packaging design of a coffee brand is taken as an example to verify the rationality and feasibility of this framework. In this way, the concept of sustainability is integrated into the framework of product affordance design, which can make users perceive the concept of sustainability conveyed by the brand in the process of contact with the product more intuitive and simpler, improve the public awareness of sustainability and acceptance of sustainable lifestyle. At the same time, this article also tries to enrich the connotation of the affordance theory and makes a certain theoretical contribution and practical exploration to the development of the affordance theory.

1. Introduction

In 1987, the World Commission on Environment and Development defined sustainable development in its conference report "Our Common Future" as "development that meets the needs of contemporary people without compromising the ability of future generations to meet their needs." It systematically elaborated on the concept of sustainable development, which is currently the most widely known and widely accepted definition of sustainable development. In 2015, the United Nations Summit on Sustainable Development formally adopted 17 Sustainable Development Goals (SDGs), with a view to solving existing problems from three dimensions of society, economy and environment before 2030, and turning to the path of sustainable development. Sustainable design, as a strategic design activity for building and developing sustainable solutions, also requires a balanced consideration of social, economic, and environmental issues, thinking about using design to guide and meet consumer needs, and maintaining continuous satisfaction of needs. The industrial innovation mentioned in SDG9 and the sustainable consumption and production model emphasized in SDG12 require designers to achieve it through design methods. Sustainable consumption and production aim to "reduce consumption, increase growth, and improve quality", that is, while improving the quality of life, to increase the net welfare benefits of economic activities by reducing resource consumption, environmental degradation, and pollution throughout the entire life cycle. Sustainable consumption and production also require the systematic participation and cooperation of various actors in the supply chain from production to final consumption, including educating consumers to accept sustainable consumption and

lifestyles, provide consumers with sufficient information through standards and labeling, as well as engage in sustainable public procurement.

In China, a sustainable development strategy was identified in the report to the 19th CPC National Congress as one of the seven strategies for realizing the goal of building a moderately prosperous society. At the same time, with the normalization of the COVID-19, more and more people begin to reflect on the relationship between human and nature. In the future, sustainable lifestyles and consumption concepts will be more popular. With the compulsory implementation of Waste sorting measures in some cities of China, the concept of sustainability has gradually changed from a slogan to a potential idea, which exerts a subtle influence on the national consumption concept. The development of sustainable product design has entered a mature stage. However, how to let consumers accept and guide users to develop a sustainable lifestyle at the level of product design, such as enabling them to unconsciously conduct environmentally friendly activities without changing the original trajectory of users' actions? This needs to be considered and planned in advance in the product concept and product design links to implement sustainable strategies in every link of the Product life cycle. Therefore, this article constructs a brand-new product sustainable design touch point diagram, providing new vision and feasibility guidance for sustainable development, and helping to promote the widespread use of sustainable design. By promoting the combination of sustainable design and product availability design, on the one hand, designers are inspired to consider the sustainable concept intervention points involved in the entire product life cycle in product concepts and design processes. On the other hand, the sustainable concept considered by designers can be better perceived by users, guiding users to engage in sustainable behavior, and achieving human-machine resonance in product functional cognition and emotional expression. Its goal is to enhance public awareness of sustainable development from a lifestyle perspective, guide people's consumption and daily life behavior, and play a role in improving national quality, guiding public green behavior, and enhancing urban cohesion.

2. Literature Reviews

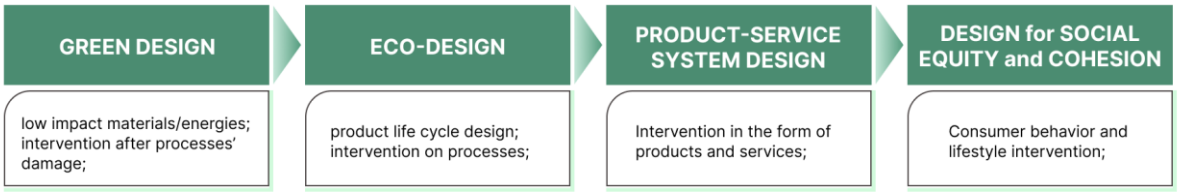
Our work is primarily related to two streams of research: sustainable design and product affordance design. Below, we review each of these streams of research and demonstrate how they interact with our research.

2.1 Sustainable Design

The concept of sustainable design (DFS) originated in the 1960s, when American design theorist Victor Papanek (1984, p. 13) wrote in his book “Design for the Real World” that design must consider the limited resource use of the Earth and serve the protection of the Earth. This is the first monograph calling for design to focus on environmental responsibility. The explanatory definition proposed by Professor Ezio Manzini and Liang Ding (2006, p.3) in The Path to Sustainability: Design and Exploration of a Sustainable Life Model in China, “Sustainable design is a strategic design activity that builds and develops sustainable solutions, utilizing systematic integration and planning of products and services, with the ultimate goal of replacing material products with utility and services. ” From a systemic perspective, replacing physical products with services and experiences can not only reduce resource consumption but also improve people's quality of life.

Sustainable development can be roughly divided into four stages: "green design", "ecological design", "product-service system design" and "design for social equity and cohesion". The study of green design puts more emphasis on the choice of materials and energy, and puts forward the 3R design concept (Reduce, Recycle, Reuse) based on the reduction of material and energy consumption, the convenient classification and recycling of products and components, and the renewable recycling and reuse. Some scholars proposed the principles of Regeneration, Restore and Redesign successively. Eco-design pays more attention to the life cycle of the product, from design and production, transportation, use, waste, recycling, recycling and reuse, to think and design the environmental problems.The third phase of sustainable design enters the field of systems, focusing on both product and service levels, and the solutions it provides shift from individual products to the design of the entire service system, especially the integration of many factors related to design in the business environment. The fourth stage focuses on social fairness and harmonious development, further improving and deepening the systematic concept of sustainable design, expanding to the spiritual level and emotional world of the public, and paying attention to the change of people's values and the transformation of consumption patterns. Professor Liu Xin (2010, pp. 36-39) of Tsinghua University said: “Although these four stages appear in sequence with the development of society and economy, there is no primary or secondary division, and the contents of the four stages are respectively complement and improve each other's ideas and sustainable ways”.

Figure 1. Four stages of sustainable design development



On the steps of sustainable design, Carlo Vezzoli (2008, pp. 253-268) divided it into Strategic product analysis (and brief), Concept design, Product design (and engineering and Communication, the main process of which is shown in the figure below.The main objective of Strategic product analysis is to evaluate the products and functional units to be designed, to find the key areas and life cycle design strategies that are most likely to achieve environmental sustainability, and to guide the final product design towards sustainable solutions in the conceptual stage. Product design (and engineering) requires designers and engineers to select environmentally friendly design details and production processes, and the final communication phase refers to the evaluation of product quality and sustainable attributes.

Figure 2. Steps to sustainable design

STAGE	Strategic product analysis	Concept design	Product design and engineering	Communication
GOAL	Evaluate the products and functional units to be designed to identify key areas and life-cycle design strategies that are most likely to achieve environmental sustainability	In the concept phase, the final product design is directed towards environmentally sustainable solutions	attention needs to be paid to sustainable design details and the use of environmentally friendly materials and processing methods	Highlight environmentally sustainable aspects when communicating product characteristics
PROCESS	1. Assess the environmental impact of existing products; 2. Define priorities in environmental design; 3. Integrated visualization of priorities;	1. Generate ideas focused on sustainability 2. Concept evaluation, defining priorities and selecting the most promising concepts	1.Pay attention to environmental sustainability in design details, 2.choose environmentally friendly design details and production process;	1. Product environmental sustainability evaluation; 2. Evaluation of product quality and environmental quality;

In this paper, the research on product sustainability focuses on the conceptual design stage of the product, with a view to considering the sustainable design contact points that will appear in the product life cycle through design means, and taking the existing technology, materials and energy conditions into consideration, so as to formulate reasonable design strategies.

2.2 Product Affordance Design

Affordance was first proposed by American psychologist James J.Gibson (1950, p.55). He defined affordance as the attribute that environment provides to an animal, which makes it complementary to the environment. This means that the meaning and value that the environment provides to the animal is physically present in the environment and can be directly perceived. In 1988, Norman (1988, p.23) introduced The concept of Affordance to the field of Design with his book The Design of Everyday Things. Norman uses this concept to describe the inspiration and guidance function of products on people's interaction behaviors driven by needs. He emphasizes that excellent product design should provide enlightening information about how users interact with it. Meanwhile, Affordance relies on users' experience and cultural background, which is users' psychological interpretation of things based on their existing knowledge and experience.

The application of affordance concept in product design can not only generate and induce natural interactive design, improve the usability and usability of products, but also promote positive emotional interaction between products and users to meet the deep emotional demands of users. Based on Gibson's theoretical research, Japanese designer Naoto Fukasawa proposed the idea of "unconscious design", also known as "intuitive design", which is the transformation of unconscious actions into visible things. Unconscious design emphasizes paying attention to the details that users are not aware of in design, and even some pain points in life that users themselves have not found, and enlarging these details into the design improvement of the original product. Unconscious is not really not conscious to participate, but we know that we need something, but have not realized what we want, unconscious behavior comes from the

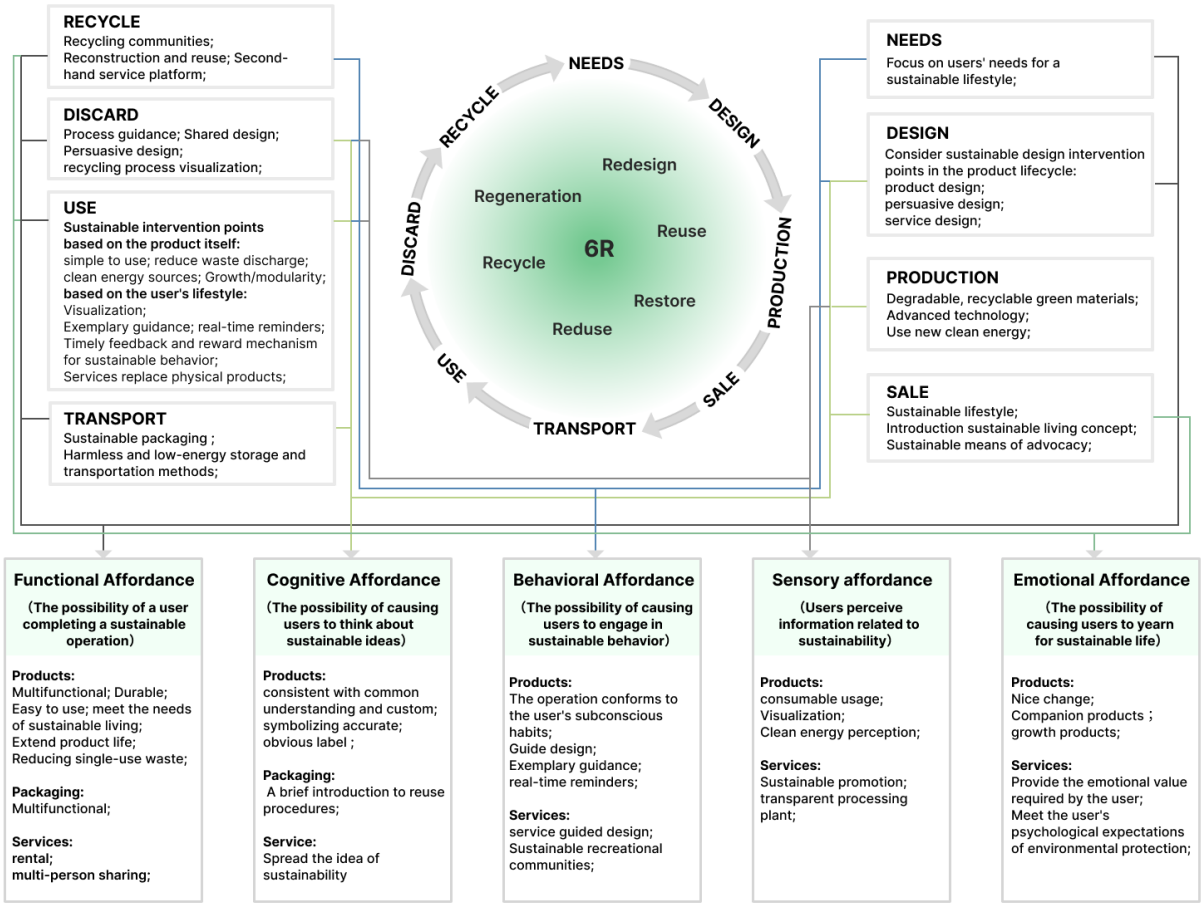
subconscious in the brain, it is the human instinct to respond to the external environment to make a balanced response. It is worth noting that the unconscious and consciousness are not relatively independent, but are interrelated and transformed. Through certain training, people's unconscious behavior can be transformed into conscious behavior.

Norman(1988, p. 51) divided the affordance into the real affordance and the perceived affordance. The real affordance comes from the function provided to us directly by objects or environments, while the perceptual affordance is dependent on human perception. The content perceived is related to people's real experiences, and may not necessarily be real. William W. Gaver argues that affordance is about the fundamental nature of action and interaction, rather than just the visual perception emphasized by Gibson and Norman, while Gaver (1996, pp. 111-129) pays more attention to the relationship between affordance and behavior. Therefore, he proposed another classification of work-based affordance, which includes four types of affordance: physical affordance, functional affordance, sensory affordance, and cultural affordance. Based on the original concept research, Hartson (2003, pp. 315-338) divides affordance into four aspects: cognitive, physical, sensory, and functional, according to the content that affordance supports users' behaviors in the process of user interaction and the roles that users play in operational tasks. Leonardi (2011, pp. 147-168) came up with the technology affordance. Scholars such as Raubal categorize affordance into three types: sensory, cognitive and emotional (Hartson H R, 2023; Raubal M, 2008). In summary, based on the existing research results extending Gibson's definition of affordance, affordance with similar expressions or common dimensions can be summarized and divided into five categories: Functional Affordance(FA), Cognitive affordance(CA), Behavioral affordance(BA), Sensory affordance(SA) and Emotional Affordance(EA).

3. Methodology

Based on the study of sustainable design concept and product affordance classification, and referring to the 6R principles of sustainable design (reduce, reuse, recycle, restore, regeneration, redesign), considering product life cycle and product system design content, Intervention points were found and matched between sustainable design strategies and the five dimensions of affordance (FA, CA, BA, SA, EA). This study takes the principle of sustainable design as the starting point, takes the product life cycle as the design thinking path, comprehensively considers the product and service system, and selects the design strategy based on sustainable product design.The purpose of this research is to help designers consider the complete life cycle of the product through the affordance process during the conceptual design stage of the product, and add sustainable consideration while considering the product affordance, so as to make the design of the product more sustainable. The research framework is shown in the figure below.

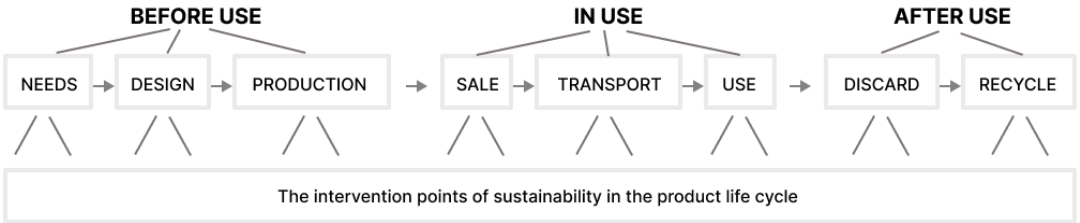
Figure 3. Overview of the methodology



3.1 Sustainable intervention points based on product life cycle considerations

The sustainable design of a product can cover the entire life process of a product. Based on the analysis and research of previous scholars on life cycle stages, this paper divides the life cycle of a product into the following eight stages from the perspective that the design stage can consider and avoid the risk of environmental damage in advance: needs, design, production, sale, transport, use, discard, recycle.Among them, the first three stages are before the product enters the market, is the consumer has not yet intuitive contact with the product stage, we can call them: before use. From the product entering the market to the sale of the product packaging and transportation, and then to the user's use, is the contact period between the user and the product. The final product from waste to recycling is the product after use.

Figure 4. Product Life cycle



he first stage is to explore the needs of users. Starting from the survey of user needs, the company manufacturers need to pay attention to the target users' yearning and expectation for a sustainable lifestyle, find and pay attention to the product functions and service systems in which the concept of sustainability can be involved, and consider the acceptance of users for a sustainable lifestyle and the possibility of successful product guidance. Therefore, in the second stage of the product life cycle -- the design stage, designers can consider the potential intervention points of sustainable design in the product life cycle from the perspective of user needs and existing technologies, including the sustainable design that the product itself can provide in terms of function and interaction, and the design of persuading users to operate in an environmentally friendly and sustainable way of life. And service design based on sustainable concept. In

the production and manufacturing stage of the product, it is necessary to consider the choice of product materials, limited choice of degradable and recyclable green materials, and the use of clean energy and advanced technology that does not damage the environment in reprocessing, which can effectively reduce the emission of harmful substances in the manufacturing process.

Starting from the fourth stage, the product enters the market and sells to the target consumer group. In the sales stage, in addition to the selling point of the product itself, sustainable design can also provide a new Angle for the promotion of the product, such as advocating environmental protection and healthy sustainable lifestyle, and attracting consumer groups who are yearning for a healthy life through sustainable marketing. In the next stage of product transportation, designers also need to consider the outer packaging of the product, more and more brands have begun to try multi-functional packaging forms and the use of environmentally friendly materials, as well as flat and detachable packaging, pollution-free, low-energy product transportation and product storage methods are also helpful to the environment and economic sustainability.

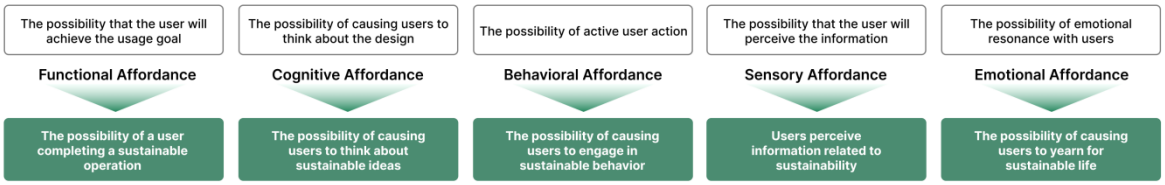
When the product is bought by the user, it enters the sixth stage of the product life cycle. In this stage, the intervention point of sustainable design can be considered from two perspectives. One is the sustainable design based on the function of the product itself, such as comprehensive, intuitive and easy to use, which can improve the frequency of users' use of the product. Multi-functional product design and growth products can also effectively extend the life cycle of the product, and the use of products in the process of saving consumables and reducing waste discharge is also a sustainable embodiment, such as reuse of products or its parts and materials, to save resources and protect the environment. Second, the product is designed to encourage users to live a sustainable lifestyle during use, such as providing sustainable guidance mode, reminding users to perform sustainable operations in real time, and giving visual feedback and appropriate rewards to users after completing certain behaviors. This is conducive to improving users' acceptance of sustainable life and enabling users to truly participate in sustainable actions. Make them feel that sustainable behavior is something meaningful.

Finally, in the waste and recycling stage of the product, providing a processing process sheet will help guide users to dispose of the product. On this basis, brand companies, product manufacturers or third-party organizations can also provide users with ancillary services for product disposal, such as sharing services for undamaged products, second-hand trading platforms for branded products, etc. If the product has been scrapped, the user can choose to return to the factory for recycling, and the factory can provide the user with a transparent recycling process, so that the user can perceive the end of the product life cycle or rebirth. The completion of a product's life cycle does not mean that it can only become waste, and the ultimate in reducing waste emissions is waste reuse. Under the guidance of conceptual design, the product life cycle can be recycled, and it is really necessary to make the best use of everything and achieve the design goal of "cradle to cradle", and recycling is an important part of the product life cycle (Norman, 2010).

3.2 Design strategy of affordance based on sustainable concept

Based on the research on the intervention points of sustainable concept in product design, this paper classifies the intervention points into the following five dimensions: Functional Affordance, Cognitive affordance, Behavioral affordance, Sensory affordance and Emotional Affordance. In this paper, the connotation of affordance under sustainable intervention also had more dimensions, as shown in the figure below. This article will describe in detail the sustainable design strategies associated with the five affordance types.

Figure 5. The connotation of affordance based on sustainable



Functional affordance is to communicate the functions of the product to users, so that users can understand and understand the functions of the product. affordance refers to the possibility for users to

perform a sustainable behavior. This possibility means that the product affordance can indeed meet users' demands for an environmentally friendly lifestyle, or even guide users to use a function through product design, so that the product functions can be delivered to users directly, easily and with maximum satisfaction. In the design, the functional design expression is required to be intuitive and concise. For example, Ewan Morrell's Bot lifejacket, designed for people living in flood-prone low-income countries, turns into an effective buoyancy device simply by inserting an empty plastic bottle into the vest pocket. The Bot life jacket is simple and intuitive in function design, so that users can understand how to operate and use at a glance, and at the same time, it is essentially the reuse of plastic waste resources, which also makes the production and distribution of clothes more convenient, and brings security to low-income countries that respond to the problem of sea level rise.

Figure 6. Bot lifejacket (Designer: Ewan Morrel)

Cognitive Affordance refers to the intuitive cognition and judgment that users can make on the product based on their own understanding and previous experience and habits, so as to avoid users' misunderstanding and misoperation of the product to the greatest extent. The appearance and symbol of the product can provide clues to the operation of the product, and these shapes and symbols are in line with the user's general understanding and experience of the product. The affordance of sustainable product design can represent the possibility that a product can cause users to think about the concept of sustainability. Some of the design of a product can cause users to reflect on the concept of sustainability, and at the same time, it can accurately and clearly display information related to sustainability. For example, straws made of PLA, bamboo fiber, coffee grounds, rice and other materials have gradually become popular in recent years, replacing the previous plastic straws, and some supermarkets replace plastic shopping bags with degradable cloth bags, which can cause users to think about the environmental protection behavior of reducing the use of plastic, making users take the initiative to reduce the use of plastic in their daily lives.

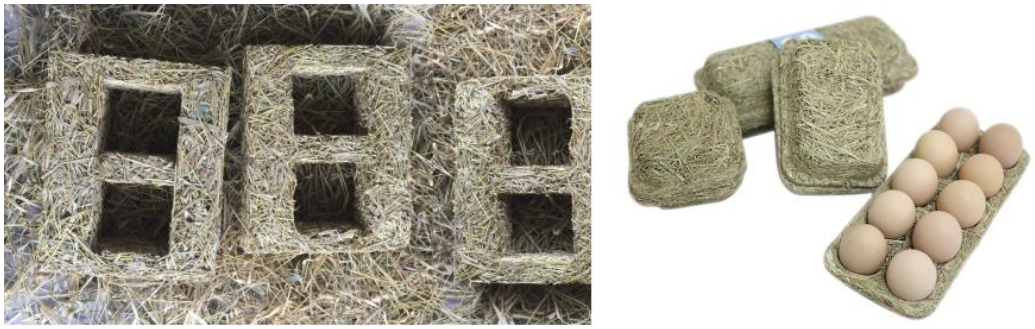
Figure 7. Sustainable packaging in everyday life

Behavioral affordance refers to actions that may occur in the user through the operation of the product affordance. As far as possible, the product affordance should be able to trigger subconscious behaviors in the user, taking into account both the possibility of the user's body doing something and the reasonableness of the product supporting the user to do that behavior. For example, Wall Paint packaging, designed by Ens Bayer, Andreas Kern and others who are concerned about healthy living and environmental protection and actively seek a healthier and more sustainable lifestyle, products and services, extends the environmental awareness of paint itself to the packaging design. Using environmentally friendly flexible packaging instead of metal drums reduces logistics costs, but also makes use of its material characteristics to enable users to roll up the packaging, so that the paint is completely empty, reducing paint waste.

Figure 8. Wall Paint packaging (Designer: Ens Bayer et al)

Sensory affordance means that certain design elements of a product can evoke user perception and feelings, such as different modeling languages, material textures, color combinations, etc., which can bring users different sensory experiences. The affordance based on sustainable design allows users to perceive the information related to sustainable products. For example, the original material texture of Green materials is preserved. The Living Green egg holder box designed by Chen Ye et al is made of pure grass by pressing. They also represent the possibility of material innovation for making everyday products. In addition to the physical product, the product service process can also be reflected, such as making the whole sustainable process more visible or easy to be perceived, or providing sensory feedback for users' sustainable behavior, which usually brings users different emotional experience such as a sense of accomplishment.

Figure 9. Living Green egg holder box (Designer: Chen Ye et al)



Emotional affordance refers to the emotional experience brought by products to users, which is usually related to the cultural background and personal emotional factors of the design object. It is a deeper reflection of the sensory affordance, as discussed by Hartson: "This new affordance is about value and meaning that can be perceived directly in the environment". It is mainly reflected in the feasibility of product functions, interactions or brand concepts to arouse users' emotional resonance, such as allowing products to truly achieve emotional companionship, allowing users to feel the changes caused by their behavior, and providing products or services with the emotional value required by users. For example, Ant Forest, which was born in 2016, takes "helping users plant a tree" as an incentive point, and with the help of Alipay platform, drives the public to understand the concept of "low carbon", which is hardly understood by anyone except professionals at that time. Every time users take low-carbon actions, they can obtain corresponding green energy points in Alipay. Users can plant a real tree in a desertification area, which not only protects nature, provides labor needs for remote areas, but also turns everyone's wish to heal and protect nature into a practical action to reduce their own carbon footprint, echoing people's deep expectations for the natural environment.

Figure 10. Ant Forest client interface and Ant Forest desert plantation

4. Case Study

4.1 Case Introduction

In recent years, the coffee market has developed rapidly, and the epidemic life has forced more consumers to begin to make their own coffee at home, and the capsule coffee machine has been favored by more and more users because of its convenient use and cleanliness. However, behind the popularity of coffee capsules is an environmental concern: most of the packaging left behind after use is not properly disposed of. The Hamburg government in Germany issued a "green procurement guide" to restrict the purchase of plastic tableware, plates and other items that are not conducive to ecological and sustainable development, including "waste of resources" and "difficult to recycle" capsule coffee. Coffee manufacturers can no longer ignore the environmental concerns of capsule coffee, and Jonny Forsyth, a food and beverage analyst at Mintel, said that sustainability will be the defining issue for the coffee industry over the next 20 years.

To solve this problem, Austrian packaging manufacturer Alpla has teamed up with material producer Golden Compound to develop a new type of fully biodegradable coffee capsule. The new capsules are made from Golden Compound, a material called "Green," which is extracted from the natural fibers of sunflower seed shells. The capsule itself, the filter layer and the lid are all biodegradable, and consumers can throw them into compost at home to decompose naturally within six months. The sunflower shells used in the capsules are a by-product of the food industry, so this invention represents an efficient use of resources without creating an additional carbon burden. In conjunction with the coffee roaster Amann Kaffee and the agency Silberball, ALPLA founded the start-up Blue Circle Coffee. Blue Circle makes sustainable and energy-efficient packaging solutions widely available. The key to this is innovation and fresh thinking. Sophisticated, plant-based plastics that biodegrade offer promising prospects. Blue Circle combines these with its many years of packaging expertise to create a sustainable alternative to regular coffee capsules. Austrian coffee producer Amann Kaffee has become the first company to use this sustainable coffee capsule packaging. Its product range now features two coffee types in sustainable capsules——an espresso and a lungo.

Figure 11. The degradation pathway of biodegradable coffee capsules

Amann Kaffee's existing packaging design for its coffee capsules is shown in the following figure. This paper will take Amann Kaffee sustainable coffee capsule packaging as the design object, according to the existing brand image and brand concept, the coffee capsule packaging affordance design. Specifically, the material breakthrough in the existing packaging has brought great benefits to the environment, but whether it can really make users feel the sustainable contribution of this coffee is yet to be considered. Therefore, this section will redesign the packaging of the product according to the design strategy of the product affordance from the sustainable perspective proposed in Section 2. Make the sustainable concept of

products can be better perceived by users, and use unconscious design to let users accept sustainable life behavior.

Figure 12. Amann Kaffee's existing packaging design

4.2 Designing Scheme

The overall packaging of the product has been redesigned. The packaging box adopts the structure of upper and lower two layers. The upper layer is the capsule storage area, and each capsule has its own exclusive location. After using the coffee capsule, the user can put the capsule back to the original position. The loosening of the buckle makes it easy for the user to press the capsule down to the degradation zone. The soil in the degradation zone will wrap the waste capsule, allowing it to enter the degradation process to the maximum extent, which is smooth and comfortable. After a period of time, the user will be surprised to find that the capsule inserted in the degradation zone has disappeared. At the same time, we also considered personalized instant coffee capsule packaging for Amann Kaffee. This packaging has a small seed at the bottom, and when the capsule degrades, the seed will enter the soil. The coffee itself is an organic fertilizer, which will promote the germination of the seeds, so after a while, the coffee box will become a beautiful pot.

The packaging design based on affordance provides a sustainable form of degradable capsules that users can intuitively feel and participate as an important role in the sustainability cycle of the product, which can effectively increase user engagement and unconsciously create a higher acceptance of sustainable behavior.

Figure 13. Packaging design for Amann Kaffee

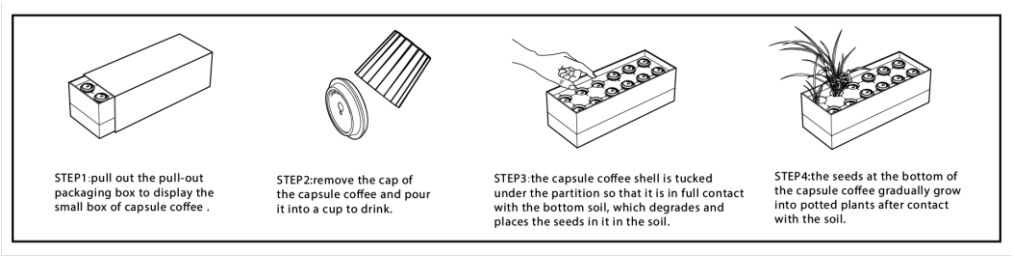
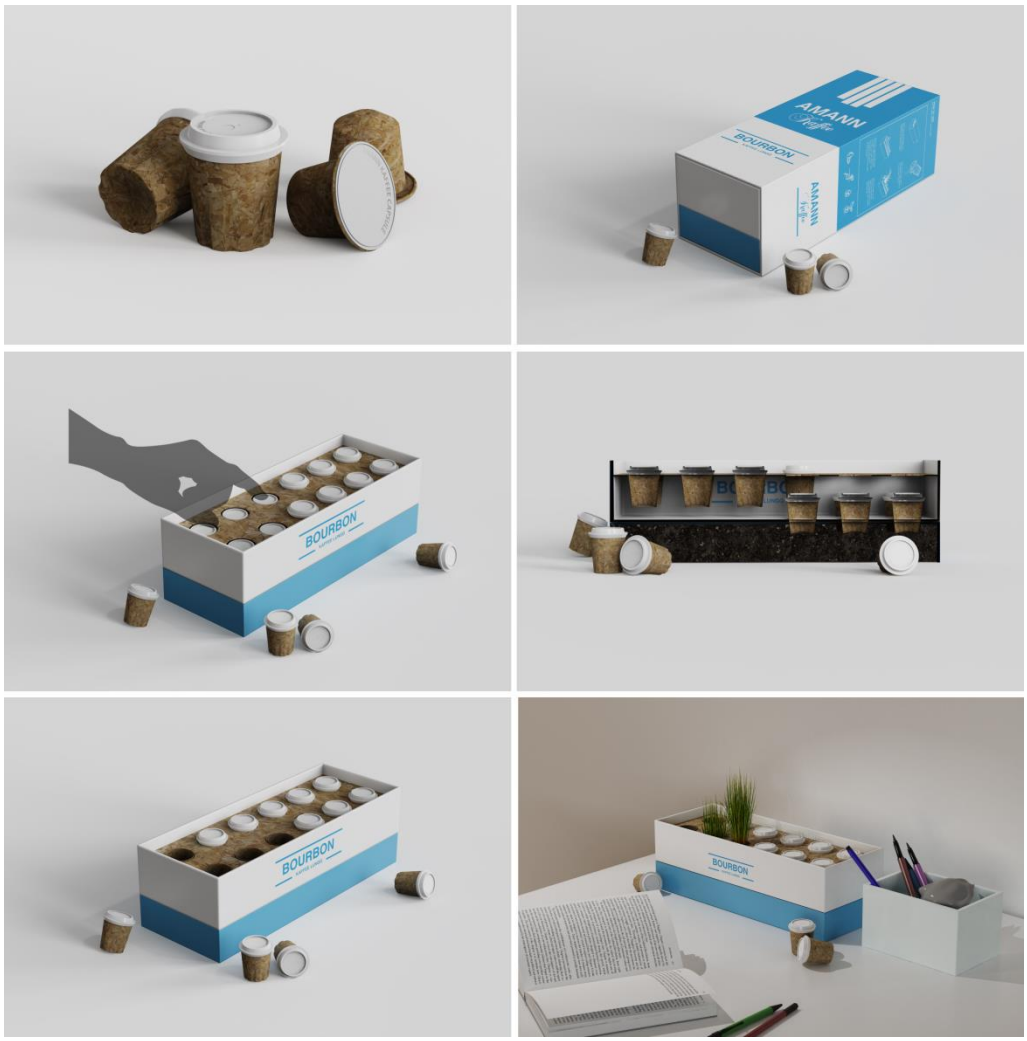


Figure 14. Packaging design for Amann Kaffee



5. Conclusion

This paper explores the influence of sustainable design ideas on the expression of affordance in conceptual design. Whether it is based on the consideration of product life cycle, the expression of specific ideas, or the supplement to the sustainable service system of brand products, the study of sustainable design strategy is a relatively realistic topic.

Product affordance design requires designers to have a more detailed observation and analysis of user behavior and psychology, requiring products to meet the subconscious needs of users, guide user behavior, and provide emotional value. After matching the sustainable design strategy as an intervention point with the design of the product affordance, the sustainable design will combine the considerations of the product affordance, so that users can accurately perceive the product's efforts and contributions to sustainability when they touch the product. And through unconscious design, users can also participate in sustainable daily behaviors. This is a relatively novel design strategy means, the purpose is to make sustainability is no longer just a matter of field experts, but a real concern to everyone, so that everyone feels the importance and necessity of sustainability. The practice of sustainable design is not only the embodiment of the harmonious development of man, nature and society, but also the consideration of the overall interests, which is another explanation of the sustainable development strategy. However, the existing research on design strategy is only a small aspect, and there are more contents that need to be further studied and discussed.

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Posters

THE 29TH INTERNATIONAL SUSTAINABLE DEVELOPMENT RESEARCH SOCIETY Conference ISDRS

Research on cultural and creative product design under the regional cultural background of Wuhan, China

INTRODUCTION

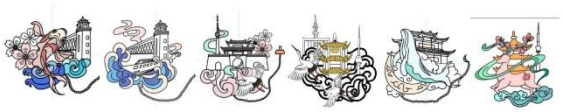
1.Wuhan regional culture：Wuhan paper-cut、Huangpi New Year wood-block prints、Wuhan Clay Sculptures

2.Architectural culture of Wuhan region：Traditional architecture （Yellow Crane Tower）、Republic of China architecture （Old building in Hankou Concession.）、Modern architecture（Wanda Film Park and Hubei Provincial Museum)

3.The role of regional culture integration in cultural and creative products： It is conducive to the image building of Wuhan city、It is conducive to the development of Wuhan city、Add to the charm and attraction of Wuhan city

RESULT

1.Practical and application research of regional cultural and creative products



2.Model production process

3.Selection of environmental protection materials and sample production：In the process of packaging design, designers should follow the design concept of ecological and natural design as far as possible, use biodegradable materials, carry out simple and reasonable packaging design, and use the original ecological materials and texture to meet people's simple aesthetic needs.

CONCLUSION

Culture has personality, its personality is first attributed to the great gap in the region where it exists.Our development of regional culture is to inherit and develop the traditional Chinese culture, it can truly show the spiritual pursuit of the Chinese people. The changes brought by The times also require the construction of a packaging design system for cultural and creative products based on the concept of green environmental protection, to jointly drive the influence and output of cultural and creative industries. Promote people's awakening to culture, promote the prosperity of the world's diverse cultures and the continuation of the earth's cultural resources.

Author, University, Track

THE 29TH INTERNATIONAL SUSTAINABLE DEVELOPMENT RESEARCH SOCIETY Conference ISDRS

Research on affordance-based product design from the perspective of sustainability

INTRODUCTION

Sustainable lifestyle and related product design are widely recognized as more and more people paid attention to the relationship between human and nature in the last decades. However, green and healthy lifestyle are difficult to be effectively carried out in the daily lives to most people.

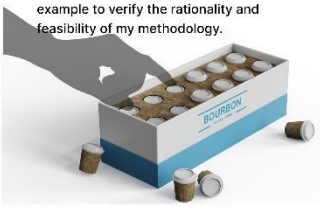
Therefore, this paper explores how to introduce the sustainable design concept into the product's affordance design strategy, so that the sustainable life concept contained in the product can be more accurately perceived by users, and users can unconsciously carry out sustainable behavior operations in the usage process of product, so as to guide users daily sustainable lifestyle.

CASE STUDY

In recent years, the coffee market has developed rapidly. However, behind the popularity of coffee capsules is an environmental concern: most of the packaging left behind after use is not properly disposed of.

To solve this problem, Austrian packaging manufacturer Alpla has teamed up with material producer Golden Compound to develop a new type of fully biodegradable coffee capsule. Austrian coffee producer Amann Kaffee has become the first company to use this sustainable coffee capsule packaging.

Based on this environmentally friendly material, I have designed a coffee packaging for Amann Kaffee, which is taken as an example to verify the rationality and feasibility of my methodology.



METHODOLOGY

USE
Sustainable intervention points based on the product itself:
simple to use; reduce waste discharge; clean energy sources; Growth/modularity;
based on the user's lifestyle:
Visualization;
Exemplary guidance; real-time reminders;
Timely feedback and reward mechanism for sustainable behavior;
Services replace physical products;

DISCARD
Process guidance; Shared design;
Persuasive design;
recycling process visualization;

RECYCLE
Recycling communities; Reconstruction and reuse;
Second-hand service platform;

NEEDS
Focus on users' needs for a sustainable lifestyle;

DESIGN
Consider sustainable design intervention points in the product life cycle:
product design; persuasive design; service design;

PRODUCTION
Degradable, recyclable green materials;
Advanced technology;
Use new clean energy;

SALE
Sustainable lifestyle;
Introduction sustainable living concept;
Sustainable means of advocacy;

TRANSPORT
Sustainable packaging ;
Harmless and low-energy storage and transportation methods;

The possibility that the user will achieve the usage goal	The possibility of causing users to think about the design	The possibility of active user action	The possibility that the user will perceive the information	The possibility of emotional resonance with users
Functional Affordance	**Cognitive Affordance**	**Behavioral Affordance**	**Sensory Affordance**	**Emotional Affordance**
The possibility of a user completing a sustainable operation	**The possibility of causing users to think about sustainable ideas**	**The possibility of causing users to engage in sustainable behavior**	**Users perceive information related to sustainability**	**The possibility of causing users to yearn for sustainable life**
Products: Multifunctional; Durable; Easy to use; meet the needs of sustainable living; Extend product life; Reducing single-use waste; **Packaging:** Multifunctional; **Services:** **rental;** **multi-person sharing;**	**Products:** consistent with common understanding and custom; symbolizing accurate; obvious label ; **Packaging:** A brief introduction to reuse procedures; **Service:** Spread the idea of sustainability	**Products:** The operation conforms to the user's subconscious habits; Guide design; Exemplary guidance; real-time reminders; **Services:** service guided design; Sustainable recreational communities;	**Products:** consumable usage; Visualization; Clean energy perception; **Services:** Sustainable promotion; transparent processing plant;	**Products:** Nice change; Companion products ; growth products; **Services:** Provide the emotional value required by the user; Meet the user's psychological expectations of environmental protection;

CONCLUSION

In this way, the concept of sustainability is integrated into the framework of product affordance design, which can make users perceive the concept of sustainability conveyed by the brand in the process of contact with the product more intuitive and simpler, improve the public awareness of sustainability and acceptance of sustainable lifestyle. At the same time, this article also tries to enrich the connotation of the affordance theory and makes a certain theoretical contribution and practical exploration to the development of the affordance theory.

Jinzhuo Liu, Xiaobo Qian, Guangming He. Jiangnan University. Design for sustainability.

THE 29TH INTERNATIONAL SUSTAINABLE DEVELOPMENT RESEARCH SOCIETY Conference ISDRS

Sustainable design study of alternative foods

1.Introduction : Due to the impact of Coronavirus Disease 2019 (COVID-19), countries are experiencing significant stagnation or even regression in multiple areas of development. The latest estimates from the Food and Agriculture Organization of the United Nations (FAO) suggest that the number of hungry people worldwide in 2021 will be between 7.02 and 8.28 million (point estimate 7.68 million) , nearly one-seventh of the world's total population. In addition, the proportion of the world's population that is severely food insecure has increased significantly from 10.9% in 2020 to 11.7% in 2021, resulting in a moderately food insecure population that is severely food insecure and may even face hunger, with about one billion people not consuming enough protein. The United Nations expects the global population to reach 96 billion by 2050, and the annual demand for protein will increase to 360-1250 billion tons, with traditional protein coming mainly from animal protein such as pork, chicken, lamb, beef, eggs and dairy products,. In addition, meat production causes a large amount of greenhouse gas emissions, becoming one of the relevant influencing factors of global warming, the supply of meat protein has a negative effect on sustainable development, these globalization under the population growth, climate change, etc. to the future of food development has brought multiple serious challenges. Therefore, considering the need to achieve the United Nations Sustainable Development Goals (SDG) for food security, relevant researchers and others are actively searching for alternative foods, alternative protein sources that can supplement animal products to feed the population, to meet the growing future dietary needs and to find sustainable solutions to the food crisis.

Due to their high protein content and ecological adaptability, such as insects, microorganisms, and seaweeds, these non-traditional foods are considered to be promising sources of edible protein and are used as alternative food sources for future protein supply. While arable land is a limiting factor for increasing agricultural productivity in some developing countries, it is not necessary for cultivating insects, microorganisms, algae, etc., which makes them an ideal source of alternative proteins, and future foods such as plant-based meat alternatives (PBMA) are also a means to achieve sustainable food systems. In Design for the Real World, Papanak first introduced the social responsibility of design, which also provides an innovative perspe The current design related to alternative food mainly includes: alternative protein food design under sustainable supply demand, alternative food design innovation under new technology paradigm, and intervention for alternative dietary approaches at farm, community, national and global levels, etc., providing systematic, forward-looking, innovative and user-centered visual design, product design, spatial design, service design and other related thinking methods to explore sustainable innovation in food science and future development.ctive on the challenging issues related to food in the context of sustainable development. Specific design practices such as visualization of non-traditional ingredients (insects, microorganisms, seaweed, etc.), technology and other innovations to achieve alternative foods to improve the global food supply, etc. The main process of design intervention is based on the discussion of issues such as food shortage, providing innovative ways of thinking for alternative food development, etc. It has a positive effect on the development of sustainable and non-traditional alternative food, and at the same time, the design means of intervention also presents the diversified characteristics of alternative food.

2.Alternative foods and their associated designs

With the improvement of people's living conditions, the demand for protein from animal sources such as meat, fish, eggs and milk in the daily diet is increasing. However, animal food has been shown to be a major cause of greenhouse gas production, pollution, land use, water use and biodiversity loss, which is detrimental to the achievement of sustainable development goals in the human living environment. In addition, there is a growing concern about animal welfare associated with captive breeding, slaughter, and consumption of animals, so there is a focus on replacing animal proteins with other proteins such as plants, insects, algae, microorganisms, etc., to reduce the possible negative effects of consuming animal food, etc. As a cutting-edge and socially responsible discipline, design has a relatively early interest in sustainable alternative food, and the approach to alternative food design is based on an extension of the traditional design discipline's approach to food as a carrier, with constant iterations in related food innovation practices and research. Alternative food design categories

1) Edible insect food design

I Insects are an abundant, affordable, and sustainable source of proteins and other nutrients. More than one million species of insects have been discovered, but millions remain to be discovered, of which about two thousand are considered edible, a number that is likely to grow in the future. Insects can be fed materials that are considered waste and turned into a high protein food source, while requiring less water and land to produce edible insects and producing less greenhouse gas emissions and pollution than conventional livestock. Overall, the rearing of insects for food is more sustainable than the rearing of livestock .

Although more than 2 billion people worldwide currently use insects as a natural part of their diet, the reluctance to eat insects due to phobias about unconventional foods (fear of trying new or unusual foods) has created a barrier to consumer acceptance of insects as food. At the same time, this food phobia may decrease over time as younger or more adventurous consumers become curious and more knowledgeable about new foods, such as insect food, but this does not mean that people will crave or enjoy insect food either. The characteristics of edible insect food and the need for innovation provide an opportunity point for design to intervene as a means of innovation. Designing edible insects to meet consumer satisfaction means that design is required to control the appearance, texture, taste, and flavor of edible insect food. Many designers are experimenting with incorporating insects as functional or nutritional ingredients into traditional foods such as bread, cookies, hamburgers, and sausages, rather than consuming them directly, or innovating them in new food forms. For example, to stimulate discussion on the issue of overconsumption of livestock products, Caroline designed the high value sausages in Figure 1. which are made from trimmings and insect proteins, an approach that improves the nutritional value and sustainability of the food while still presenting it in a form that is comfortable for consumers to eat. In addition, information about the sustainability and environmental benefits of eating insects instead of meat or fish is designed to potentially inspire more consumers to try and incorporate them into their daily diets.

Figure 1. High-value sausages designed from trimmings and insect proteins

2) Sustainable design of algae food

Many algae are nutrient-rich foods suitable for mass production, and their yields exceed those of many plants.At the same time, algal food production is more sustainable than livestock production; for example, algal protein production requires much less land and water and produces much less CO2 emissions than the production of the same amount of beef protein18.Importantly, the biological fixation of CO2 by algae helps to reduce atmospheric greenhouse gas levels, which may be one important strategy for reducing global warming.In summary, algae are expected to be one of the important sources of protein food in the future and have great potential to address food security, environmental issues and other aspects of sustainable development.Design participation in the innovation process of algae food is based on protein food production in a commercial economy. In addition, the important role of food design is to guide the relevant sustainable dietary lifestyle of consumers and drive them into such a lifestyle, thus enhancing the value of algae food as a sustainable alternative food.

The current design of algae food is mainly about the decomposition of algae raw materials and thus design innovation to achieve innovation in various aspects such as form and taste.Although algae food is relatively well accepted by its audience, the intervention of design can bring more opportunities for the development of algae food and expand more possibilities of algae alternative food design.The design of algae food is to further optimize the design content related to the visual presentation and user experience of edible algae so that it can drive the commercially required yield, meet the nutritional needs of users and enhance its sensory experience attributes on a large scale.

3) Plant protein food design

Plant protein is one of the animal protein alternatives that can meet the needs of a growing global population and help alleviate the sustainability issues associated with producing animal protein, such as the production of legumes that require less water than many other crops, the ability of legumes to fix nitrogen so that they require less nitrogen-based fertilizers, and their ability to absorb CO2 to improve carbon sequestration in the soil17.In addition to this, plant proteins can be isolated from grains, pseudocereals and many other plants18.The wide range of functional properties they exhibit lends itself to the construction of plant-based foods with a wide range of nutrients and suitable for multiple use scenarios.Together, these factors are driving interest and practice in the use of plant proteins to create alternative new foods, but the differences between plant and animal molecular structures require innovative formulations and multiple design presentations when using plants to create animal-like foods.For example, innovative material structure design, physical form design, and eating experience design for the design practice and commercial presentation of plant protein foods.

Since plant foods are a familiar way of eating, research and practice on plant protein food design predate and outnumber other alternative food design activities.Activities on plant-based food design include innovative changes to modern food and conceptualizations of future food, which can be specifically categorized into three major categories: innovation of itself, fusion innovation, and new food innovation.Design offers new approaches and ideas for the appearance, taste, visual presentation, and experiential approach of plant-based foods.

3. Influencing factors of alternative food design and design methods

3.1 Design factors for alternative foods

Through the above-mentioned research and analysis of alternative food designs such as edible insects, algae, and plant-based diets, the main factors involved in the design of alternative foods include the relationship between "human-food-social perception (Figure 2)".Human needs are used as the design direction, food is used as a vehicle for sustainable design, and the need for sustainability is considered in the context of social development.In general, the design of alternative food is constructed from micro human needs to macro social perceptions, so the user needs, food characteristics and social perceptions involved in alternative food are also the main factors influencing its design.

Figure 2. "Human-food-society" design factors for alternative foods

3.2 Alternative food design methods

The approach to alternative food design is derived from traditional design disciplines and primarily from industrial design methods, and the relationship between alternative food design and traditional industrial design can be understood as a design study that concretizes food as a "product.Unlike traditional design, alternative food design is based on the concept of sustainable design and in-depth research on non-conventional foods, and is a design practice based on the material and immaterial aspects of alternative foods, such as structure, material, form, and flavor.Specific design tools include,1) Insects, algae and other alternative foods are mostly unconventional foods, and the optical illusion design of their unconventional characteristics can form a "normalized" presentation with "visual deception", which can reduce consumers' cognitive consumption and promote food development.2) The original forms of alternative foods such as insects are also considered difficult to be accepted as food. By deconstructing their forms and then designing and reorganizing them, the acceptance of alternative foods can be enhanced, for example, by breaking people's imagination about the appearance and taste of food and forming new foods(Figure 3).3) Combining alternative foods with everyday universal foods by means of design, thus forming easily accepted foods that meet people's physiological and psychological needs(Figure 4).The approach on alternative food design is not limited to the above. With the development of various aspects such as technological means and group cognition, the design approach is constantly iterating and improving, but in general, it is the demand for innovative ways to meet social needs and promote food development in the framework of sustainable development needs.

Figure 3. "Digital DARK Food" by Spanish designer Martí Guixé

Figure 4.Due to people's habit of "judging fruits by their appearance", many supermarkets have encountered the problem of leftover fruits that end up being wasted.Inspired by this phenomenon, Brazilian artist Monica Piloni decided to transform these "crooked" fruits to challenge the aesthetic standards of the fruit's.In this series called Hybris, the fruit is cut in half to reveal a skeletal structure that she has cleverly implanted to look like a hybrid of fruit and animal.

4.Conclusion

Food, as one of the essential substances for human survival, provides a source of nutrition and determines the future development of human beings. Food design in a sustainable context goes beyond its material properties and provides solutions to the sustainable needs of the social layer.Among them, alternative food is the inevitable trend of sustainable development, alternative food involves not only the insects, algae and plants mentioned in the text, but also the scope of alternative food is extended with the development of technology.In the context of the relatively complex population relations and diverse economic and ecological environment of modern society, how design intervenes in the development of alternative food is the main research content of this paper, which focuses on how design can provide methodological tools for the sustainable development of alternative food. From the perspective of the concept, theory and practice of alternative food, this paper examines the relationship between "people, food and society" in relation to alternative food, and explores the value of alternative food design in sustainable development, so that alternative food can go beyond its own material properties to promote the sustainable development of food-related societies. We will explore the value of alternative food design in the context of sustainable development.

In conclusion, the involvement of design in the process of alternative food innovation is mainly based on the design tradition approach, which emphasizes alternative food design for food sustainability. It is hoped that this study will provide a methodological basis as well as theoretical support for subsequent researchers in alternative food design.

YueHui Liang, Kookmin University, Track 5b Design for sustainability

TRACK 5
Production, consumption and innovation

5c. Circular economy

Abstracts

8

Status quo - Circular business models and their strategies in the manufacturing textile industry in Germany: a survey study

Prof. Dr. Marlen Gabriele Arnold[1], M. Sc. Constanze Pfaff[1], Dipl.-Ing. (FH) Thomas Pfaff[2]
[1]University of Technology Chemnitz, Chemnitz, Germany. [2]Sächsisches Textilforschungsinstitut e.V., Chemnitz, Germany

Abstract

The textile industry is one of the world's biggest environmental polluters. In Germany this industry is the fourth largest cause of ecological damage. Water pollution by pesticides, high water, energy and CO2 consumption and large quantities of waste are among others some of the major environmental impacts of the German textile industry along the entire value chain. For this reason, the EU strategy for sustainable and recyclable textiles has been initiated since 2022. It calls for recyclable and sustainable materials, most of which should be kept in the material cycle. Consequently, it is necessary to rethink current businesses and establish circular strategies and business models in the textile industry and, if necessary, to amend them towards more digitalization as well. The transition from a linear economy to a circular economy, concrete changes are needed, among others the reorganization of business models. This concerns the three areas of "value proposition", "value creation and delivery" and "value capture". The greatest challenge is usually how to ensure economic added value and thus the continued existence of the company when social and ecological changes are made in the company. However, little is known how circularity is already embedded in German manufacturing textile industries. Thus, the status quo of circularity is investigated.

Therefore, a digital survey study in December 2022 until January 2023 was conducted. The survey was open to all processing companies in the textile industry in Germany, regardless of which textile value-added stage they belong to. In total, the results of 56 German manufacturing textile industries will be presented by applying descriptive statistics.

The sample represents a general understanding of sustainability requirement and potentials as well as circularity and circular strategies in the German textile industry. Yet, there is a lack of sustainable management concepts and knowledge, even of the EU strategy for sustainable textiles. The sample shows companies applying circular business strategies in all three value-added areas "value proposition", "value creation and delivery" and "value capture" like product-as-a-service, repair & reuse, upcycling & recycling and material or process innovation. The systemic strategy closed loop supply chain is not yet embedded. Overall, the majority of the manufacturing textile companies in the sample is not well prepared for a circular transformation. Supportive seems an organized provision of information and intended financial state support.

The survey supports SDG 12, especially 12.1., 12.2 and 12.5., because circular business models offer the opportunity to reduce waste and environmental impact by keeping materials in the material cycle. Consequently, finite resources can also be saved. The survey also offers a significant contribution to the 5 Ps of the SDGs, especially for the textile industry. It first shows the status quo of the mentioned industry, in order to derive research gaps and needs based on it, which lead to closed loop supply chains. When loops are closed, resources can be saved and planetary boundaries can be preserved.

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Bioeconomy opportunities and challenges in Nepal: a closer look at biowaste potential at a subnational level

Sagar Kafle[1], Manoj Gyawali[2], Prajal Pradhan[3,4]
[1]Department of Agricultural Engineering, Purwanchal Campus, Institute of Engineering, Tribhuvan University, Dharan, Nepal. [2]Pulchowk Campus, Institute of Engineering, Tribhuvan University, Lalitpur, Nepal. [3]Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany. [4]Bauhaus Earth, Berlin, Germany

Abstract

Biowaste makes up the largest fraction of waste generated in developing countries like Nepal. However, its potential is often underutilized due to the lack of proper valorization. Therefore, we assess the biowaste potential at the national and subnational levels for Nepal. The assessment includes all major sources of biowaste including agriculture and forest residues, municipal biowaste, and livestock, poultry, and human waste. Building on the assessed potential, we identify existing biowaste management and consumption practices and analyze the possibilities of a waste-based bioeconomy focusing on fuel, feed, and fertilizers. We estimate an annual biowaste potential of 151.6 metric megatons (Mt) for the whole country. This includes 24.3 and 82.1 Mt from agriculture and forest residues, respectively. Municipal biowaste contributes 1.3 Mt and the remaining 43.9 Mt is from livestock, poultry, and human waste. At the subnational level, Province 1 has the highest share of estimated potential (19%) whereas Province 2 has the lowest (9%). This variation can be attributed to the geography and area of the provinces as well as their land use practices. Currently, the available biowaste potential in Nepal is extremely underutilized. Depending on the source, biowaste can be converted to high-value products such as densified biomass fuel (pellets and briquettes), densified total mixed ration feed blocks, biogas, biofertilizer, and biochar. This conversion and utilization can have significant environmental and economic benefits. The insights into biowaste valorization potential at national and subnational levels offered in this study can help authorities to formulate appropriate policies and entrepreneurs to develop business plans while also opening the door for further research.

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Barriers and potential drivers to the utilisation of circular bio-based building materials in Vietnam

Dinh Linh Le[1,2,3], Roberta Salomone[2], Quan T. Nguyen[3], Alexis Versele[4], Chiara Piccardo[4]
[1]University School for Advanced Studies IUSS Pavia, Pavia, Italy. [2]Department of Economics, University of Messina, Messina, Italy. [3]Faculty of Construction Economics and Management, Hanoi University of Civil Engineering, Hanoi, Vietnam. [4]Building Physics and Sustainable Design Unit, Department of Engineering Technology, Ghent Technology Campus, KU Leuven, Ghent, Belgium

Abstract

Using circular bio-based building materials (C3BMs) offers a viable solution to mitigate the building sector's climate and environmental impacts, yet they are still underused. The barriers that hinder and drivers that promote C3BMs utilisation need detailed investigation. However, few studies have been done on the barriers to and drivers for C3BMs in developing countries such as Vietnam. This study explores perceived barriers and potential drivers for C3BMs with reference to the Vietnamese construction market. Firstly, a literature review is carried out to explore the existing barriers to and drivers for C3BMs both in developed and developing countries. Secondly, data collected from a questionnaire survey with building professionals in Vietnam, including architects, engineers, contractors, etc., were analysed using descriptive methods to identify the critical barriers to and drivers for C3BMs. The results indicate that "building code restriction" and "lack of design guides and tools for projects using C3BMs" are the key obstacles. Meanwhile, "government regulations and policies encouraging the use of C3BMs" and "public incentives and strategies for promoting the use of C3BMs are the most critical drivers. These findings may provide valuable information for scholars, businesses, and policymakers in promoting the utilisation of C3BMs in Vietnam.

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Circular economy in the cosmetic industry: a literature review.

Ms. Alice Mondello, Prof. Roberta Salomone, Dr. Giovanni Mondello
Department of Economics, University of Messina, Messina, Italy

Abstract

Cosmetic industry is involved in finding sustainable solutions to reduce any negative environmental, economic and social impact related to the different stages of cosmetic products' life cycle. Due to this growing interest, the concept of Circular Economy (CE) has started to be observed as a way to develop sustainable solutions, both from companies and scientific community. However, there is still a lack of information regarding how CE principles are implemented by cosmetic companies as well as understanding their connection with sustainability goals. In this context, it is of basic importance to analyse the state of the art of the academic literature in this field with the aim of providing an overview of CE practices and strategies which are or could be applied in the cosmetic industry. A bibliometric and systematic literature review is carried out. The sample of studies has been extracted from Scopus and Web of Science databases. The process identified articles and reviews having a focus on how circular solutions are developed. Results have been classified in: input valorisation, packaging optimisation, output valorisation, management and governance. The main findings highlight that the input valorisation is the most investigated category. In addition, results show a connection with agri-food, chemical and biochemical sectors, and with sustainability .

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Critical review of the available tools for assessing Circular Economy and a new guide for action

Mariana Cardoso Chrispim, Marie Mattsson, Pia Ulvenblad
Halmstad University, Halmstad, Sweden

Abstract

The measurement of progress towards Circular Economy (CE) in micro level (within a company) is crucial for identifying opportunities and designing circular practices. However, most of the existing tools fail in considering the systemic view and principles of CE. This research aimed at assessing the contributions and limitations of CE assessment tools regarding the key elements: social dimension, stakeholder engagement, R-imperatives and industrial symbiosis. Based on that, we also offered guidance for improvements towards a CE transition. The methodology was an integrative literature review; then based on the critical assessment of tools a guide was created. Thirty-eight tools were thoroughly analysed and our results show that there is a limited number of multidisciplinary tools (only 10), that is including all CE key elements, and in some cases partly. Social dimension is not fully explored; only 6 tools have indicators related to society, local community, customers, and workers. Recommendations for future tools development include to offer training for possible users of the tools. Finally, we conclude that all the key elements of CE are interconnected and we proposed a guide-ACTION (Assessing Circular Transition In Organisations Now)- which includes the key elements, databases, tools, and indicators to help companies in planning and making decisions about circularity issues. The abstract is based on a recent publication by the authors.

Reference:

Chrispim, M. C., Mattsson, M., & Ulvenblad, P. (2023). The underrepresented key elements of Circular Economy: A critical review of assessment tools and a guide for action. Sustainable Production and Consumption, 35, 539–558. https://doi.org/10.1016/j.spc.2022.11.019

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Circular economy practices in the agri-food sector: an exploratory survey regarding Portuguese companies

Federica Scandurra[1], Professor Roberta Salomone[1], Professor Sandra Caeiro[2,3], Professor Ana Pinto de Moura[4]
[1]Department of Economics, University of Messina, Messina, Italy. [2]Center for Global Studies, Department of Science and Technology, Universidade Aberta, Lisbon, Portugal. [3]CENSE - Center for Environmental and Sustainability Research & CHANGE - Global Change and Sustainability Institute, NOVA School of Science and Technology, NOVA University of Lisbon, Lisbon, Portugal. [4]4GreenUPorto—Sustainable Agrifood Production Research Centre/INOV4Agro, Department of Science and Technology, Universidade Aberta, Porto, Portugal

Abstract

The circular economy has gained attention as a new sustainable paradigm to promote the protection of the planet and the well-being of the present and future society. One of the sectors that urges the most the transition to circularity is the agri-food sector. The food system represents the connection point of human interactions with the ecosystem, thus generating environmental, economic, and social impacts. Countries are introducing circular principles into their food systems to face such issues. Despite this, several gaps in the literature are present, especially regarding the assessment and monitoring of circularity. Thus, it is urgent to understand how circularity is implemented and monitored in the agri-food sector to spread its knowledge and accelerate the transition. In this sense, Portugal, in the South of Europe where agri-food sector is relevant, has shown great interest in adopting circularity, implementing several projects to identify circular best practices in the agri-food sector. The present study aims to explore the examples of circularity in Portuguese companies of the agri-food sector, focusing on the characteristics of such practices and the assessment and monitoring systems adopted. For this, an online survey from January to February 2023 was conducted on a convenient sample of Portuguese agri-food companies already involved within the circular economy context (being members of Portugal foods, a private non-profit association, that brings together food industry companies and entities from the Portuguese scientific ecosystem or being the participants in the project Alentejo Circular, aimed at identifying examples of circularity in the region). The survey was composed into three parts: i) the general characteristics of the company and the respondent; ii) the level of awareness regarding circularity and sustainability; and iii) the identification, assessment, and monitoring of circular practices. The preliminary results (n=31) show that: i) most of the practices are connected to reduction or re-use strategies (52%), so entail a high level of circularity; ii) they largely involve incrementally innovative processes (77%), with a technological (50%) or socio-organizational (37%) driver; and iii) most of the companies use specific indicators (56%) to assess and monitor circularity, specifically Key Performance Indicators (e.g., to monitor the amount of total waste recovery, the increase of organic matter in the soil, or the reductions in terms of CO2). The study aims to offer other practitioners a valuable guide for adopting and assessing Circulatory Economy in the food context. This contribution, in line with the Sustainable Development Goals 2.4 and 12.3, aims to make the food system sustainable and resilient and fight food loss and waste along the supply chain.

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Operation Flood 2.0

Prof. S Rajeshwaran, Prof. Amrita Dhiman
Development Management Institute, Patna, India

PROF. S RAJESHWARAN

PROF. AMRITA DHIMAN

Abstract

The growth in milk production of 5.5% on a CAGR basis over last 10-year period from 2009-10 to 2019–2020, seems to be insufficient as indicated by the steady rise in the consumer price, with bare minimum domestic buffer stock, with no surplus for export. The Indian dairy sector has much to thank for the vision of Dr Verghese Kurien envisaging the Operation Flood programme nearly 50 years ago and Governments in power for having given the leeway to go ahead with the implementation of that vision. As a result, India not only became the world's largest milk producer in quick time, but was also able to establish milk processing units by adroit financing and setting up dairy cooperatives across the country with milk collection, processing and marketing system. However, it catered mainly to the needs of consumers of milk in urban centres beginning with the metros. The production system was based on a linear economy, wherein major portion of income from surplus milk sale went out of the village towards the purchase of inputs mainly feed; fully knowing that feeds made from seeds that are clearly unsuitable for digestion by ruminant stomach. Hence, this initiative on enhancing milk production needs a fresh direction both in terms of reduction in cash outflow from villages while creating a market for locally grown fodder and agro waste. The purpose should now be a sustainable rise in profit to individual dairy farmers, in real terms. Profit could be earned, from the consumer through segmentation and targeted marketing and by integrating dairy farming with other livelihoods from agriculture thereby lowering the cost of production, reducing technical and financial risks; inducing higher efficiency and higher value addition to products. Combining dairy animal rearing with the local resources and skills, a circular economy at every household, village and taluka level could be energised through Distributed Autonomous Organisations. This could be a way forward, using the 73 different Indian breeds of cows and buffaloes, the highest genetic diversity for any country, each with high bio-diversity and producing A2 type of milk with limited breed improvement activities till date through pure breeding. India is all geared and on the cusp of taking off in the growth in milk production making India along with its neighbouring countries self-sufficient for milk, bio-fertiliser, bio-gas and the requirement of dairy animals. Further, availability of new cost-effective technologies in digital communication, neural networks and young and skilled manpower from within the country can quicken the reach of economic benefit to every household. Following the principle of economic partnership between people in a peaceful and decentralised manner will bring prosperity to all. This review paper on public policy on milk production in India is an attempt to deliberate on the new strategies required for enhancing milk production through circular economy.

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Profiling Circular Economy Practices of Religious Non-profit Organisations

Mrs Susana Cunha Trindade[1], Dr Tomás Ramos[2], Dr Pauline Deutz[3], Dr Natacha Klein[2]
[1]NOVA University Lisbon, Lisboa, Portugal. [2]NOVA University Lisbon, Lisbon, Portugal. [3]University of Hull, Hull, United Kingdom

MRS SUSANA CUNHA TRINDADE

Abstract

Non-profit Organisations (NPOs) have earned increasing visibility in recent years, especially in the current global context which is facing new environmental, health, and socio-economic challenges. NPOs play an important role in several societal areas from health and education to social and community development, helping children, young people, and families, supporting social and community integration, and helping the elderly and disabled. Within this group of social organisations are many religious ones, including Catholic, which also fill several gaps that governments cannot provide to their citizens. The Catholic Church has addressed the environmental crisis by launching in 2015 a papal Encyclic specifically on this matter: Laudato Si': "Praise be to you, my Lord", which demonstrates the Church's concern, but the connection between this high-level document and the actions of Catholic NPOs are relatively unknown. Little research on sustainability and circular practices has been reported in the context of sustainability and Circular Economy (CE) in Catholic NPOs. Consequently, we propose to find out whether and how the CE agenda might be promoted from the sector of Catholic NPOs. In this way, the main aim of this study is to address this research gap by analysing to what extent Catholic NPOs engage with CE and how they are influenced by specific motivations and barriers to CE engagement. The methodological approach is based firstly on an integrative literature review to have the state of the art concerning the application of CE in this specific sector. Following this first step, semi-structured interviews will be conducted with a sample of catholic NPOs representatives, on their internal initiatives regarding CE practices and strategies, to better understand how such practices are implemented in their day-to-day operations. This study aims to contribute to deepening the study of the CE concept at the organisational level, with a special focus on religious NPOs. Extending the knowledge of CE practices beyond the private and government sectors to the non-profit will enable us to have a wider view of what can be the role of the CE in this sector and how to accelerate the CE transition and improve its sustainability performance.

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Perception of Smallholder Farmers on the Adoption of Circular Bioeconomy in the Northern Region of Ghana

Mr Ibrahim Tuzee Abdul-Raheem[1], Dr Olawale E. Olayide[2], Mr Douglas Otoo[3], Mary N. Gichure[4], Dr Frank Kwaku Agyei[1]
[1]Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. [2]University of Ibadan, Ibadan, Nigeria. [3]Gulu University, Gulu, Uganda. [4]Chuka University, Chuka, Kenya

MR IBRAHIM TUZEE ABDUL-RAHEEM

Abstract

The current linear model of resource utilization has been shown to be non-restorative and unsustainable, making it difficult to achieve the United Nations' 2030 agenda of sustainable development goals (SDGs), which aims to end hunger and ensure sustainable production and consumption patterns worldwide. An alternate and more sustainable model of resource utilization is the circular bioeconomy (CBE), which is better suited to achieve these strategic SDGs. However, there is limited research on the factors that influence the adoption of CBE practices, particularly in the setting of smallholder households in Africa. This study aims to assess the knowledge, perception, and willingness of smallholder farmers in Ghana towards CBE, as well as identify the factors that influence the adoption of CBE. The study utilized a qualitative research method to collect data from respondents in order to answer the research questions. The results revealed that smallholder farmers had limited knowledge about CBE, with many farmers being unaware of the concept. However, those who had heard of CBE had a positive perception of it, with many recognizing the potential economic benefits it could bring. Factors that influenced the adoption of CBE included access to finance and credit facilities, access to training and technical support, access to markets, and availability of appropriate technology and infrastructure. The findings of this study highlight the importance of raising awareness about CBE among smallholder farmers in Ghana. Efforts to promote CBE should focus on increasing knowledge and awareness among smallholder farmers, as well as providing access to training, technical support, and financial and credit facilities. In addition, efforts should be made to improve market access for smallholder farmers and provide appropriate technology and infrastructure to support the adoption of CBE practices. The adoption of CBE practices among smallholder farmers in Ghana could lead to significant economic, social, and environmental benefits. CBE practices could help to increase agricultural productivity and improve soil health, leading to increased yields and improved food security. In addition, the adoption of CBE practices could provide new economic opportunities for smallholder farmers, through the production of biofuels, bio-based materials, and other value-added products.

Keywords: Circular bioeconomy, Organic waste, Smallholder farmers, Economic sustainability, Resource reuse.

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Circular economy self-assessment tool for households: A collaborative approach

Alexandre Silva[1], Tomás Ramos[2]
[1]NOVA School of Science and Technology, NOVA University Lisbon, Faculty of Science and Technology (FCT), Nova University Lisbon (UNL), Lisbon, Portugal, Lisbon, Portugal. [2]CENSE – Center for Environmental and Sustainability Research & CHANGE - Global Change and Sustainability Institute, NOVA School of Science and Technology, NOVA University Lisbon, Faculty of Science and Technology (FCT), Nova University Lisbon (UNL), Lisbon, Portugal, Lisbon, Portugal

Abstract

Household daily activities, such as food acquisition, housing, and mobility, are closely linked to sustainability impacts, including climate change, raw material use, quality of life, and waste production. Furthermore, economy growth has been associated with more demanding consumption patterns. However, individuals still don't know how to act to better manage and improve their household sustainability performance, covering sustainable consumption and well-being, among other related aspects. In addition, when associated with circular economy, household/individuals mainly focus on reduction, re-use, and recycling strategies, providing limited attention to other circular economy-based strategies, such as refuse, rethink, or repair. In the context of households, when sustainable consumption is connected with circular economy, financial benefits become a possibility, and a main driver towards a sustainable lifestyle. Multiple studies have been conducted to understand circular economy assessment in products, private or public organizations, eco-industrial parks, and cities. However, there is still a lack of knowledge regarding the assessment of circular economy practices implemented at the household level, including current strategies, and indicators. Thus, the present work aims at developing a self-assessment tool to assess and report the implementation of circular economy-based strategies at the household level, including the definition of consumption activities, and indicators. This study is supported by a two-stage methodology, based on a mix-method procedure, that centers co-creation with residents/ family's representatives in its approach, through the use of questionnaire surveys, and semi-structured interviews with open-ended questions. The developed self-assessment tool will allow individuals and families to assess, communicate, and reflect on their behaviors about sustainability, in the vein of circular economy. It will foster a pro-environmental mindset, social equity, and economic consciousness in everyday decisions. This research contributes to the debate on the role of the household in the transition towards a circular economy, and its inherent assessment, and communication, using circular economy indicators.

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Developing a Framework for National Electrical and Electronic Equipment Waste Management applying Sustainable Circular Economy Stratagem

Dr Anupama Singh, Prof Arunaditya Sahay
Birla Institute of Management Technology, Greater Noida, India

DR ANUPAMA SINGH

PROF ARUNADITYA SAHAY

Abstract

Waste Electrical and Electronic Equipment (WEEE) are electrical and electronic equipment (EEE) which cannot be used further and are rejected as waste without any possibility of recycling and reuse processes. With the increasing market demand for EEE, their manufacturing has also correspondingly increased, leading to a substantial rise in WEEE. At the same time, the current formal sectors do not have sufficient expertise to address escalating WEEE. Further, there is a lack of infrastructure, public awareness, policies and technologies required to manage WEEE in an environmentally safe way. Such a scenario has triggered massive environmental and public health threats. There is an urgent need to focus on sustainable circular economy strategies to protect the environment and public health from toxic WEEE. Ellen MacArthur Foundation (2018) has made it evident that circular economic approaches have substantial advantages for EEE industries; it can reduce customer expenditure by 7% and 14% by 2030 and 2040, respectively. This study analyses recent developments and challenges in numerous aspects of WEEE, including collection, treatment, and recycling. It has been found that Europe is the largest producer of WEEE, trailed by Asia, America, Oceania, and Africa. The material recovery from WEEE was worth $57.0 billion in 2015, out of which only $10.0 billion has been recycled and recovered sustainably, equipoising 15.0 million tonnes (Mt) of CO2. Hence the foremost challenges of WEEE management include inhomogeneity of waste that requires sorting and zero emission treatment, low energy density for recycling, sustainable consumer behaviour, and cost-effective operations.

Almost 70% of countries around the globe have WEEE management policies and regulations. Such policies and regulations have not been efficiently implemented in most countries. Developing countries belonging to Asia and Africa have limited or no WEEE policies and regulations. Hence, this research attempts to provide a Sustainable Circular Economy Stratagem (SCES) framework. It has been developed through Sustainable Development Goals (SDGs) synergy with Circular Economy (CE) principles, resulting in a list of policy implications in the current WEEE management. The SCES framework will be validated through a scientific research plan and methodology, including data collection, data analysis by machine learning tools, and final model validation. This research is expected to validate SCES.

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The elephant in the room - the ambiguity of the extended producer responsibility in the Latvian packaging waste management system

Jana Simanovska, Inga Belousa
Vidzeme University of Applied Sciences, Valmiera, Latvia

JANA SIMANOVSKA

INGA BELOUSA

Abstract

The notion that the increasing use of natural resources to satisfy human consumption needs and the pollution of the environment with post-consumption waste exceeds the planetary boundaries appears more often in both scientific and applied discourse. The circular economy is seen as a response to this challenge, where no material is wasted but turned back into production, and this concept is integrated into Sustainable Development Goal 12. So far, the conventional, purely market-driven development has led to a linear economy, therefore the shift towards the circular economy requires policymakers and public administration to interfere using various tools and instruments to enforce this transition engaging the stakeholders of the material management ecosystem to close the material loops.

The presented research hereto explores the packaging waste management ecosystem in Latvia, starting with producers of packaging and ending with the waste managing companies and recyclers focussing on separate collection of packaging waste - a precondition for more efficient recycling. We applied qualitative content analysis of the legislation and relevant policy documents defining the responsibilities of various stakeholders and analyzed how the responsibilities of waste management aiming to achieve recycling goals agreed upon within the European Union are transferred. To enhance the recycling of packaging waste, a promising instrument - the extended producer responsibility - is applied in Latvia, entrusting the companies placing packaging on the market to take financial and organizational responsibility for collecting and recycling the packaging waste. However, the waste management system at the national level lags in achieving the European Union's waste recycling goals and, seemingly, the producer responsibility is insufficiently integrated into the regional waste management ecosystem using the metaphor of the elephant in the room. Our research reveals that unclear responsibility definitions and insufficient feedback loops between stakeholders can be the reason for this poor achievement. Also, the research identifies positive legislative developments in this field of waste management.

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Upcycling and Circular economy in Cultural and Creative Industries

Dr Leonardo Borsacchi, Mrs Giulia Lippi

ARCO - PIN University of Florence, PRATO, Italy

DR LEONARDO BORSACCHI

Abstract

According to many definitions, upcycling, within the framework of circular economy practices, is the way to reuse waste materials by creating something new that is more valuable than the original materials. It is configured as a cost and energy-saving production method that involves the creative reuse of waste products or materials to obtain new and more valuable items. Upcycling is becoming a trend, showing a growing increase in popularity. It involves, among others, the re-use of old homewares by means of small do-it-by-yourself, and thus, it is likely to be adopted within the production processes of Cultural and Creative Industries (CCIs). This paper may be a useful tool to lay the foundation for an overall strategy that looks for a new model of production, especially at the urban level, which respects local traditions as well as the territories. The CCIs sector is increasingly growing, bringing out opportunities for new jobs, collaborative economy, social innovation, start-ups, and urban regeneration. It is often sponsored as a booster for sustainable development since it relies more on human input, rather than on materials ones, thus it may relieve the pressure on the environment. Thus, this work targets local authorities and industries as main users. With a wide review and analysis of good practices offered by the manual, cities and industries may learn about the different solutions that can be adopted, considering their specific urban and economic features, such as the socio-economic fabric, the availability of raw materials and technologies, or the position along the global supply chain. The paper may provide suggestions to CCIs to achieve SDGs' goals. Upcycling within CCIs, which is the main topic of the manual, covers primarily SDG 11 (Sustainable cities and community) and SDG 12 (Responsible consumption and production), but it contributes also to implementing SDGs 8 and 9 (decent work and economic growth, Industry, Innovation, and Infrastructure, respectively). This work has been developed within the framework of the ENI CBC MED project "INNOMED-UP - Promoting UPcycling in Circular Economy through INNovation and education for creative industries in MEDiterranean cities" involving partners in Greece, Italy, Tunisia, Palestine, Jordan.

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The on-going project FLOWTEX (Dynamic FLOW diagrams for circular TEXtile) in the textile district of Prato (Italy): implementation and future perspectives

Dr Leonardo Borsacchi, Mr Gabriele Feligioni, Mr Alessandro Ferrini, Mrs Cello Caroline Lockwood
ARCO - PIN University of Florence, PRATO, Italy

DR LEONARDO BORSACCHI

MR GABRIELE FELIGIONI

MR ALESSANDRO FERRINI

Abstract

The textile sector is one of the most impactful at the global level. It is responsible for a significant amount of CO2 emissions and waste generation, with a strong impact on climate change. The Italian textile district of Prato, is one of the largest Italian industrial districts and one of the most important textile and clothing production centres in the world. Since the post-war period, textile waste management has represented one among the main drivers for textile district development: recovery and recycling of natural fibres from rags and used clothes were the basis for the Prato's yarn and textile industry. Prato has been always a model of innovation in this sector having historically based its industrial fortune on the reuse of waste from the textile process and on the reuse of second-hand clothing from all over the world. The evolution of materials technologies, together with the progressively changing market demands have led to a profound transformation both in industrial processes and in the use of materials and the district is nowadays involved in new paradigms of digitalisation and sustainability. In order to comply with sales specifications and as evidence within certification's schemes, enterprises are carrying out the Life Cycle Assessment of its production process. In many cases, however, these studies could being unrepresentative of the actual environmental impacts associated with the steps in the production process, which is not standardized and involves a great deal of variability in starting materials and in the combination of production steps. This paper presents the preliminary results of an action-research, still in progress, called FLOWTEX (Dynamic FLOW diagrams for circular TEXtile). The project is financed by national and local funds, aiming to support technological transition of the textile sector. The action-research involves four enterprises, dealing with textiling recycling, representing different steps in the chain. The proposed innovation is the creation of an IT platform capable of combining process data in order to: i) adopt digital solutions for data collection and process and product control by enterprises; ii) obtain effective information (i.e. environmental indicators) from the production steps, in order to return flowcharts and to get an inventory database to carried out future LCA. The data acquisition and calculation model is carried out either by dialoguing with the enerprise's ERPs. so that information on the specific process/product is returned in real time, or by manual input. The pilot platform can be implemented in the future to carry out comprehensive LCA studies that will be able to combine inventory and process data. At the distric level, the implementation of the technology along the supply chain, creating industrial symbiosis phenomena, could make it more sustainable, generating good circular practices and reducing environmental impacts. The project covers primarily SDG 12 (Responsible consumption and production), but it contributes also to implementing SDGs 8 and 9. This study will show the critical issues that have emerged and the future prospects that will be addressed and developed in the continuation of the project.

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Practicing more Circular Economy enabling configurations of CE technologies and managerial practices in the manufacturing industry

MSc Alexandra Barón Dorado[1], Dr Paul Ligthart[2], Dr Sjors Witjes[2]
[1]Universitat de Girona, Gerona, Spain. [2]Radboud University, Nijmegen, Netherlands

Abstract

Although CE literature mainly focuses on technologies contributing to enabling more circular economy, some of these papers also suggest managerial practices associated with CE. Enhancing the understanding of the link between CE and enabling practices, this paper explores enabling configurations of supportive technologies and practices discussed in CE literature using an extensive database of the European Manufacturing Survey on innovation and sustainability practices in the manufacturing industry. Using the QCA methodology, analyses show multiple consistent configurations of technologies and management practices implemented by the 288 manufacturing companies. The results show that a wide range of technologies related to CE in combination with managerial practices can lead to the adoption of more CE in manufacturing companies. While this research adds the configuration-of-practices lens to debates on CE adoption by companies, the outcomes provide production managers with more insight into which configurations technologies and enabling managerial practices contribute to CE adoption.

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Circular fashion – choice or necessity? Factors contributing to the adoption of sustainable business models in fashion industry

Dr Anita Uchanska-Bieniusiewicz
Kozminski University, Warsaw, Poland

Abstract

Fashion industry is responsible for substantial resource consumption and environmental pollution. Coupled with elaborate marketing practices invoking extensive consumption of fashion items and shortening their life cycles fashion industry is a suitable candidate for adoption of circular economy business models and implementation of sustainable practices along the entire value chain. Sustainability in fashion is therefore an area for extensive research, resulting in gaining more insight into circular business models, business model innovation, changes in consumer behavior, challenges and obstacles related to transition to sustainability, born-sustainable companies or frameworks for creation a circular ecosystem. While these studies explore companies and consumers through different lenses an interesting research gap is noticeable. Although it is undeniable that fashion industry should become more sustainable and that consumers' awareness towards conscious consumption is growing, less is known about the drivers, motives and incentives that trigger the adoption of sustainable practices by companies.

Therefore the objective of this study is to detect the drivers of change in fashion companies. Is sustainability a fashion, a new trend that has to be adopted, or is it a necessity for them? This research problem may be investigated through three stage research method. The first stage encompasses literature analysis comprising the relevant academic articles from Web of Science and Scopus databases. The aim of this stage is to discover what reasons for participation in circular economy were mentioned in the studies. The second stage encompasses the analysis of industry reports and journalistic articles with the aim of selecting the companies to concentrate on in the third stage. The third stage aims at screening the websites and materials of the companies in search for their publicly expressed motivations. The findings are then combined and the links between them are established using content and thematic analyses.

The main reason why searching for the true motivations for the decisions of fashion companies going sustainable may encounter difficulties is the social context and the pressure from both consumers and regulators. That is why there may be discrepancies between real and declared reasons. Taking this into account it is still possible to indicate such motivations as: rising competition, threat from ultra-fast fashion, disruptive innovation, business model innovation, COVID 19 pandemic and its consequences in terms of changed consumer habits and expectations, supply chain alterations, slow fashion, laws and regulations, social movements and initiatives.

The subject of reasons, motivations and incentives for transition to circular fashion may be perceived as important especially because of such an extensive environmental impact of fashion industry. To state that fashion companies should be more sustainable may not be enough to actually augment the overall level of sustainability, Discovering the reasons why they do that on the one hand and why not on the other may lead to more conscious and focused initiatives that could significantly contribute to the realization of the sustainability goals. This study relates to SDG+Target 12.6.

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Food waste recycling: last frontier or boundary case for the circular economy?

Sue Huang
The University of Melbourne, Melbourne, Australia

Abstract

Food waste (FW) is a significant cross-cutting issue for sustainable development with relevance to urbanisation, waste management, food security, climate change, pollution, and loss of biodiversity (UNEP, 2021). Compared to the significant progress seen in CE for non-organic materials, food waste recycling (FWR) lags behind and is largely untapped at scale with much of the innovation spurred by civil society at local scale. There are both temporal and spatial limits to the cost-effective movements of FW across space. Yet to date the geographies of FW have been largely neglected in the more techno-economic CE literature (Zhang et al., 2022). Where geographers have studied the spatial limits of sustainable transitions, their focus has been mainly on Europe and North America largely ignoring rapidly urbanising Asia, a major producer of food and waste (Muchangos, 2022).

In this paper I ask, "What do considerations of place and scale tell us about creating a circular economy for food waste recycling?" To answer this I explore case studies in Malaysia looking at urban FWR in three settings: large corporate FWR in a rapidly developing precinct; community-driven public urban farm in a mature township; and not-for-profit food rescue charity operating across a metropolitan region.

I find that FWR occurs in diverse emerging living labs, and lacks the enabling regulatory environments, infrastructure and capital to scale. The drivers of FWR are primarily social and environmental (echoing Lekan et al. (2021)'s CE drivers); capturing economic value remains difficult. FW cannot easily spatially co-exist with idealised sanitised urban environments, thus closing the loop in urban environments require spatial displacement and an alignment with social and environmental objectives. Yet the relational work associated with urban farms and waste collection are significantly burdensome and subject to frictions. Strong state governance is also required to enable FW to move – this involves translating and coordinating sustainable waste management principles from the international, to national and subnational scales. Nevertheless, despite these spatial, scalar and material limitations, strong local cultures of waste management can be found in recently urbanised environments. They are realised in the unlikely spaces of unproductive infrastructural lands, and in longstanding ethical practices of gifting and care. Overall, my research shows how FWR is a boundary case for CE due to its unique geographies and requires more spatially-nuanced and place-based approaches to succeed. This abstract relates to SDG+Target:12.3. With its attention on socially just, ecologically sustainable and economically viable circular food/waste systems, and the collaborative networks needed to realise them, this paper speaks to all 5Ps and seeks to contribute towards achieving the SDGs.

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Evolution of national Circular Economy and Bioeconomy initiatives: the Italian case

Maria Antonietta Passari, Professor Roberta Salomone, Assistant Professor Giovanni Mondello, Assistant Professor Teresa Maria Gulotta
University of Messina, Messina, Italy

Abstract

In recent years, the concepts of Circular Economy and Bioeconomy have become increasingly prominent in both academic and political debates for their recognised role in addressing the urgent climate crisis and its social, environmental and economic challenges. In fact, the widespread optimism about the potential sustainability and resilience character of the two narratives has led to the increasingly felt need for their mutual interaction, fostering the elaboration and diffusion of the popular Circular Bioeconomy paradigm. In this sense, it is interesting to observe the year-by-year increase in the number of countries adopting nationally relevant documents in both the Circular Economy and the Bioeconomy. This trend is particularly evident in the old continent, where the European institutions have elected the synergy between the inspiring principles of the two concepts as the driving force behind their own path of ecological transition, as most recently reaffirmed by the Recovery and Resilience Facility, the cornerstone of the NestGenerationEU. Undoubtedly, in this context, Italy is worthy of attention as the promoter of important initiatives aimed at concretising the establishment of a socio-economic context increasingly oriented towards bio-circularity at a national, regional and local level. However, while the academic landscape is characterised by numerous publications dealing separately with national Circular Economy and Bioeconomy strategies, a joint treatment of the two environmental policy perspectives is lacking. Consequently, the study proposed here represents a first attempt in this direction by trying to reconstruct the evolution of the constituent elements of the Circular Economy and the Bioeconomy in the Italian national policy landscape until the most recent National Recovery and Resilience Plan (NRRP). In particular, after having selected the national documents produced by Italian institutions concerning the Circular Economy and Bioeconomy sectors, we proceed to the subsequent qualitative analysis and comparison of their contents, emphasising, among others, the sectors and actors involved, the role of institutions, the proposed measures and their expected impacts in terms of sustainability. The aim is to trace the thematic orientations that characterise these policy initiatives, as well as to clarify their place in the Italian legislative structure, their content relationship with similar documents of European and international origin and, above all, their influence on the drafting of the NRRP. Indeed, implementing the NRRP represents a crucial strategic moment to give an effective, sustainable and regenerative turn to the Italian socio-economic system, enabling the achievement of the climate objectives indicated by the European interlocutors. However, assessing the strengths and weaknesses of the proposed measures through a critical reconstruction of the political-institutional pathway in which they have matured is indispensable for understanding whether Italian institutions can effectively manage the provided economic resources to concretise the expected ecological transition. Therefore, as main results, this research seeks to to investigate the Circular Economy and Bioeconomy discourses promoted in the most recent NRRP and to verify the effectiveness of the actions proposed to implement them and their coherence with previous initiatives taken on the subject in the Italian national policy context.

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Circular rare earth element in sustainable development

Mrs Asma-Qamaliah Abdul-Hamid[1,2], Dr Nur Suraya Ahmad[3], Dr Mohd Helmi Ali[2], Dr Mazzlida Md Deli[2]
[1]Faculty of Economics and Management, Universiti Kebangsaan Malaysia, UKM-Bangi, Malaysia. [2]UKM-Graduate School of Business, Universiti Kebangsaan Malaysia, UKM-Bangi, Malaysia. [3]Universiti Kebangsaan Malaysia, UKM-Bangi, Malaysia

Abstract

Rare earth elements are becoming increasingly important to the high-technology and low-carbon economy, which is raising living standards around the world. Yet, rare earth elements are not actually rare in terms of their abundance in the earth's crust. However, they are often difficult and expensive to extract and process and the production of rare earth elements is often associated with environmental and social challenges. Traditional linear process is synonym with unsustainable production and consumption patterns. As such, there is a growing need for sustainable practices in the production and use of these critical materials. Initially, rare earth element is a group of 17 chemically related metallic elements that are essential components in a wide range of modern technologies, including smartphones, electric vehicles, wind turbines and many other products. Many of the low-carbon technologies that are vital to combating climate change, rely heavily on rare earth elements for their production. As a result, the demand for rare earth elements has increased rapidly in recent years and there are concerns about the availability and sustainability of the global rare earth elements supply. With a shift to sustainable development that aims to be less fossil fuel dependent, global demand for rare earth element continues to rise, despite their uncertain supply chain and high environmental impact of production. This study intends to revisit the notion of circular economy in the rare earth elements business through a systematic literature review in order to establish if the body of research has progressed beyond concept development and into verified application in the industry. Additionally, the purpose of this research is to examine the critical link between the circular economy in the rare earth industry and sustainable development. The major finding is that the areas have definitely progressed from simply conceptual work to practical studies and research into implementation techniques. Yet, empirical studies often examine the environmental impact of CE practices while ignoring the social and economic elements. Furthermore, a key finding is that industry must take part in all collaboration with government, end-user, universities and research institutes. To summaries, a holistic approach is required to avoid implementing solutions that are portrayed as circular yet ignore the sustainability component.

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How intensive aquaculture is facing the challenge of the transition to a circular economy: evidence from a literature review.

Maria Cozzolino, Prof. Roberta Salomone, Dr Giovanni Mondello, Dr Teresa Maria Gulotta
University of Messina, Messina, Italy

MARIA COZZOLINO

Abstract

The world population has reached 8 billion in 2022 and is estimated to increase by one billion in the next fifteen years. Providing food for this growing population is the challenge of the coming years. Aquaculture (the farming of aquatic animals and plants) can support the world's food supply, as it has been considered a fast-growing agri-food sector, supplying more than half of the fish consumed by humans in 2020 (up from just 7% in 1974). Aquaculture, however, puts pressure on terrestrial and aquatic resources and ecosystems, threatening biodiversity and climate change. FAO (2022) warns that "more targeted transformations are needed to make aquaculture more sustainable with a view to achieving the UN Sustainable Development Goals". However, current aquaculture production methods are thus not bearable in the long term. Therefore, approaches to promote sustainable growth in aquaculture are needed to reach sufficient production to meet the needs of the human population, while respecting environmental issues and promoting health benefits. Indeed, there is now an indisputable need to evaluate the current aquaculture production systems and move to more environmental-friendly production models. A promising strategy for saving resources and reducing negative environmental impacts, which is also gaining momentum in the agri-food sector, is the circular economy (CE). In this context, a literature review of CE practices adopted in the aquaculture production sector is presented here to shed light on how intensive aquaculture is facing the challenge of transitioning to a CE. The literature analysis used scientific papers from SCOPUS and Web of Science (WoS) from 2015-2022. The Preferred reporting items for Systematic Reviews and Meta-Analysis 2020 (PRISMA) protocol was applied. The final set of 99 was used for this article. The literature review highlights the CE empirical practices/strategies applied in aquaculture farms, which are classified considering: a) area of implementation (e.g., improvement and/or reduction of resource use; treatment and/or reduction of waste; use of by-products); b) type of product studied (micro/macro algae, proteins from terrestrial activities, other microorganisms), c) farmed species for which the product studied is tested; d) geographical area where the CE practice was conducted. Furthermore, referring to the 4Rs framework, the analysis highlights which R(s) is prevalent in the observed CE practices. Finally, the articles reviewed are also analysed, searching for the use of any assessment method or indicator to measure the CE practices, as well as explicit or implicit connection with the dimensions of sustainability (environmental, economic, social). Preliminary results show that the aquaculture sector is already experiencing various CE practices intending to contribute to: i) reducing the pressure on fish stocks (target of the feed industry), ii) reusing resources coming out to form the production phases (wastewater and by-product), iii) recycle used materials (such as marine cage nets, shellfish farming socks, other materials).

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Tracing European plastic waste shipped to Vietnam for recycling – proposal for a just circular economy transition

Mr Kaustubh Thapa[1], Prof. Walter Vermeulen[1], Ms Mo Ming De Waal[2], Prof. Pauline Deutz[3], Prof. Hong Quan Nguyen[4]
[1]Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, Netherlands. [2]Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, Vietnam. [3]Department of Geography, Geology and Environment, University of Hull, Hull, United Kingdom. [4]Institute for Circular Economy Development, Vietnam National University – Ho Chi Minh City, Ho Chi Minh, Vietnam

PROF. HONG QUAN NGUYEN

Abstract

Exporting waste for recycling to destinations without sound recycling capacity raises questions of fairness and sustainability. As recycling infrastructures in Europe have been inadequate to keep up with growing plastic waste generation, waste is traded, aiming for sound resource recovery in a global value chain with multiple actors. Such trade creates increasing governance and sustainability challenges. In the EU, policies and systems are in place for plastic waste management, which includes separate collection to safeguard against potential harm and reuse resources. Waste handling is outsourced to destinations with cheaper operating and labour costs at the expense of harming other individuals, societies and the environment. Half of the collected European plastic waste for recycling is shipped for recycling outside the EU without accountability. This case study of the EU plastic waste exports for recycling to Vietnam aims to increase our understanding of waste governance, circularity, sustainability and justice implications. We bring a multidisciplinary perspective to understand the challenges of the EU's recycling practices for the broader socio-ecological system. Finally we propose a multidisciplinary framework as an ethical guide for fair future waste shipment practices with strong consideration for the social dimension for a just circular economy transition which can guide emerging policies like the UN treaty on plastic waste pollutionTracing European plastic waste shipped to Vietnam for recycling – proposal for a just circular economy transition

Full Papers

Factors Influencing the Implementation of Circular Bio-Based Building Materials in Vietnam

Dinh Linh Le[1], Roberta Salomone[2], Quan T. Nguyen[3], Alexis Versele[4], Chiara Piccardo[4]

[1]University School for Advanced Studies IUSS Pavia, Italy; Department of Economics, University of Messina, Italy; Faculty of Construction Economics and Management, Hanoi University of Civil Engineering, Vietnam
[2]Department of Economics, University of Messina, Italy
[3]Faculty of Construction Economics and Management, Hanoi University of Civil Engineering, Vietnam
[4]Building Physics and Sustainable Design Unit, Department of Civil Engineering, Ghent Technology Campus, KU Leuven, 9000 Ghent, Belgium

[1] Email: dinh.le@iusspavia.it/ dinh.le@studenti.unime.it/ linhld@huce.edu.vn

Abstract. Using circular bio-based building materials (C3BMs) offers a viable solution to mitigate the building sector's climate and environmental impacts, yet they are still underused. The factors influencing, i.e., the barriers to and drivers for, the implementation of C3BMs need detailed investigation to boost their use. However, few studies have been done on the barriers to and drivers for C3BMs in developing countries such as Vietnam. This study explores perceived barriers and potential drivers for C3BMs with reference to the Vietnamese construction market. Firstly, a literature review is carried out to explore the existing barriers to and drivers for C3BMs both in developed and developing countries. Secondly, data collected from a questionnaire survey with building professionals in Vietnam, including architects, engineers, contractors, etc., were analysed using descriptive methods to identify the critical barriers to and drivers for C3BMs. The results indicate that "building code restriction" and "lack of design guides and tools for projects using C3BMs" are the key obstacles. Meanwhile, "government regulations and policies encouraging the use of C3BMs" and "public incentives and strategies for promoting the use of C3BMs are the most critical drivers. These findings may provide valuable information for scholars, businesses, and policymakers in promoting the utilisation of C3BMs in Vietnam.

Keywords: Circular bio-based building material (C3BM), Sustainability, Circular economy, Vietnamese building sector, Barriers, Drivers.

1. Introduction

The construction industry (CI) is the largest global consumer of materials and energy. Indeed, only buildings account for almost 35% of global energy demand, 55% of total electricity use worldwide, and 38% of global CO_2 emissions globally (United Nations Environment Programme, 2020). Furthermore, buildings and infrastructure, particularly in developing countries, use up to half of the resources extracted globally for materials (De Wit et al., 2018). This figure is expected to continue rising due to the demand for new housing and infrastructure to meet population and economic growth requirements. Furthermore, global material consumption is projected to more than double by 2060, with the construction industry accounting for one-third of this increase (United Nations Environment Programme, 2020). These facts cause various negative impacts, such as global warming, sea-level rise, natural resource depletion, etc.

Numerous efforts have been undertaken to address the aforementioned issues. However, most of them concentrate on reducing energy consumption, especially operational energy in buildings (Enkvist et al., 2018), while all stages of a building's lifespan are accountable for these negative impacts. For example, embodied carbon from materials and equipment can account for between 15% and 50% of whole-life carbon emissions, depending on building location, use, and energy supply (Enkvist et al., 2018). This percentage is approximately 15% for European buildings, whereas in countries with low-carbon electricity and heating systems, this can increase to roughly 50% (Enkvist et al., 2018). This implies that, as operating efficiency improves and the carbon intensity of the energy supply decreases, embodied carbon's contribution to life cycle emissions is predicted to grow even further. Literature shows that using circular bio-based building materials (C3BMs) is a promising solution to deal with environmental impacts, especially climate change, associated with the construction industry (Le et al., 2022). C3BMs are materials resulting from renewable biological origin, especially by-products and biowaste of plant or animal biomass that may be utilised as raw materials in construction and decorating items, as well as building materials (Le et al., 2022). Using C3BMs can provide opportunities to reduce construction waste, CO_2 emissions, and non-renewable resources, especially fossil fuels (Rabbat et al., 2022). However, there are still many barriers to the adoption of these materials among construction professionals (Giesekam et al., 2015).

Indeed, Zhang and Canning (2011) highlighted that new materials always encounter barriers when they are first introduced to any industry, but probably more so in the construction industry, with its long-standing reputation for being highly conservative and cost-driven. Despite the higher initial costs of new materials like C3BMs can be offset by enhancing a building's lifecycle performance to reduce the life cycle costs, the construction industry has continued using conventional and unsustainable building materials (Gounder et al., 2021). For instance, compared to conventional insulation materials like stone wool or even expanded polystyrene (EPS), circular bio-based insulation material like miscanthus has outstanding economic and environmental benefits, yet its market is still limited compared to EPS (Schulte et al., 2021). This proves that the utilisation of C3BMs faces not only cost-related barriers but also other unavoidable hindrances. Therefore, the identification of barriers and driving factors for C3BMs is crucial to support decision-making process to boost their use in the sector.

However, only a few studies have examined the factors that hinder the use of sustainable building materials in general and C3BMs in particular. For instance, Zhang and Canning (2011) asserted that various factors impede the choice of new materials in the building sector, including some C3BMs like straw, plant oils and colours in the United Kingdom. Similarly, Gounder et al. (2021) investigated the barriers to sustainable materials, including high-strength natural fibre - a type of C3BM - in Australian building projects. Giesekam et al. (2015) highlighted the obstacles to and drivers for low-carbon building materials, including several C3BMs like straw bale and hemp. Furthermore, Markström et al. (2016a, 2016b) identified the hindrances and driving factors for bio-based building materials in Sweden. However, all these studies take into account the contexts of developed countries. In the case of developing markets, Akadiri (2015) researched barriers affecting the choice of sustainable materials in Nigerian building projects. Lakys et al. (2022) investigated the drivers of sustainable building materials in Kuwait. Nonetheless, no C3BMs have been mentioned in these two studies. These highlight a gap in the literature in terms of C3BMs barriers and drivers studies in both developed and developing countries, particularly those most vulnerable to climate change, such as Vietnam.

Vietnam is highly susceptible to the devastating effects of climate change, particularly the sea level rise. According to Kulp and Strauss (2019), by the end of the century, it is projected that Vietnam will encounter tidal waves surpassing the current shorelines that are home to almost a third of the country's population. Therefore, initiatives and solutions should be proposed and adopted to mitigate the impact of climate change

by reducing the GHG emissions and raw material consumption of all the economic sectors, with special emphasis on the construction industry. Thus, utilising C3BMs can be a viable solution that not only mitigates the negative consequences of the construction industry but also takes advantage of Vietnam's agricultural production. Indeed, as the sixth-largest rice producer (US Department of Agriculture, 2023) and second-largest coffee producer (ICO, 2022), etc., Vietnam is equipped with a diverse array of agricultural waste materials to employ for developing C3BMs. In line with this, the Prime Minister of Vietnam promulgated Decision No. 882/QD-TTg (2022), approving the National Action Plan on Green Growth for the 2021-2030 period, which highlights the significance of producing and utilising environmentally friendly building materials, increasing the use of recycled materials, wastes and by-products from agricultural and other sectors to manufacture building materials according to the circular economy model. It means that C3BMs are going to be prioritised in Vietnam in the following years. However, a literature review discovered that the use of C3BMs in Vietnam is hardly discussed in previous studies, even in local publications. This practice may reflect the underuse of these sustainable materials in the Vietnamese building sector, and actions need to be taken to change this predicament, firstly by identifying barriers to and drivers for these materials' adoption.

Given the aforementioned background, the objective of this study is to investigate the critical barriers to and drivers for C3BMs adoption with reference to the developing country of Vietnam.

2. Literature Review

The study begins with a thorough review of existing literature to provide an overview of the current understanding of the barriers and drivers to the utilisation of C3BMs. It is noted that C3BMs are special types of bio-based buildings. Therefore, the barriers to and drivers for C3BMs are similar for bio-based building materials. Furthermore, the barriers to and drivers for C3BMs could also be drawn from relevant studies on low-carbon, sustainable, alternative, or green building materials, since several C3BMs were referred to as these types of materials in the relevant studies. For example, hemp and concrete containing agricultural or consumer wastes were identified as low-carbon building materials (Giesekam et al., 2015), while straw bales and hemp lime were considered sustainable building materials (Zhang and Canning, 2011). Moreover, using C3BMs is aligned with the goal of promoting sustainable construction practices and is a vital aspect of green building efforts. Consequently, some articles (e.g., Akadiri, 2015, Gounder et al., 2021) referred to the barriers and drivers for sustainable construction and green building development when researching barriers to the use of sustainable building materials. This approach is also adopted in this study.

The relevant studies were found by applying the search query: ("barriers to" OR "drivers for") AND (building OR construction) AND material AND ("bio$based" OR alternative OR natural OR green* OR sustainable OR "low carbon" OR circular*), which was restricted to the "Title-Abstract-Keywords" field of Scopus database. No restrictions related to language or types of publications were applied, which helped to identify 502 publications. The data then being screened to exclude papers not written in English, those not focusing on the construction industry, and those not considering barriers to or drivers for using new building materials or sustainable construction and green building in general. As a result, 20 studies were included. Furthermore, in order to explore other related papers, a search using "barriers and drivers for building materials" was applied to the Google Scholar database. After that, all the explored articles were screened based on their titles, abstracts, and full texts to choose the most related ones with the same eligibility criteria. Cross-checking previous studies was also carried out, relying on the reference lists of the collected papers to identify articles that could not be found from the search query. Consequently, a total of 33 publications were included in the literature review.

It is worth noting that most of the collected papers studied only the barriers; very few evaluated the driving factors. However, a barrier in one context may appear as a driver in another. The literature review is clustered into developed markets (e.g., European countries, The United States, Australia, Singapore – a Vietnam' neighbouring country) and developing markets, especially Southeast Asian countries like Malaysia and Cambodia, as well as Vietnam, to investigate the similarities and differences between the barriers to and drivers for C3BMs in different levels of market maturity and economic development.

2.1 Barriers to the utilisation of circular bio-based building materials

Several studies have explored the obstacles to using sustainable building materials in developed markets. For example, in Australia, Gounder et al. (2021) identified high costs, potential cost overruns, a lack of incentives, government policy gaps, and resistance to change as the most significant barriers. In the United Kingdom, Giesekam et al. (2015) found that high costs, ineffective distribution of responsibility, and industry culture are the most significant barriers to low-carbon building materials. Markström et al. (2016a, 2016b) investigated significant obstacles to C3BMs in Sweden, including insufficient incentives, inadequate knowledge and experience, performance issues, and construction-related habits and culture. Krueger et al. (2019) pointed out that design and construction communities in the green building and construction sector are hesitant to promote alternative materials, including recycled cellulose insulation – one kind of C3BM – due to their definition and specification in a range of contexts relating to green building guides and certification systems. In the United States, Ahn et al. (2013) identified the project's first cost premium and long payback periods as the most significant barriers to sustainable design and construction. Similarly, in Singapore, Yin et al. (2018) highlighted perceptions of high costs, complex building codes and regulations, and a lack of stakeholder interest as the most significant barriers to implementing sustainable construction practices.

In developing markets, Akadiri (2015) identified perceptions of extra costs and lack of information on sustainable materials as the top obstacles to the choice of sustainable building materials in Nigeria. In China, economic-related factors such as high fabrication costs and cost control during the construction phase were the most significant barriers against green practices in the construction industry (Ying Liu et al., 2012). Similarly, in Cambodia, the higher cost of sustainable building options was the most significant barrier to sustainable construction, followed by a lack of government incentives and economic needs of higher priority (Durdyev et al., 2018). Conversely, cost-related factors were not the leading hindrances to sustainable construction in Kuwait. AlSanad (2015) found a lack of awareness, government support/incentives, existing rules, and qualified staff to be the four leading barriers. However, it is emphasised that economic-related barriers are the most dominant factors inhibiting the use of sustainable building materials, including C3BMs, in both developed and developing markets.

There is currently no study in Vietnam investigating the specific barriers to new building materials like C3BMs. However, regarding sustainable construction in general, Pham et al. (2019) identified limited availability of sustainable materials and technologies, resistance to change, lack of government incentives, low implementation levels of sustainable practices, etc., as significant barriers. Meanwhile, Nguyen et al. (2017) highlighted that legislative and institutional barriers, as well as social and cognitive barriers, are widely perceived as the most challenging obstacles to green building in the country.

Comparing the two markets, perceptions of high initial costs are the most recognised barrier to sustainable construction and green building practices, as well as new emerging materials like C3BMs. However, cost-related barriers seem not as dominant in Vietnam as in other countries. Despite these differences, the utilisation of new and emerging materials like C3BMs in both developed and developing countries, including Vietnam, may face similar main barriers, as presented in Table 1.

2.2 Drivers to the utilisation of circular bio-based building materials

In developed markets such as the United Kingdom, various factors drive the use of low-carbon building materials, including C3BMs. Giesekam et al. (2015) identified feeling morally obliged, client requirements, and earning points towards assessment schemes as the main drivers. The study also suggested that client requirements are the most important driving factor for hemp and straw bale, two kinds of C3BMs (Giesekam et al., 2015). These findings highlighted that the changing motivations of clients and construction professionals can drive demand for emerging materials, including C3BMs, in the short term. However, in Sweden, Markström et al. (2016a, 2016b) concluded that green building certificates and other environmental standards and regulations, quality evidence over time, and educational support from municipalities are the primary drivers for bio-based building materials.

On the other hand, in the developing market, Lakys et al. (2022) explored the factors driving the adoption of sustainable building materials in Kuwait and concluded that these drivers vary depending on the perspective. Practitioners considered energy efficiency, resource availability and accessibility, and environmental impact as the most influential drivers. In contrast, clients prioritised cost savings and enhanced health and safety. These findings differ from Alsanad (2015), which identified educational programs,

regulations and legislation, green design guidelines and construction standards, and economic incentives as the significant drivers for green construction in Kuwait. In Cambodia, Durdyev et al. (2018) explored greater energy efficiency, reducing the environmental impact of buildings, and improving indoor environmental quality as key factors driving the adoption of sustainable construction.

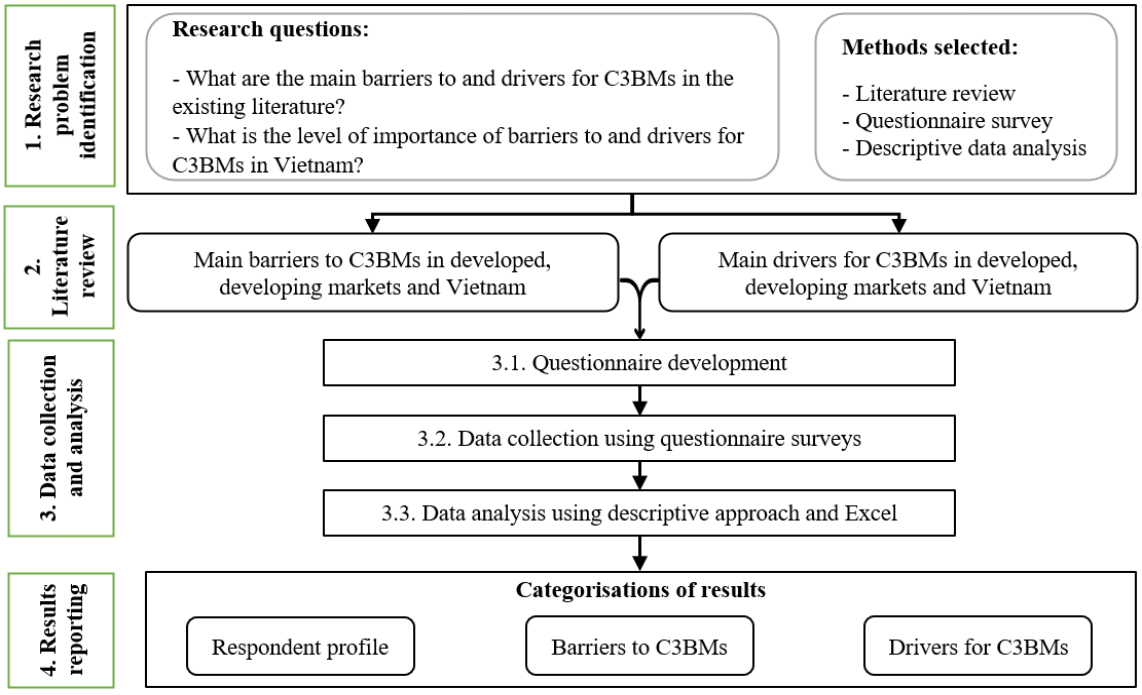
In Vietnam, no studies on the drivers for new and sustainable building materials such as C3BMs could be found in the literature. Moreover, only a few studies identified factors promoting sustainable construction and green building in general. For example, Nguyen et al. (2017) suggested that enhancing the knowledge and willingness of experienced practitioners and owner and designer representatives is the best way to promote the adoption of sustainable building. Yang et al. (2022) indicated that factors related to environmental impacts, such as energy conservation and reduced environmental impact, are crucial for green building development.

It is noted that while the level of importance of drivers may vary between countries, the main drivers identified in Table 2 could promote the utilisation of C3BMs in both developed and developing markets.

3. Methodology

The study adopts a combination of quantitative and qualitative approaches. Indeed, a literature review was conducted to identify the existing hindrances to and driving factors for C3BMs, while a questionnaire survey was adopted to collect data from construction professionals in Vietnam. Meanwhile, the data was analysed by a descriptive approach. The structure of the research methodology is organised in four steps, as shown in Figure 1.

Figure 1. Research methodology



Firstly, the research problem was identified in accordance with the focal point and aims of the research. As the objective of the present study is to scrutinise and examine the critical barriers to and drivers for C3BMs with reference to the developing country of Vietnam, two research questions were put forward: *i) What are the main barriers to and drivers for C3BMs in the existing literature*? and *ii) What is the level of importance of barriers to and drivers for C3BMs in Vietnam?*

Secondly, a literature review of existing studies with a priority on journal articles was carried out, as presented in Section 2, to answer the first research question. Indeed, 23 barriers to and 22 driving factors for the use of C3BMs have been identified from the existing literature.

Thirdly, quantitative data were collected and analysed by descriptive method to answer the second research question. Indeed, based on the main barriers and drivers explored in the second step, a questionnaire was developed, targeting respondents as professionals in the Vietnamese construction industry, including architects, contractors, developers, researchers in construction management, authorities, material

manufacturers and green building development consultants. The questionnaire was first tested in a pilot study conducted in February 2023 and then refined by incorporating feedback and comments obtained from the pilot study. The final questionnaire was presented in Google Forms and disseminated to potential respondents via email and professional groups on social media. It is important to note that the responses are measured on a Likert scale, and these data cannot be analysed using parametric statistical methods without making precarious and possibly unrealistic assumptions about the underlying distributions (Akadiri and Olomolaiye, 2012). Therefore, the collected data is analysed using non-parametric statistics involving descriptive statistics analysis. Indeed, the level of importance of barriers and drivers is ranked using the mean score ranking technique, with the mean score calculated using the following equation (Ahn et al., 2013):

$$Mean = \sum_{i=1}^{5} \frac{n_i \times w_i}{N} \qquad (1)$$

where w_i represents the weighting assigned by each respondent on a scale from 1 to 5 in accordance with the lowest to the highest; n_i is the number of respondents on each scale; and N is the sample size.

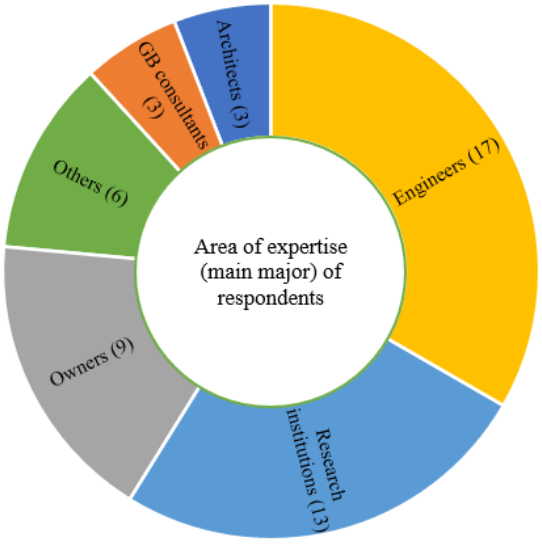
Finally, the findings are classified into three macro-categories: i) Respondent profile, ii) Barriers to C3BMs, and iii) Drivers for C3BMs. In the first section, the demographics of the respondents are analysed and presented. In the second and third sections, the primary barriers to and drivers for C3BMs adoption are analysed and ranked based on the data analysis.

4. Results and Discussions

The questionnaire survey collected 40 full responses and 11 partial ones that provided answers to the majority of the questions. Figure 2 provides an overview of the demographics of the respondents. The majority of respondents are engineers, owners, research institutions, architects, and green building (GB) consultants. Other professionals engaged in research include construction materials producers, quantity surveyors and investment decision-makers, and nearly four-fifths of them have over five years of experience working in the building sector.

To identify the relative importance of barriers to and drivers for C3BMs based on the survey data, ranking analysis is performed according to equation (1). Indeed, the barriers and drivers are ranked based on their mean score results, as presented in Sub-sections 4.1 and 4.2.

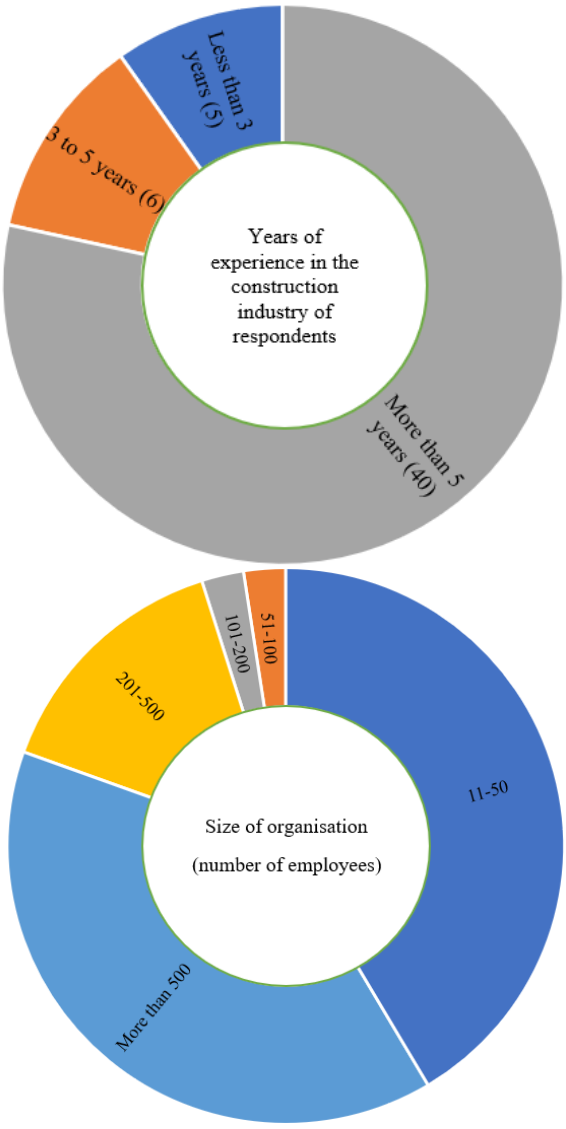
Figure 2. Demographics of survey respondents



4.1 Barriers to C3BMs

In order to identify barriers perceived by building professionals as they sought to use C3BMs, towards sustainability in the building sector, questions using the Likert scale were used. Indeed, respondents were asked to rank the obstacles affecting the utilisation of C3BMs from "extremely low" (1) to "extremely high" (5). A summary of the result is presented in Figure 3.

Based on equation (1), the mean score of the 23 barriers was computed relying on the collected data. The results and the ranking of each obstacle to C3BMs are shown in Table 2. Based on these ranking results, "building code restriction, i.e., lack of regulation" stands out as the most important barrier, followed by "lack of design guides and tools for projects using C3BMs". The next most



essential barriers are "lack of government promotion and incentives", "lack of case studies and demonstration projects", and "risks and uncertainties involved in adopting new materials". These results suggest that the government's involvement plays a determining role towards the use of C3BMs rather than other actors in the building sector. Another significant factor that hinders the utilisation of C3BMs is "unwilling to change from conventional materials to C3BMs". This outcome suggests a perception that construction stakeholders tend to maintain their current practices of using materials. This aspect reflects the conservative nature of the construction industry.

Interestingly, despite the fact that the construction industry is well-known as a cost-driven industry (Zhang and Canning, 2011), some cost-related factors, such as "concern about the high initial cost" and "perception of the extra cost being incurred", are not considered as key barriers to the use of C3BMs in Vietnam. These findings are totally different compared to the cases of several developed countries, for instance, Australia (Gounder et al., 2021), the United Kingdom (Giesekam et al., 2015), etc.

On the other hand, "unstable prices of C3BMs", "lack of effective marketing from material producers", and "low flexibility of alternatives or substitutes" are the least significant barriers. These results suggest C3BMs themselves and their related factors may not be the obstacles to their adoption in the construction industry.

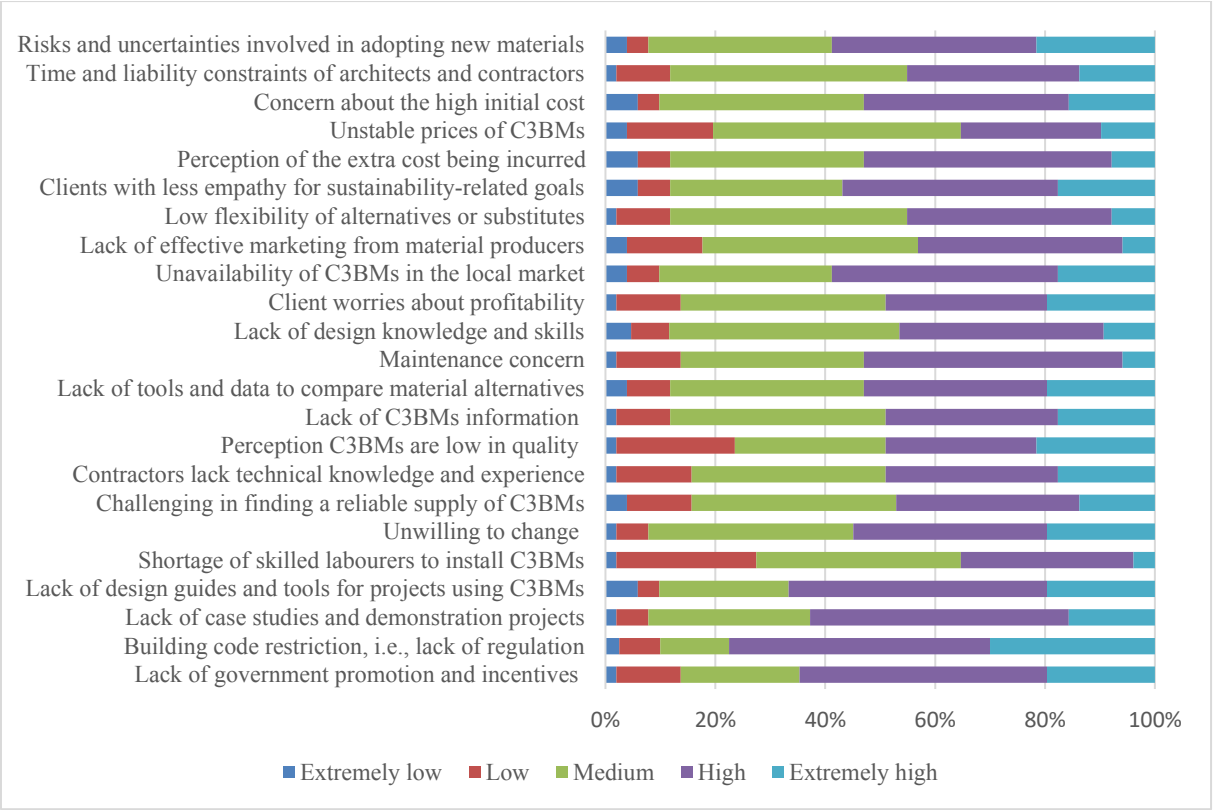
Table 1: The main barriers to the use of C3BMs

Code	Barriers	Sources	Mean	Overall rank
B01	Building code restriction	(Akadiri, 2015, Markström et al., 2016a, Markström et al., 2016b, Krueger et al., 2019, Gounder et al., 2021, Ameh et al., 2019, Gatóo et al., 2014, Giesekam et al., 2014, Laguarda Mallo and Espinoza, 2015, Hoxha and Lecaj, 2022, Omopariola et al., 2022, Ahn et al., 2013, Pham et al., 2019, Nguyen et al., 2017a)	3.95	1
B02	Lack of government promotion and incentives	(Ernest et al., 2018, Chan et al., 2018, Gounder et al., 2021, Ameh et al., 2019, Omopariola et al., 2022, Illeperuma and Abeynayake,	3.69	3

Code	Barriers	Sources	Mean	Overall rank
		2022, Yin et al., 2018, Pham et al., 2019, Nguyen et al., 2017a)		
B03	Lack of case studies and demonstration projects	(Giesekam et al., 2015, Ernest et al., 2018, Giesekam et al., 2014, Omopariola et al., 2022, Nguyen et al., 2017a)	3.69	3
B04	Lack of design guides and tools for projects using C3BMs	(Giesekam et al., 2015, Giesekam et al., 2014)	3.71	2
B05	Shortage of skilled labourers to install C3BMs	(Krueger et al., 2019, Giesekam et al., 2015, Gounder et al., 2021, Franzini et al., 2018, Giesekam et al., 2014, Xia et al., 2014, Omopariola et al., 2022, Illeperuma and Abeynayake, 2022, Pham et al., 2019)	3.1	16
B06	Unwilling to change from conventional materials to C3BMs	(Akadiri, 2015, Ernest et al., 2018, Gounder et al., 2021, Giesekam et al., 2014, Omopariola et al., 2022, Ahn et al., 2013, Yin et al., 2018, AlSanad, 2015, Pham et al., 2019)	3.65	4
B07	Challenging in finding a reliable supply of C3BMs	(Krueger et al., 2019, Akadiri, 2015, Ernest et al., 2018, Nußholz et al., 2019, Ameh et al., 2019, Giesekam et al., 2014, Nguyen et al., 2017a)	3.41	11
B08	Contractors lack technical knowledge and experience	(Giesekam et al., 2015, Giesekam et al., 2014, Omopariola et al., 2022, Ahn et al., 2013, Ying Liu et al., 2012, Nguyen et al., 2017a)	3.49	8
B09	The perception that C3BMs are low in quality (fire and moisture resistance, low durability, etc.)	(Akadiri, 2015, Markström et al., 2016a, Markström et al., 2016b, Giesekam et al., 2015, Ernest et al., 2018, Giesekam et al., 2014)	3.45	9
B10	Lack of C3BMs information (e.g., environmental impacts, performance)	(Akadiri, 2015, Krueger et al., 2019, Ernest et al., 2018, Gounder et al., 2021, Ameh et al., 2019, Giesekam et al., 2014, Laguarda Mallo and Espinoza, 2015, Omopariola et al., 2022, Nguyen et al., 2017a)	3.53	7
B11	Lack of comprehensive tools and data to compare material alternatives	(Akadiri, 2015, Gounder et al., 2021, Nguyen et al., 2017a)	3.57	6
B12	Maintenance concern	(Akadiri, 2015, Markström et al., 2016a, Markström et al., 2016b, Gounder et al., 2021, Riala and Ilola, 2014)	3.43	10
B13	Lack of design knowledge and skills	(Krueger et al., 2019, Ernest et al., 2018, Gounder et al., 2021, Ameh et al., 2019, Franzini et al., 2018, Xia et al., 2014, Ahn et al., 2013, Nguyen et al., 2017a)	3.4	12

Code	Barriers	Sources	Mean	Overall rank
B14	Clients worry about profitability	(Ernest et al., 2018)	3.53	7
B15	Unavailability of C3BMs in the local market	(Markström et al., 2016b, Gounder et al., 2021, Ameh et al., 2019, Giesekam et al., 2014, Laguarda Mallo and Espinoza, 2015, Omopariola et al., 2022, Ahn et al., 2013, Pham et al., 2019, Nguyen et al., 2017a)	3.63	5
B16	Lack of effective marketing from material producers	(Giesekam et al., 2015, Franzini et al., 2018, Giesekam et al., 2014)	3.27	14
B17	Low flexibility of alternatives or substitutes	(Akadiri, 2015, Giesekam et al., 2015, Ernest et al., 2018, Nguyen et al., 2017a)	3.39	13
B18	Clients with less empathy for sustainability-related goals	(Krueger et al., 2019, Ernest et al., 2018, Ahn et al., 2013, Yin et al., 2018, Pham et al., 2019)	3.57	6
B19	Perception of the extra cost being incurred	(Akadiri, 2015, Krueger et al., 2019, Giesekam et al., 2015, Ernest et al., 2018, Gounder et al., 2021, Giesekam et al., 2014, Xia et al., 2014)	3.43	10
B20	Unstable prices of C3BMs	(Ernest et al., 2018)	3.22	15
B21	Concern about the high initial cost	(Markström et al., 2016a, Franzini et al., 2018, Riala and Ilola, 2014, Giesekam et al., 2014, Laguarda Mallo and Espinoza, 2015, Omopariola et al., 2022, Ahn et al., 2013, Yin et al., 2018, Ying Liu et al., 2012, AlSanad, 2015, Pham et al., 2019, Nguyen et al., 2017a)	3.53	7
B22	Time and liability constraints of architects and contractors	(Krueger et al., 2019, Akadiri, 2015, Giesekam et al., 2014)	3.45	9
B23	Risks and uncertainties involved in adopting new materials	(Chan et al., 2018, Markström et al., 2016a, Akadiri, 2015, Gounder et al., 2021, Franzini et al., 2018, Giesekam et al., 2014, Ahn et al., 2013, Yin et al., 2018, AlSanad, 2015)	3.69	3

Figure 3. General barriers to the use of C3BMs (response to the survey question: From your perspective, please rate the importance of the following barriers to the use of C3BMs).



4.2 Drivers for C3BMs

Similarly, to identify the perception of building professionals regarding the driving factors for the use of C3BMs in Vietnam, respondents are asked to rank 22 given barriers, from "extremely low" (1) to "extremely high" (5). By applying Equation (1), the mean score of the barriers is computed and shown in Table 2. The percentage of respondents ranked each barrier is shown in Figure 4.

Based on the mean score results, as shown in Tabe 2, "government regulations and policies encouraging the use of C3BMs" emerge as the most important driving factor to C3BMs. This finding aligns with the barrier identified regarding the government's role in issuing new regulations and policies to facilitate the development and utilisation of C3BMs. The second most critical driver is "public incentives and strategies for promoting the use of C3BMs". This suggests that policies and regulations may not be enough to motivate stakeholders to change their current practices regarding the use of construction materials. Additional efforts from the government could contribute positively to altering the current scenario. Furthermore, building professionals seem concerned about the cost-effectiveness and advantages of using C3BMs since "proof of cost-effectiveness of C3BMs" and "more evidence about the quality of C3BMs over time (regarding moisture sensitivity, durability, fire resistance, and acoustics)" are the next two critical driving factors to C3BMs. Besides, since C3BMs are emerging materials, not many professionals have been involved in projects that use these materials; therefore, they expect more case studies and demonstration projects. That is why "more demonstration projects and case studies to highlight the advantages of C3BMs" is the next key driver perceived by respondents.

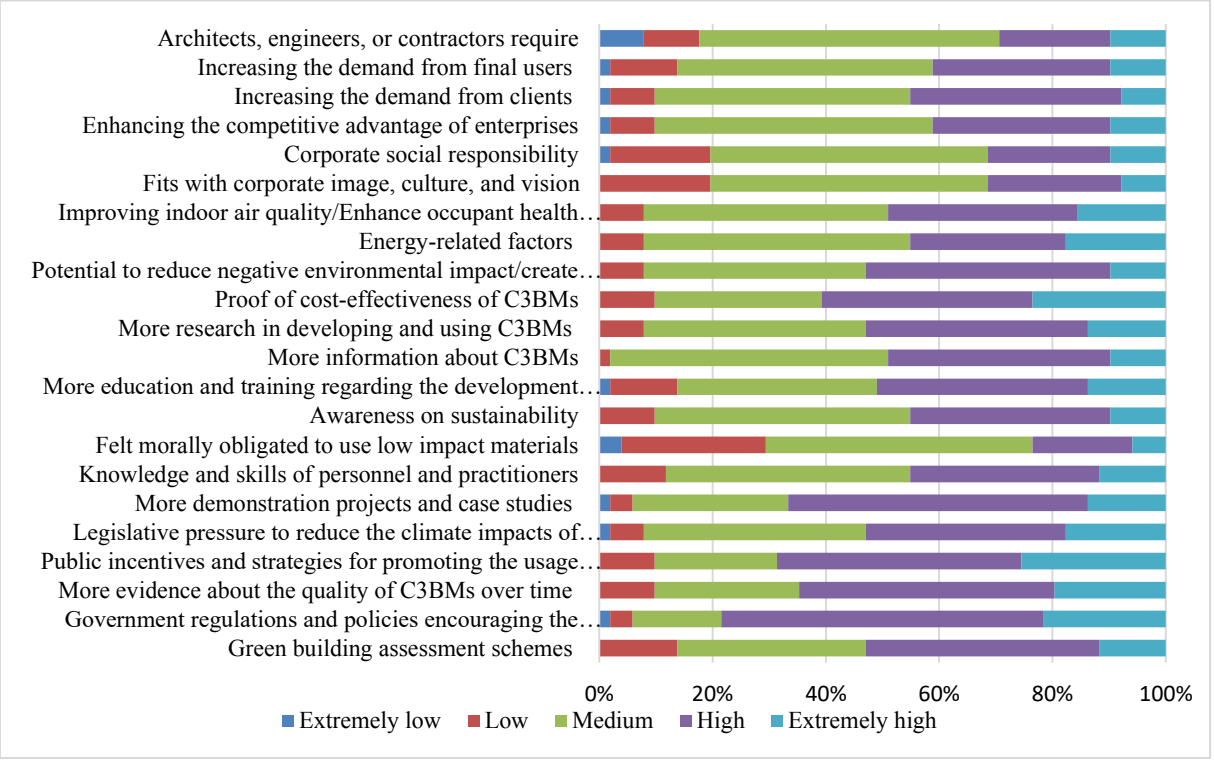
On the other hand, "felt morally obligated to use low-impact materials" and "architects, engineers, or contractors required to use C3BMs" are the least drivers for C3BMs. These findings are opposite compared to the case of the United Kingdom, where clients' requirement is a particularly crucial factor for the use of C3BMs such as hemp and straw bale (Giesekam et al., 2015). Otherwise, driving factors associated with the company, such as "fits with the corporate image, culture, and vision", "corporate social responsibility", and "enhancing the competitive advantage of enterprises", are also less significant to the decision to use C3BMs.

Table 2: The main drivers for the use of C3BMs

Code	Drivers	Sources	Mean	Overall rank
D01	Green building assessment schemes (e.g., stronger promotion, higher points related to materials credit)	(Markström et al., 2016a, Markström et al., 2016b, Giesekam et al., 2015, Ahn et al., 2013, Yang et al., 2022)	3.51	9
D02	Government regulations and policies encouraging the use of C3BMs	(Darko et al., 2017, Lakys et al., 2022, AlSanad, 2015)	3.92	1
D03	More evidence about the quality of C3BMs over time (regarding moisture sensitivity, durability, fire resistance, and acoustics)	(Markström et al., 2016a, Markström et al., 2016b)	3.75	3
D04	Public incentives and strategies for promoting the use of C3BMs (e.g., incentives on taxes and land rental fees)	(Markström et al., 2016a, Markström et al., 2016b, Lakys et al., 2022, Tokbolat et al., 2019, Ahn et al., 2013, Yin et al., 2018, Ying Liu et al., 2012, AlSanad, 2015)	3.84	2
D05	Legislative pressure to reduce the climate impacts of building materials	(Markström et al., 2016a, Markström et al., 2016b, Giesekam et al., 2015, Illeperuma and Abeynayake, 2022, Yin et al., 2018)	3.61	5
D06	More demonstration projects and case studies to highlight the advantages of C3BMs	(Markström et al., 2016a, Markström et al., 2016b, Giesekam et al., 2015)	3.73	4
D07	Knowledge and skills of personnel and practitioners	(Lakys et al., 2022, Nguyen et al., 2017b)	3.45	11
D08	Felt morally obligated to use low-impact materials	(Giesekam et al., 2015)	2.96	17
D09	Awareness on sustainability	(Lakys et al., 2022, Ahn et al., 2013)	3.45	11
D10	More education and training regarding the development and use of C3BMs (designing, installing, maintaining)	(Markström et al., 2016a, Markström et al., 2016b, Giesekam et al., 2015, Lakys et al., 2022, Ahn et al., 2013, Yin et al., 2018, AlSanad, 2015)	3.49	10
D11	More information about C3BMs (e.g., performance, types exist and how and where to use them)	(Markström et al., 2016a, Markström et al., 2016b, Giesekam et al., 2015)	3.57	7
D12	More research in developing and using C3BMs to increase the number of C3BMs to choose from	(Markström et al., 2016a, Markström et al., 2016b, Lakys et al., 2022)	3.59	6
D13	Proof of cost-effectiveness of C3BMs (e.g. reduced whole lifecycle costs)	(Markström et al., 2016a, Markström et al., 2016b, Giesekam et al., 2015, Lakys et al., 2022, Durdyev et al., 2018, Tokbolat et al., 2019, Ahn et al., 2013)	3.75	3
D14	Potential to reduce negative environmental impact/create positive impacts	(Markström et al., 2016a, Markström et al., 2016b, Lakys et al., 2022, Durdyev et al., 2018, Yang et al., 2022)	3.55	8

Code	Drivers	Sources	Mean	Overall rank
D15	Energy-related factors (energy efficiency, energy consumption, energy price increase)	(Lakys et al., 2022, Durdyev et al., 2018, Tokbolat et al., 2019, Loučanová, 2020, Ahn et al., 2013, Ying Liu et al., 2012, Yang et al., 2022)	3.55	8
D16	Improving indoor air quality/Enhance occupant health and safety	(Lakys et al., 2022, Durdyev et al., 2018, Tokbolat et al., 2019, Ahn et al., 2013, Yin et al., 2018, Ying Liu et al., 2012, Yang et al., 2022)	3.57	7
D17	Fits with the corporate image, culture, and vision	(Darko et al., 2017, Lakys et al., 2022, Durdyev et al., 2018, Tokbolat et al., 2019, Yin et al., 2018, Yang et al., 2022)	3.20	15
D18	Corporate social responsibility	(Darko et al., 2017, Lakys et al., 2022, Ahn et al., 2013, Yang et al., 2022)	3.20	15
D19	Enhancing the competitive advantage of enterprises	(Darko et al., 2017, Tokbolat et al., 2019, Yin et al., 2018, Ying Liu et al., 2012, Yang et al., 2022)	3.39	13
D20	Increasing the demand from clients for C3BMs or more environmentally friendly homes	(Markström et al., 2016a, Markström et al., 2016b, Giesekam et al., 2015, Lakys et al., 2022)	3.41	12
D21	Increasing the demand from final users (tenants, buyers) for more environmentally friendly homes	(Markström et al., 2016a, Markström et al., 2016b, Giesekam et al., 2015, Lakys et al., 2022, Ying Liu et al., 2012)	3.35	14
D22	Architects, engineers, or contractors require to use C3BMs	(Giesekam et al., 2015)	3.14	16

Figure 4. General drivers to the use of C3BMs (response to the survey question: From your perspective, please rate the importance of the following drivers for the use of C3BMs)



5. Conclusion

Although using C3BMs presents a coherent solution to address the climate and negative environmental impacts associated with the building sector, their adoption in the developing country of Vietnam is still in its infancy and faces numerous barriers. Therefore, these barriers need to be explored and addressed, and the driving factors need to be investigated to facilitate the successful and widespread adoption of C3BMs. To achieve the aim, 23 barriers and 22 drivers identified from a literature review were used to form a questionnaire survey to investigate the perception and opinion of 51 building professionals in Vietnam. Through descriptive analysis using the mean score ranking technique, the level of importance of barriers and drivers has been ranked. The results highlight the government's vital role in boosting the use of C3BMs. Indeed, the findings suggest that the government should allocate resources to prioritise and address the lack of codes, standards and regulations regarding this kind of construction materials. Furthermore, public promotions, incentives and strategies are also needed to overcome the obstacles and drive the utilisation of C3BMs. Besides, the government should also promote the research and other activities needed to provide more evidence about the quality regarding moisture sensitivity, durability, fire resistance, and acoustics of C3BMs over time.

However, this study still has some limitations that are worth mentioning to warrant future research. First, in this study, many different barriers or drivers have the same mean score results, which may be caused by the inadequate sample size and because of 11 partial responses. Therefore, future research with a larger sample size would be important to minimise the impacts of these partial responses and also to determine whether the results would significantly differ from those reported in this study. Second, the data analysis used in this study still lacks the assessment of the reliability of the Likert scale in the survey, which can be addressed by using Cronbach's alpha coefficient in future studies. Plus, the mean score ranking technique used to rank barriers and drivers is not comprehensive enough to analyse the collected data. Hence, other methods could be adopted, such as the relative importance index combined with the factor analysis, which allows for examining the underlying structure or the interrelationships (or correlations) among barriers and drivers. Moreover, future studies could analyse the differences between the barriers to and drivers for C3BMs in Vietnam and developed countries using the comparative approach to collect lessons learned that could be applied in Vietnam. Finally, although the findings of this study may be useful to policymakers and practitioners in other developing countries worldwide, the results may differ between different contexts.

Consequently, utilising the proposed barriers to and drivers for C3BMs, comparable studies could be conducted in various developing nations to observe market-specific differences, which would aid in the development of market-specific solutions to eliminate the barriers and also prioritise the drivers.

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Circular Economy in the Cosmetic industry: a literature review

Alice Mondello[1], Roberta Salomone[2] and Giovanni Mondello[3] [4]

[1] University of Messina, Department of Economics, Via dei Verdi, 75 – 98122 Messina (Italy)
[2] University of Messina, Department of Economics, Via dei Verdi, 75 – 98122 Messina (Italy)
[3] University of Messina, Department of Economics, Via dei Verdi, 75 – 98122 Messina (Italy)

[4] alice.mondello@studenti.unime.it, roberta.salomone@unime.it, giovanni.mondello@unime.it

Abstract. Cosmetic industry is involved in finding sustainable solutions to reduce any negative environmental, economic and social impact related to the different stages of cosmetic products' life cycle. Due to this growing interest, the concept of Circular Economy (CE) has started to be observed as a way to develop sustainable solutions, both from companies and scientific community. However, there is still a lack of information regarding how CE principles are implemented by cosmetic companies as well as understanding their connection with sustainability goals. In this context, it is of basic importance to analyse the state of the art of the academic literature in this field with the aim of providing an overview of CE practices and strategies which are or could be applied in the cosmetic industry. A bibliometric and systematic literature review is carried out. The sample of studies has been extracted from Scopus and Web of Science databases. The process identified articles and reviews having a focus on how circular solutions are developed. Results have been classified considering: input valorisation, packaging optimisation, output valorisation, management and governance. The main findings highlight that the input valorisation is the most investigated category. In addition, results show a connection with agri-food, chemical and biochemical sectors, and with sustainability .

1. Introduction

Cosmetic industry represents a significant sector in the global economy contributing with a revenue of 100.49bn USD worldwide (Statista, 2022) and considering the important role of its products in the day-to-day life. The cosmetic market includes different product categories: skincare, haircare, make-up, perfumes, toiletries and deodorants, and oral cosmetics, of which the skincare represents the leading category in the global market in 2021 with a share of about 41% (Statista, 2023).

The industry is constituted by many multi-national corporations (Statista, 2023), but also a significant number of Small and Medium Enterprises (SMEs) are present in the sector, especially in Europe where SMEs were 5.800 in 2018 (Cosmetics Europe, 2019b).

In general, the cosmetic industry is one of the most fast-growing in the world and the sector is expected to continue to grow: indeed, at global level the cosmetic products market should register a Compounded Average Growth Rate (CAGR) of about 5,5% between 2021 and 2028 (Zion Market Research, 2021), while at European level the personal care and cosmetic products market should register a CAGR of 2,6% between 2022 and 2027 (Mordor Intelligence, 2021).

As a consequence of this growth, also the generation of waste and the environmental pressure related to its impacts is increasing in all the phases of cosmetic products' life cycle (Cubas et al., 2022; Bom et al., 2019).

Therefore, cosmetic companies are looking for green, sustainable and natural products (McIntosh et al., 2018), with the aim of reducing any negative environmental, economic and social impact deriving from the entire life cycle of cosmetic products (Cosmetics Europe, 2012). Indeed, many cosmetic companies are involved in various initiatives in this field, such as the Responsible Beauty Initiative (RBI), which is launched in 2017 by some leading cosmetic companies with the aim of monitoring the social and environmental

impacts generated by the entire supply chain of the industry, but especially by the manufacturer companies (Nikolova, 2022). Another important initiative regards the increase of using renewable and bio-based materials, which is promoted especially for packaging with the Sustainable Packaging Initiative for Cosmetics (SPICE) (Cosmetics Europe, 2019a).

The importance of these issues is also demonstrated by the increasing commitment of the European Commission (EC), which is involved in establishing regulations aimed to guide all the society in the transition to a sustainable future (EC, 2019). In this field, important regulations are the European Green Deal and the Chemicals Strategy for Sustainability (EC, 2019; EC, 2020), which include a set of initiatives aimed to the protection of society and environment in all the economic sectors. In addition, the EC introduced the Action Plan for Circular Economy (CE), which is focused on the need of finding sustainable solutions for products (EC, 2019).

2. Literature review

CE represents a potential solution to achieve sustainable development goals (e.g. Geissdoerfer et al., 2017; Suárez-Eiroa et al., 2019). Indeed, in literature CE represents a tool for cosmetic companies involved in the formulation of products (e.g. Novara et al., 2022) and design of packaging (e.g. Gatt and Refalo, 2022; Civancik-Uslu et al., 2019), but it could also support companies in all the activities related to the achievement of their sustainability goals (e.g. Morea et al., 2022).

The interest in CE is growing and in literature many definitions are present, including that of European Commission which states that "CE aims to maintain the value of products, materials and resources for as long as possible by returning them into the product cycle at the end of their use, while minimizing the generation of waste" (EC, 2015, p.2). From this definition, it appears clearly that CE could support companies in all the phases of products' life cycle. In addition, the concept has certainly a connection with sustainability and its dimensions (Kristensen and Mosgaard, 2020).

Despite the potential help that CE could offer to cosmetic companies and the growing interest in the concept, there is still a lack of information in the industry about the practical implementation of the CE principles in the formulation and packaging of cosmetics, as well as in the achievement of sustainability goals (Rocca et al., 2022).

In this context, an analysis of existing literature on CE in the cosmetic industry is necessary to define the state of the art. The present study is thus focused to the CE options which are or could be applied in the cosmetic industry according to scientific literature, with the aim of showing evidence of CE practices and experiences in the cosmetic industry.

3. Methodology

The presented literature review is carried out in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA) (Moher et al., 2009) with the aim of providing a full vision of CE practices related to cosmetic industry proposed in literature. Bibliometric (Wallin, 2005) and systematic (Khan et al., 2003) analysis are employed to provide an overview of CE in the cosmetic industry.

Before to formulate the search strategy, a research question was identified: "What is the state of the art of circular economy in the cosmetic industry according to the scientific community?"

After that, two keywords were defined for the investigation which employed two different databases: Scopus (SP) and Web of Science (Wos) Core Collection, which are selected to ensure quality and quantity of records. The search query was defined using "cosmetic*" and "circular economy" as keywords, tied by the Boolean operator "AND" for obtaining records that include both the terms. The query is structured for collecting all the studies focused on CE in the cosmetic industry, without any foreclosure. The search was focused on title, abstract and keywords using the "Title-Abstract-Keywords" search field in Scopus and "Topic" search field in Web of Science. A time frame wasn't defined and the search was updated at the 31st January 2023.

A total of 332 results were obtained, of which 188 were collected from Scopus and 144 from Web of Science. Then, the results were limited to articles and reviews while other types of publication were excluded. In details, excluded results were: book chapters (n=20), conference papers (n=8), conference reviews (n=2), books (n=2), erratum (n=1), proceeding papers (n=8), early accesses (n=5), meeting abstract (n=1), editorial (n=1). In addition, articles in press (n=3) were also excluded. Then, articles not in English (n=2) and duplicate results (n=125) were excluded and a sample of 154 publication was obtained.

The full-text download process is carried out and not-available publications (n=8) are excluded. After that, the abstract screening is carried out but no records were excluded. The remaining 146 articles and reviews were employed for the full-text screening. In this step, articles and reviews (n=54) were excluded due to different exclusion criteria, such as: i) cosmetic application of CE is mentioned only in abstract, introduction or conclusion without any complete description in study; ii) cosmetic application of CE is mentioned as potential, but without any complete description in study; iii) cosmetic application and CE are mentioned in the study but discussed separately, without any connection; iv) the context of the study isn't in line with the search strategy, thus does not refer to CE in the cosmetic sector.

The remaining sample is composed of 86 records, which were included in the study.

3.1 Bibliometric analysis

The analysis of bibliometric information is carried out considering the metadata extracted from both Scoups and Web of Science. The analysis of the collected data is performed using Microsoft Excel, SciVal and VOSviewer. In details, VOSviewer is employed for analysing the occurrence of authors' keywords, while Microsoft Excel and SciVal are used for the analysis of the others bibliometric information.

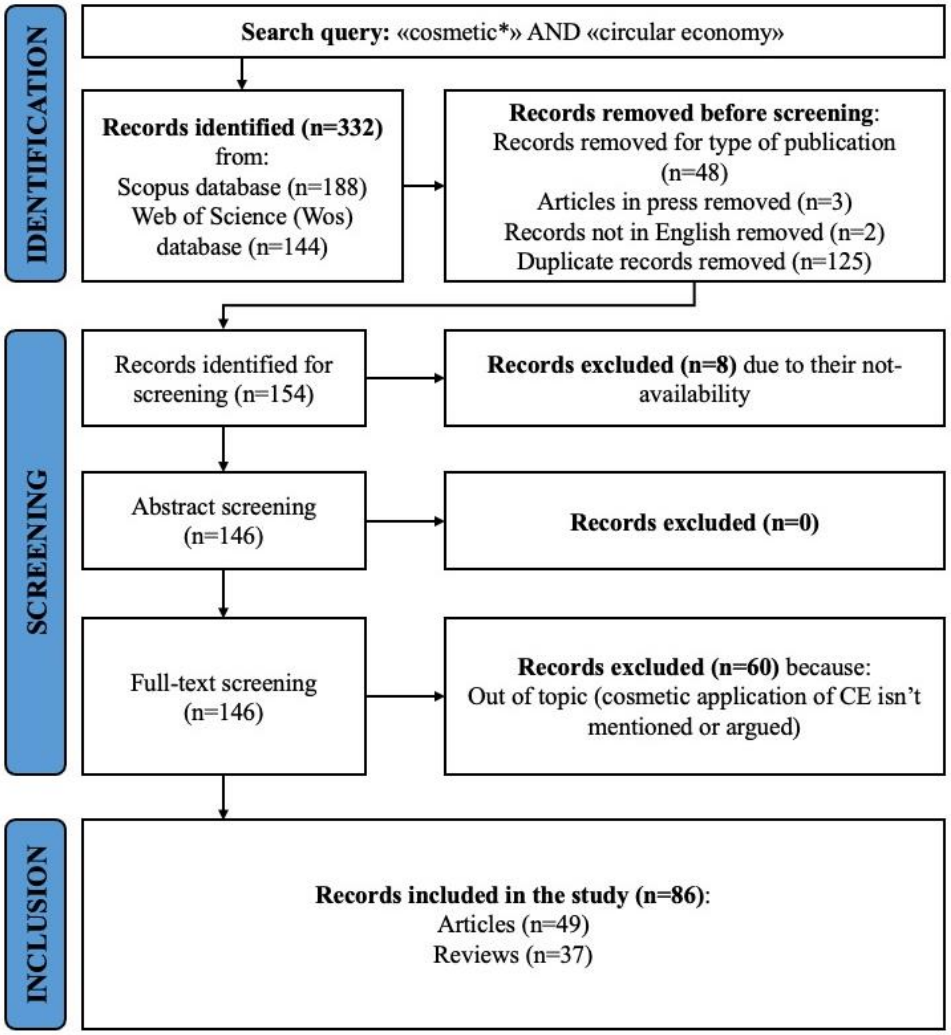
3.2 Systematic analysis

The systematic analysis is carried out considering the characteristics of the proposed CE options and practices in the cosmetic industry.

All the results are analysed considering the object of analysis and the used research methods. In addition, products and materials are analysed considering also the industrial sector to which they belong.

All the proposed CE options are also considered in terms of the 4Rs principles with the aim of analysing whether and what principles are explicitly or implicitly mentioned in the studies, referring to cosmetic application. The identification of the principles is based on the framework established by the Directive 2008/98/CE of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.

Figure 1. Search strategy diagram (based on PRISMA guidelines)



4. Results and Discussion

In this section, the preliminary results of bibliometric and systematic analysis are presented and discussed.

4.1 Bibliometric analysis

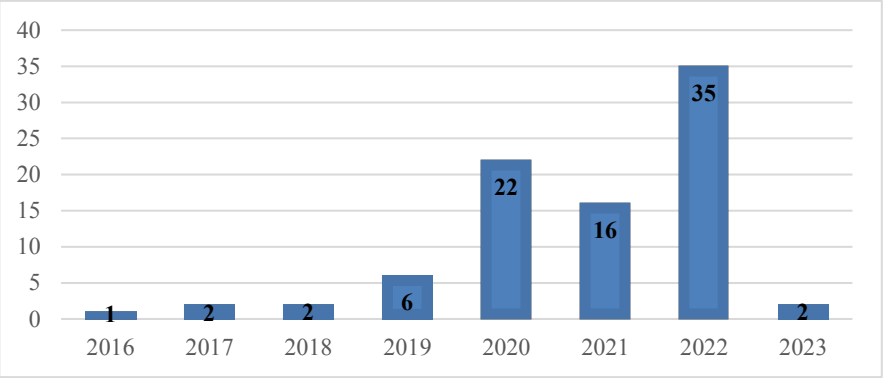
The bibliometric analysis is carried out by considering: the year of publication, the journal source and subject areas, the authors' keywords, and the country.

4.1.1 Yearly distribution of publications

Regarding the year of publication, the 86 studies included in the sample were published between 2016 and the end of January 2023. The results have been published only since 2016 probably because the term "circular economy" has begun to receive increasing attention and acceptance after the publication of the Circular Economy Package (European Commission, 2015).

Results show an increasing interest of academics on the topic, with an exponential growth of number of publications since 2020. In details, the highest number was registered in 2022, in which the published studies were more than doubled respect the previous year, in which there was a slight decrease. The small number of publications in 2023 is due the research was updated only at the beginning of the year.

Figure 2. Yearly distribution of publications



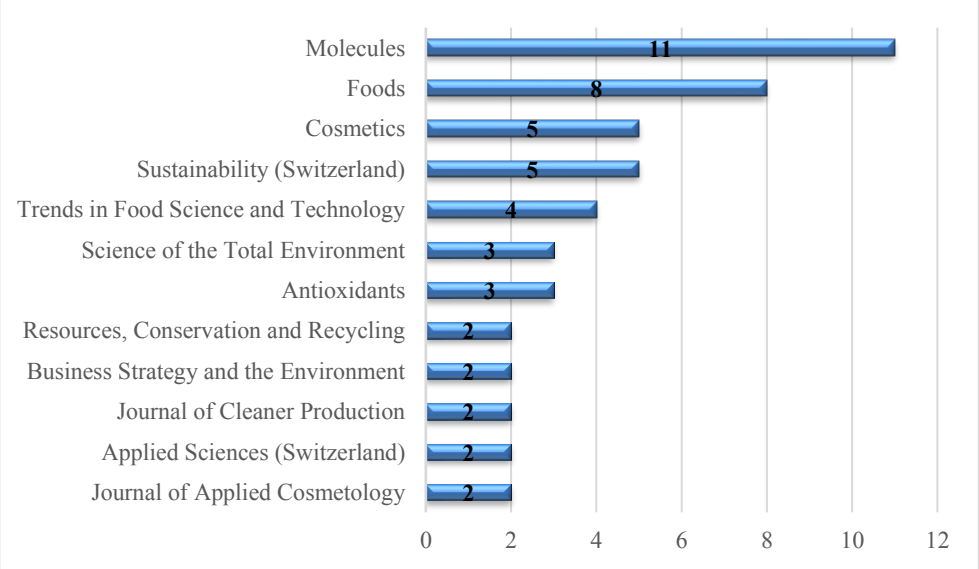
4.1.2 Journals source and subject areas

Regarding the journal source and subject areas, the studies included in the sample were published in 49 journals that covered 19 different subject areas.

The most recurring journal is "Molecules", which published 11 publications during the period of analysis. After that, other recurring journals are "Foods", with 8 publications, "Cosmetics" and "Sustainability (Switzerland)", both with 5 publications. It is interesting to note that 37 out of 49 journals published only one study on the topic.

Figure 3. reports the number of records per journal, considering only journals which published more than 1 study for aesthetic reasons.

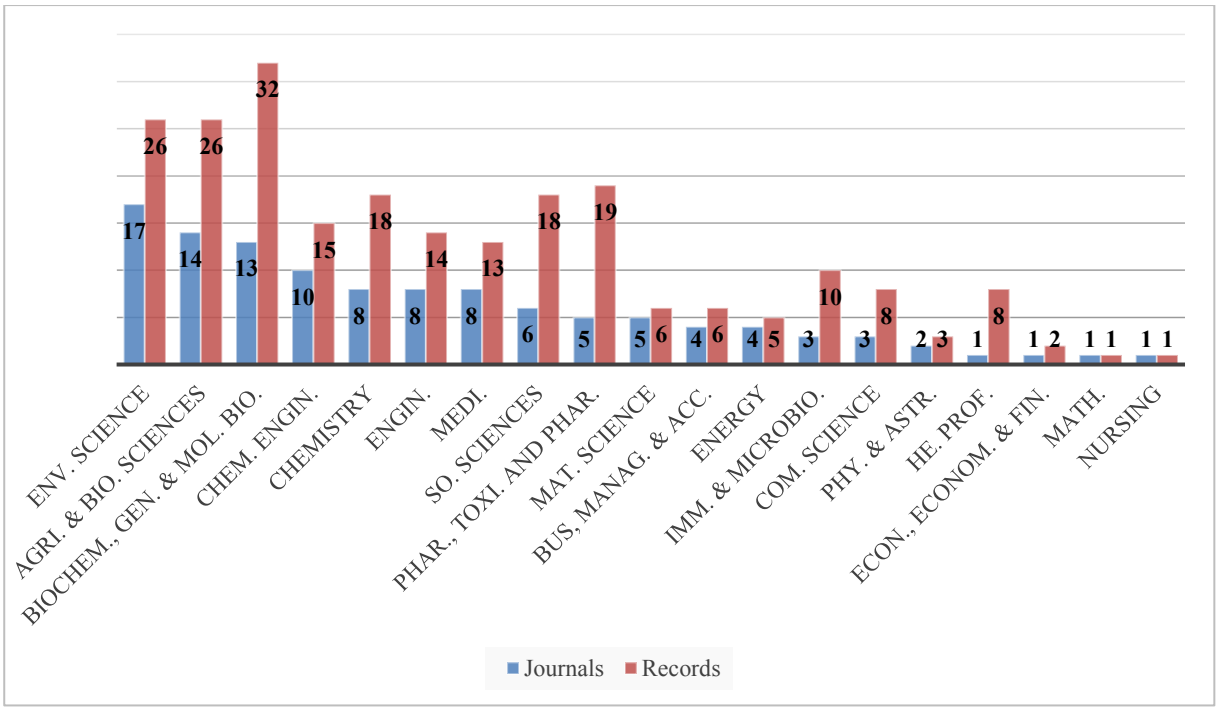
Figure 3. Number of records per journal



Regarding the subject areas, the number of journals and records related to each one is reported in Figure 4. The most recurring in the sample are "Biochemistry, Genetics and Molecular Biology", covered by 32 studies published in 13 different journals, "Agricultural and Biological Science" and "Environmental Science", both covered by 26 studies published, respectively, in 14 and 17 different journals, and "Pharmacology, Toxicology and Pharmaceutics", covered by 19 studies published in 5 different journals.

The recurrence of these subject areas shows important findings. Indeed, CE in the cosmetic industry is related to other industrial sectors, such as the chemical and biochemical, the agricultural, and the pharmaceutical ones. In addition, the importance of the environmental dimension is shown due to the high occurrence of the "Environmental Science" subject area.

Figure 4. Subject areas per journal and record



4.1.3 Authors' keywords

Considering the authors' keywords, a total of 395 different keywords are identified. VOSviewer is employed for the analysis of their occurrence. The process allows to create a co-occurrence network map where the number of occurrences of each keyword is represented by the sizes of circles. The map shows also the strength of correlation between different keywords, which is calculated by counting the number of publications in which two keywords occur togethers and is represented by the thickness of the lines (Van Eck and Waltman, 2010).

The replace of terms referring to the considered topic is performed, allowing to select 392 keywords. The co-occurrence network map is carried out considering all the keywords with a minimum number of 2 occurrences, which are a total of 37 keywords. The items are classified in 6 different cluster which are identified by the VOSviewer software.

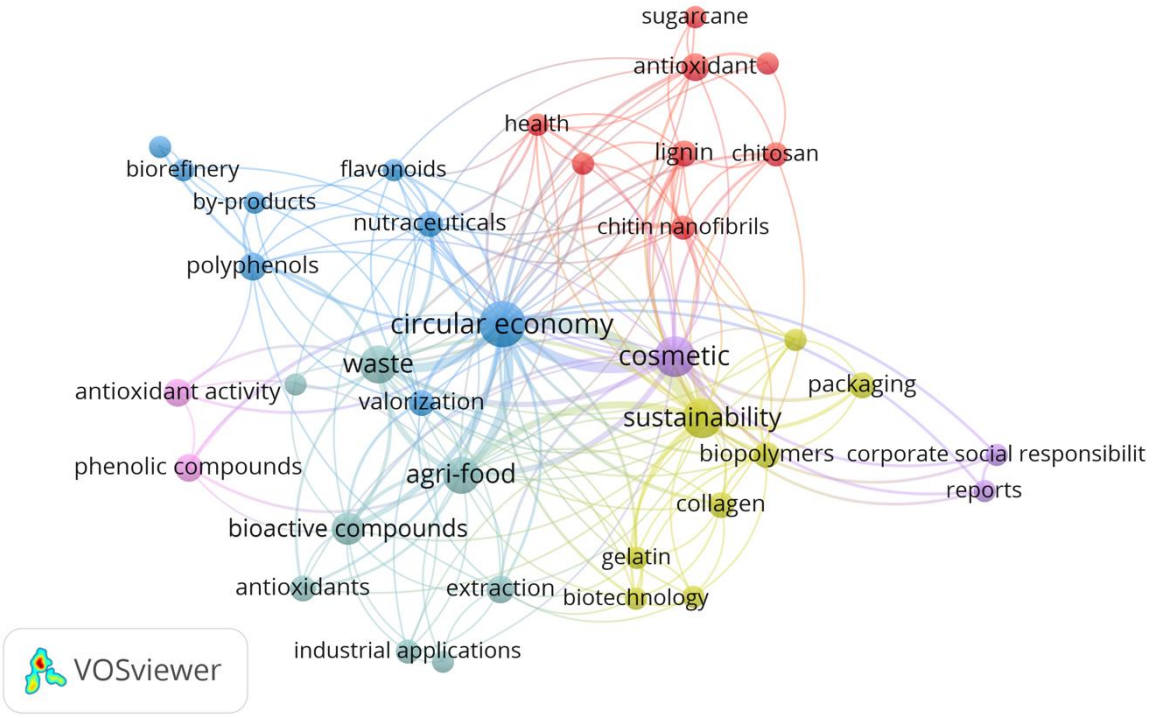
The most recurring keywords are "circular economy", with 48 occurrences, and "cosmetic", with 27 occurrences, followed by "sustainability", which occurs 26 times. It is interesting that "sustainability" has the highest occurrence after the two terms used in the search query. This result demonstrates the existence of a connection between CE and sustainability, also in the cosmetic sector.

Other keywords with a significant number of occurrences are "waste" (20 times), "agri-food" (19 times) and "bioactive compounds" (10 times), while the others occur 5 times at maximum. The keywords "waste", "agri-food" and "bioactive compounds" belong to the same cluster identified by VOSviewer. The same cluster also includes words as "extraction" (5 times) and "industrial application" (3 times).

It is interesting to highlight that "agri-food" in the only sector mentioned as keyword, which demonstrate a strong connection between it and CE in the cosmetic industry. In addition, the composition of its cluster shows an interest of many authors in the utilization of agri-food waste for the extraction of bioactive compounds to be used in the cosmetic industry in compliance with CE.

The composition of all the clusters also shows the interest of many authors in chemical and biochemical topics, due to the high presence of terms related to these sectors.

Figure 5. Authors' keywords co-occurrence



4.1.4 Country of publication

Considering the country of publication, the studies of the sample are published by authors worldwide. The analysis of this information is carried out using SciVal, which considered the 84 studies published between 2016 and 2022. In details, 41 different countries are identified and analysed considering the number of publications, which is named "Scholarly Output" on SciVal.

Results demonstrate a general interest on the topic from all over the world. The top countries for number of publications are Italy, in which 24 records are published, Portugal, with 22 publications, and Spain, with 19 publications. In addition, a consistent number of studies occurs for China and Brazil, with, respectively, 9 and 8 publications. On the contrary, Australia, Africa and North America result the areas less interested in the topic, with a range of 1 to maximum 2 publications per country.

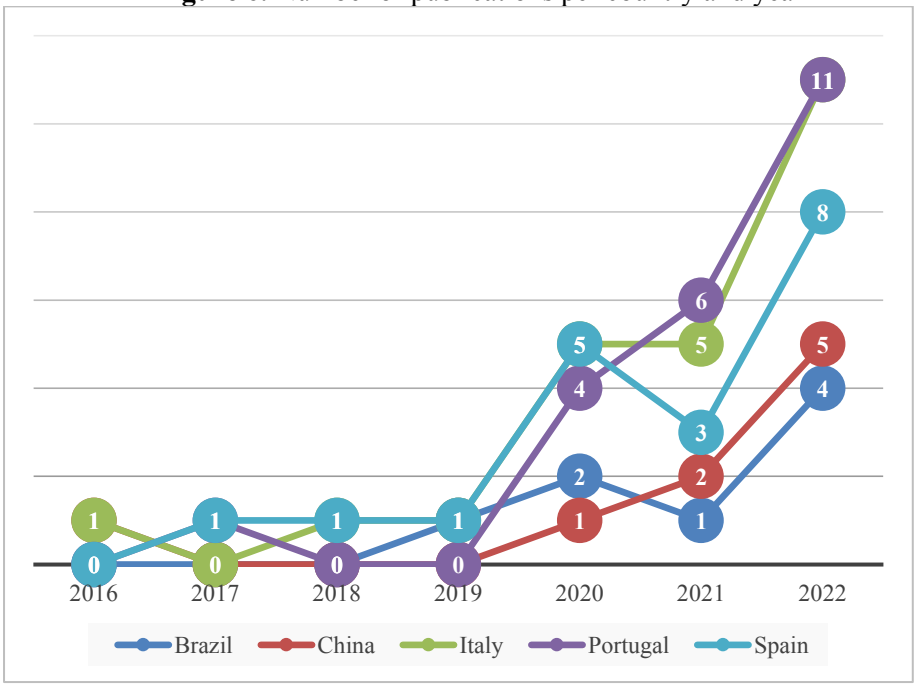
In general, it appears clear that European countries, not considering numbers of China and Brazil, are the most active in publishing studies on the topic under examination, i.e. CE in the cosmetic industry. This result reflects the attention of Europe on CE, which is shown also due the publication of documents on the topic, such as the Directives of the European Commission.

Figure 6. summarizes the descripted results with a world map where the number of publications is reported for each country, which are represented with a color scale from white-light green (1 publication) to darker green (up to 22 publications).

Figure 6. Countries map per number of publications

In addition, it has to be noted that the growing interest on the topic during the period of analysis is demonstrated especially for the top five countries above mentioned. The yearly distribution of their number of publications is shown in Figure 6.

Figure 6. Number of publications per country and year



4.2 Systematic analysis

The systematic analysis allows classifying the results in four sub-categories: input valorisation, packaging, output valorisation, governance and management.

The sub-category of "input valorisation" includes articles and reviews focused on materials and substances used as ingredients for the formulation of cosmetics and their methods of extraction and valorisation, but some where the authors argue their practical application, while others are not focused specifically to cosmetic application.

The sub-category of "packaging" includes studies proposing circular solutions for replace, reduce or recycle specific materials, such as plastic.

The sub-category "output valorisation" includes articles focused on circular practices applied by cosmetic companies to manage their waste and by-products.

Finally, the last sub-category "Governance and Management" includes studies which take into consideration other CE practices oriented to the design of business models and circular strategies at management and governance level.

4.2.1 Input valorisation

The sub-category of input valorisation includes the majority of the studies (n=72), representing about 84% of the sample. The high percentage is probably due to the challenge that cosmetic industry has to face, related to find safe and sustainable alternatives for ingredients replacing synthetic materials which imply environmental impacts and also effects to human health (e.g. Antunes et al., 2022; Gaspar et al., 2022).

The articles and reviews in this category analyse circular options for the valorisation of materials and substances used for the formulation of a cosmetic product (n=41), but some of them propose only the extraction and processing of specific materials which can be potentially and not specifically applied to cosmetic industry (n=31). In both cases, the most common option proposed by authors regards the valorisation of industrial waste and by-products for extracting valuable compounds which can be used in the cosmetic formulations. In addition to the circularity of this kind of process, these bioactive compounds present several beneficial effects for human health and especially for the skin, due to their properties of, such as, anti-aging, antioxidant, antimicrobial and anti-inflammatory (e.g. Andrade et al., 2022; Chamorro et al., 2022; Kholssi et al., 2021). The extraction of compounds also entails both economic and environmental implications due to the reduction of the impacts deriving from the disposal of products from which compounds are obtained (e.g. Panwar et al., 2021; Romani et al., 2020) and from the use of materials for which compounds represent a more sustainable alternative (e.g. Ancuta and Sonia, 2020).

More in details, several authors propose the valorisation of agri-food waste and by-products (n=59) (e.g. Morganti et al., 2022; Del Rio Osorio et al., 2022), confirming a strong connection between agri-food and cosmetic industry. In addition, this relation is specifically considered in an article of the sample which is focused on the beneficial effects deriving from the use of food-derived ingredients in the cosmetic formulations (Faria-Silva et al., 2020). This result is already shown through the bibliometric analysis of the sample and present several implications in terms of circularity of the process. The agri-food industry is one of the most waste-producing due to the annual huge amount, which globally consist of around 931 million tons (Morganti et al., 2022). Thus, the chance to transform this waste into new resources is needed and CE principles offers various alternatives aimed to the recovery and reduction of agri-food waste, especially due to the several by-products of the industry that contain a high content of bioactive compounds (Del Rio Osorio et al., 2021).

Overall, the studies in this category are almost equally divided into articles (n=38) and reviews (n=34). It is interesting to note that about 89% of articles (n=34) is carried out by authors using chemical and bio-chemical methods of analysis. This result also confirms the findings obtained with the bibliometric analysis of the sample. The reason behind that is probably due to the need of studying the composition of materials and the extraction methodologies (e.g. Mellinas et al., 2022; Truzzi et al., 2022). In addition, the impacts on health of cosmetic products is strongly related to the chemical composition of ingredients (Morganti et al., 2022).

The 4Rs principles are explicitly mentioned in about 82% of studies about formulation (n=59), with reference to one or more principles. In addition, all the 4Rs principles are explicitly mentioned in about 14% of studies in this category (n=10). However, the most mentioned are Reduce and Recovery, both alone and together.

4.2.2 Packaging

The sub-category of packaging includes about 5% of studies of the sample (n=5).

Despite the small number of studies, some important findings can be highlighted. In details, the importance of plastic emerges as it represents the main used material for cosmetic packaging despite its environmental impacts (e.g. Cubas et al., 2022).

The studies in this category are indeed focused on how to replace plastic, such as using bio-based or biodegradable plastics (Cinelli et al., 2019), or mineral fillers and/or post-consumer recycled plastics (Civancik-Uslu et al., 2019). The study of Cubas et al. (2022) considers all the problem related to plastic in

the cosmetic industry and it has to be noted that its work is analysed also in the formulation category. In details, this study argues the possibility of using biopolymers for cosmetic packaging, which could be also in compliance with the achievement of some SDGs, among which the 12, 13, 14 and 15 (Cubas et al., 2022).

To propose more environmentally friendly solution to the use of plastic, authors argued the importance of the concept of recycling in all the life cycle phases of the cosmetic packaging, often considered only regarding the post-use phase. Using the Life Cycle Assessment (LCA) method, one of the most important phases result indeed the design ones (Ren et al., 2022), in which the choice of using recycled materials allows to have a lower impact and also to reduce the amount of used material (Civancik-Uslu et al., 2019).

The 4Rs principles are explicitly mentioned in all the records about packaging, with references to one or more principles. In details, Recycle is mentioned in all the studies, while Recovery is only reported in the study carried out by Cinelli et al. (2019), in which the authors in addition to reuse and recycle principles, also referred to the recovery of a fraction of rigid packaging from waste.

4.2.3 Output valorisation

Regarding the output valorisation, only about 3% of studies of the sample (n=3) are focused on this issue. The studies are focused on CE strategies oriented to the valorisation of waste and by-products of the cosmetic industry.

Despite the topic of waste is recurrent in all the studies of the sample and emerges also in the bibliometric analysis, authors focus more on the valorisation of waste from other industries rather than on the circular practices which could be applied for the management of that of the cosmetic industry.

In details, the studies in this category are focused on the possible treatment of cosmetic waste proposing different possibilities: i) the valorisation of biomass extracted from the cosmetic industry to obtain pellets (Izydorczyk et al., 2020); ii) the description of different pre-treatments of a mixture of cosmetic waste materials with organic content not ready biodegradable (Demichelis et al., 2018); iii) the plastic waste management and its consequences after the COVID-19 pandemic (Igalavithana et al., 2022).

Regarding the 4Rs principles, in all the three different options, the principle of Reduce has a predominant importance due to the aim of reducing waste and of using the resources in a more efficient way, always to reduce the production of waste and its impacts.

4.2.4 Management and Governance

Regarding the Management and Governance of CE in the cosmetic industry, some authors take into consideration business models, circular communication and Corporate Social Responsibility (CSR) strategies. About 8% of studies of the sample (n=7) are classified in this sub-category.

The studies are focused on the link between CE and sustainability, considering how cosmetic companies could implement circular business models, how they could communicate their commitment to CE, and how they could achieve their sustainability goals with the support of CE.

Most studies of the category are case-studies (n=4), while other authors employ qualitative content analysis. This is probably due to the object of analysis, which in this category isn't a product or a material, but mainly consists of sustainability and Corporate Social Responsibility (CSR) report of cosmetic companies (Tiscini et al., 2022; Morea et al., 2021; Fortunati et al., 2020; Sehnem et al., 2020). In the other studies, the object of analysis is represented by circular business models (Puglieri et al., 2022), governance instruments (Cardoso de Oliveira et al., 2019), and other documents publicised by the company object of case-study (Cassol and Sellitto, 2020).

All the studies in this category confirm the existence of a positive relationship between CE and sustainability in the cosmetic industry, showing the advantages that CE could provide to cosmetic companies in terms of sustainability and its dimensions.

Despite the small number of studies focused on this issue, the link with sustainability is already of interest of authors and it is carried out regarding all the articles and reviews of the sample.

The 4Rs principles are explicitly mentioned in 6 out of the 7 records of this category. In particular, there is a reference to all the principles in almost all of them (n=5).

5. Conclusion

This review was carried out with the aim of providing an overview of the state of the art of CE in the cosmetic industry, but also with the aim of understanding the existence and the nature of the link between CE and sustainability in this sector.

A systematic and bibliometric analysis of relevant articles and reviews was performed identifying 86 studies which were taken into consideration for answering to the proposed research question.

The interest of academics in CE options related to the cosmetic industry is increasing in the last years, with a focus on the input valorisation for the formulation of cosmetic products. Other options related to CE were also investigated, such as ones related to packaging, output valorisation, and governance and management.

The main preliminary findings of the review are showed by both the bibliographic and the systematic analysis. However, a link between the research about CE in the cosmetic industry and chemical, biochemical, agri-food and pharmaceutical sectors is shown, especially regarding the input valorisation for the formulation of cosmetics. In details, the chemical and biochemical research is necessary for the identification of raw materials properties and for the extraction of high-added value compounds, especially from waste and by-products. The agri-food sector has as well a fundamental role due to the great amount of raw materials which can be obtained from its waste and by-products and that can be used as ingredients for cosmetic formulations, in compliance with CE principles. Finally, the pharmaceutical sector also assumes importance due to the human health implications related to the composition of cosmetics.

Important results were obtained from all the studies of the sample, such as the importance of plastic in all the phases of cosmetic products' life cycle. In addition, the importance of Reduce and Recovery principles is shown in all the sample, although overall all the 4Rs principles result fundamental for the application of CE in the cosmetic industry.

The findings of this study showed the main characteristics of the state of the art of CE in the cosmetic industry according to the scientific community, as defined in the research question. The obtained results have indeed some implications, such as the links of the cosmetic industry to other industrial sectors which are necessary to develop circular solutions. In addition, this review highlights the importance of the valorisation of waste and by-products for the implementation of CE in the cosmetic industry, as well as the importance of the 4Rs principles and in particular of the Reduce and Recovery ones.

The study here reported presents some limitations. In particular, despite the choice of defining a query aimed to collect all studies regarding CE in the cosmetic industry, the results showed that most of the analysed records were focused on the input valorisation for the formulation of cosmetics, while few studies were oriented on analysing the packaging. In this regard, Ren et al. (2022) highlighted the importance of packaging in terms of sustainability impacts, which could be greater than those generated from the formulation of cosmetics. Thus, future research should be oriented in specifically assessing the role of packaging in cosmetic industries in terms of CE strategies and sustainability performance. In addition, some studies are excluded due to the absence of a practical application of CE options in the cosmetic industry, despite the presence of a mention to a future potential application.

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Circular economy practices in the agri-food sector: an exploratory survey regarding Portuguese companies

Federica Scandurra[1,5], Roberta Salomone[1], Sandra Caeiro[2,3] and Ana Pinto de Moura[4]

[1] Department of Economics, University of Messina, Italy
[2] Center for Global Studies, Department of Science and Technology, Universidade Aberta, Lisbon, Portugal
[3] CENSE - Center for Environmental and Sustainability Research & CHANGE - Global Change and Sustainability Institute, NOVA School of Science and Technology, NOVA University of Lisbon, Lisbon, Portugal
[4] GreenUPorto—Sustainable Agrifood Production Research Centre/INOV4Agro, Department of Science and Technology, Universidade Aberta, Porto, Portugal

[5] federica.scandurra@unime.it

Abstract.

The circular economy is a paradigm able to reconnect the food system to the ecosystem, generating closed loops of inputs and resources. The agri-food sector has followed an intensive production and consumption model but now urges a change in roots to ensure sufficient resources for present and future generations.

However, the application and evaluation of CE in companies in the agri-food sector remain underexplored, but it is still a crucial step in pushing the sector's transition. Moreover, circularity is a huge opportunity for companies to increase their efficiency and competitiveness while respecting ecosystem boundaries. In this sense, Portugal represents an interesting context for exploring the potential of circularity, given the centrality of the agri-food sector in the country's economy and the interest shown in the topic, evidenced by several projects and initiatives launched to promote circularity in the sector. For this reason, this study aims to explore how circularity has been adopted and evaluated in the Portuguese agri-food sector. To this end, an online survey of a sample of Portuguese agri-food companies already involved in circularity was conducted from January to March 2023.

Considering a final sample of 31 companies, results indicate that: i) company size and the respondent's department have an impact on the level of detail of responses; ii) practices are largely associated with incrementally innovative (77 %), technological (50 %) or socio-organizational (37.5 %); iii) most evaluating companies adopt specific indicators (56 %), while a significant proportion does not evaluate circularity but already adopt evaluation tools related to CE.

The study aims to identify circular best practices for the industry to guide practitioners toward adopting circularity and offer insights for future academic contributions. This article aims to restore the sustainability of the food system and prevent food loss and waste along the food chain, in line with Sustainable Development Goals 2.4 and 12.3.

1. Introduction

The circular economy (CE) represents a promising paradigm for achieving sustainability in the agri-food sector (AFS) (Zhang et al., 2022), as the food system plays a central role in society because of its direct and indirect impact on human life. Whereby AFS is meant the system that "…*covers the journey of food (e.g., cereals, vegetables, fish, fruits, and livestock) from farm to table including when it is grown, harvested, processed, packaged, transported, distributed, traded, bought, prepared, eaten and disposed of. It also encompasses non-food products (e.g., forestry, animal rearing, use of feedstock, biomass to produce biofuels, and fibers) that also constitute livelihoods and all of the people as well as the activities, investments and choices that play a part in getting us these food and agricultural products*" (FAO, 2021, p. 3).

It is responsible for significant greenhouse gas emissions, soil depletion, and water pollution, but at the same time, it generates wealth and employment in rural and urban settings (Kumar et al., 2022).

The sector has traditionally followed a linear model of production and consumption based on the make-use-waste approach, which in the long run has proven unsustainable (De Bernardi et al., 2023). Worldwide, one-third of the food produced gets wasted, while hunger is rising. According to FAO projections, 670 million people will starve in 2030, the same target projected in 2015, before the introduction of the 2030 Agenda (FAO, 2022). The picture will additionally be compromised by the population increase projected for 2050, which will severely affect food loads (Martins, 2020.). The additional demand for food will exacerbate deforestation, reduce biodiversity, and water pollution (Silvestri et al., 2022). In this context, the CE offers a restorative and regenerative pathway for food production and consumption (Zhang et al., 2022). To enable this transition, organizations must integrate circularity into their operations. CE helps agri-food companies to improve process efficiency and increase market competitiveness while respecting the biosphere's limits (Martins, 2020). The potential of circularity in the AFS makes it a strategic tool for agri-food-driven countries.

In Europe, Portugal offers an attractive context for exploiting such potential. AFS is the backbone of the Portuguese economy. Its Atlantic and Mediterranean climate conditions result in a great variety of products. In particular, crop for 59.5% of the total production (18% of vegetables and horticulture, 20% of fruit and 10% of wine), and animal outputs for 38% (9.6% milk, 7.8% cattle and 7.1% of pigs (fi-compass, 2020) Today, agri-food production is one of the main drivers of the Portuguese manufacturing industry, representing 14.5% of total sales in 2016 (fi-compass, 2020). Agri-food production is mainly for the internal market, but exports are increasing, with the sector contributing 11.8% of Portuguese exports in 2018 (Martins, 2020.) Moreover, is one of the largest employers in Portugal, counting 294,000 workers and 135,000 companies (FIPA, 2019).

Portugal implemented the CE Action Plan in 2017 (Leading the transition: Action Plan for Circular Economy in Portugal 2017-2020) and since then has established several CE projects in the agri-food context. Relevant examples are the "Alentejo Circular" (2016-2018) focused on identifying circular practices in the olive, pork and wine production, excellences products of the Alentejo region, or the "REiNOVA Si" (2019-2021), a cross-border project that involved Portugal and Spain in mapping circular best practices among SMEs of the AFS or the CERTAGRI project (2018-2019), for introducing circular labels in agri-food products.

For this reason, the present study carried out an empirical analysis, exploring how CE is implemented and measured in a convenient sample of Portuguese agri-food companies.

This study presents the preliminary results of a more in-depth analysis involving semi-structured interviews with some sample companies. One part of the survey analysis, aimed at determining the main characteristics of the companies, the identification of practices and their evaluation, is described here. The complete study analysis will follow in future publications.

2. Literature review

The interest in CE in the AFS has increased in recent years, confirmed by the scientific literature on the subject (Esposito et al., (2020); De Bernardi et al., (2023)). However, its implementation remains limited in the sector (Mehmood et al., 2021).

A previous study (Scandurra et al., 2023) assessed the sector's maturity regarding circularity by analysing case studies reported in the literature. This result stems from the prevalence of conventional practices in the literature, showing how circularity is not new in the food system but rather an element to rediscover. In their review, Mehmood et al., (2021) explored the drivers and barriers to CE adoption in the AFS, calling for more empirical studies on the integration of CE at different food supply chain stages. Relevant now is to understand

the maturity previously assessed is also recognized by the companies of the sector and how they apply circularity in their activities.
Moreover, the importance of adequately measuring and monitoring the CE strategies implemented has recently been stressed to understand how CE principles are applied and to quantify progress made (Fassio and Chirilli, 2023). Currently, no economic sector has a standardized method for measuring the impacts of CE, but this is particularly the case for AFS (Poponi et al., 2022). Indeed, only a few studies in the literature focus on CE measurement in the AFS (e.g., Velasco-Muñoz et al., (2021), Silvestri et al., (2022), Poponi et al., (2022)). Besides identifying measurement tools for the industry, it is also critical to understand if and how agri-food companies use such tools (Silvestri et al., 2022). Therefore, an empirical study focused on companies' experience may gauge relevant insights to guide future research towards valuable assessment tools for the AFS.

3. Methodology

The study relies on an online survey, designed with Microsoft Forms. The survey was delivered with email invitations and open from 26 January until 13 March 2023. It was written in English and then translated into Portuguese and tested by the research teams.
The survey was based on closed and open-end questions and articulated in:

- Section A, General information. The section enables to collect information regarding companies' localization, size, supply chain type and stage and the respondent's department into the company (5 multiple choice questions, of which 4 single and 1 multi select, and 1 classical open text question).
- Section B, Circular practices classification and assessment. The section identifies and evaluates the CE practices and processes in terms of the level of circularity, analyzed through the 4 R framework, that connects CE' principles to reduction, reuse, recycling, or recovering approaches; and the level and nature of innovativeness, as suggested in Scandurra et al.(2023), as well as the assessment of circularity and the tools/methods adopted (8 multiple choice questions, of which 5 single and 3 multi select, and 3 classical open text questions questions).

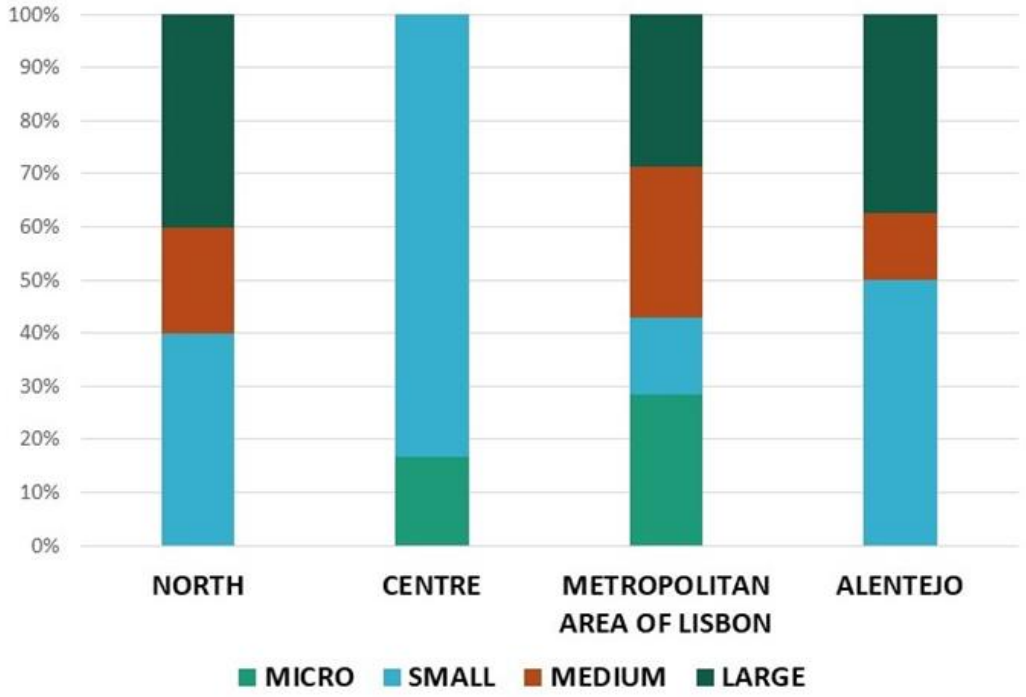
Data were exported and analyzed on Microsoft Excel. In this analysis, frequency tables, different graphical representations were used.
The study adopts a convenient sampling methodology to identify Portuguese Agri-food companies related to CE. This methodology makes it possible to include in the sample only those companies that meet the objective of the study, without considering the entire potential target population (Saunders et al. 2012). This enables the inclusion of private companies operating in the AFS: i) part of the Portugal Foods (https://www.portugalfoods.org/en/), a private nonprofit association that brings together various stakeholders in the Portuguese AFS, from companies to entities in the scientific ecosystem, ii) engaged in the circular Alentejo project (https://alentejocircular.uevora.pt/), a project developed in partnership between the Istituto Soldatura e Qualidade (ISQ) and the University of Évora, to raise awareness and mobilize economic actors in olive oil, wine and pig production in the Alentejo region (Portugal) to adopt the CE paradigm, promoting interest and awareness on the issue. The final sample consisted of 148 companies to be contacted.

4. Results and Discussion

4.1 Sample characterization

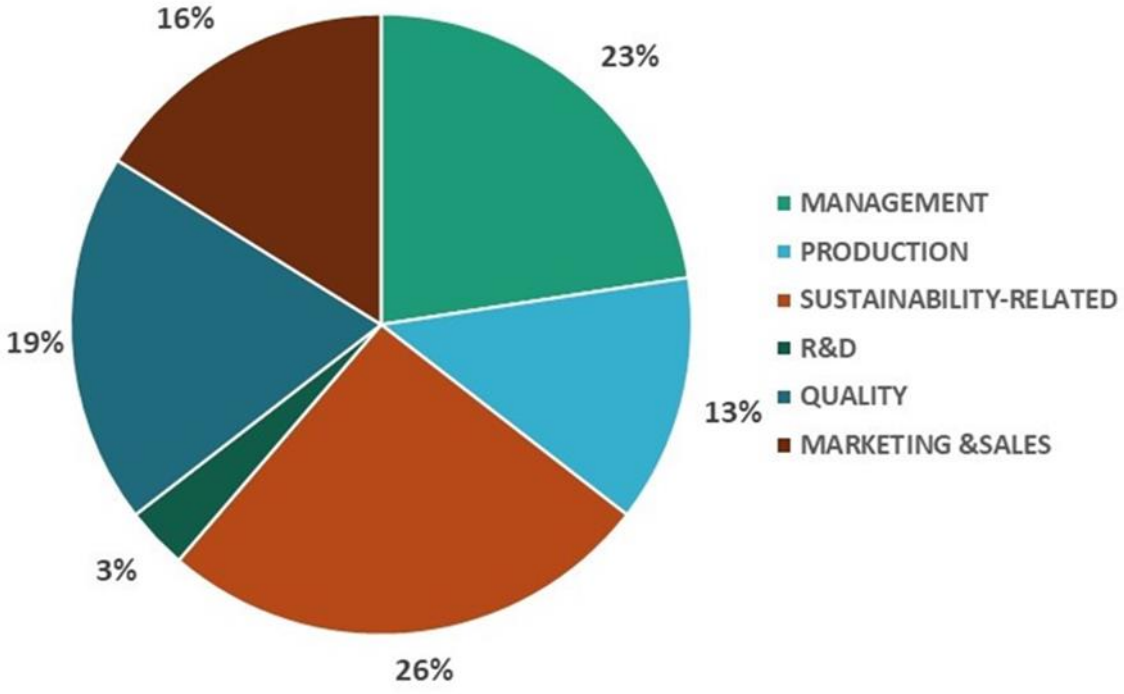
From the survey task, 31 answers were obtained, with a response rate of 20%. According to the Portuguese official geographic localization (NUTS II), the responding companies were localized in northern Portugal (32%), Alentejo (26%), Centre (19%), and the Lisbon metropolitan area (23%). Companies were also classified according to the number of employees, as suggested by Eurostat: small and medium-sized enterprises (SMEs) (10-249 employees) account for 61% of our sample, microenterprises (1-9 employees) characterize 10% of the sample, and large enterprises (250+ employees), corresponding 29% of our sample (Figure 1).

Figure 1. Companies of the sample classified per size and location (n=31).



Regarding the food supply chain companies' positions, around 75% of them are linked to processed food supply chains (e.g., olive oil and cheese), 19% to fresh food supply chains (e.g., almonds or meat), and 6% to processed foods used as raw materials for other production (e.g., plant extracts). As evidenced by figure 2, the survey gathered information from different departments: 26% of respondents work in sustainability-related departments, 23% in management, 19% in quality, 16% in marketing and sales, 13% in production, and 3% in research and development (R&D) departments.

Figure 2. Survey respondents classified according to corporate department (n=31).



4.2 CE adoption

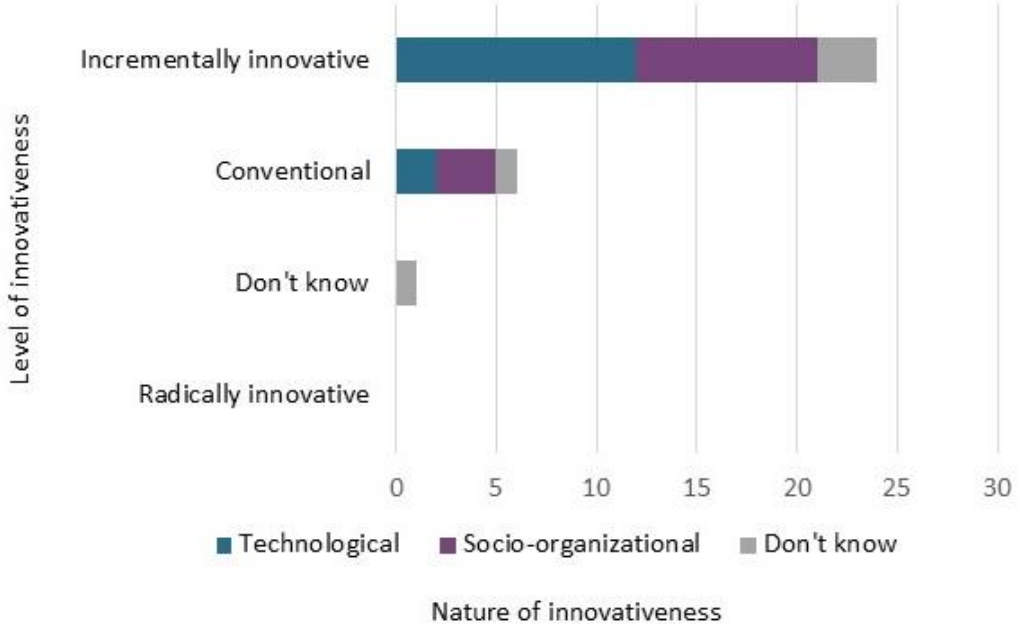
Results shows that circularity has been implemented by almost the entire sample (90%), although a residual fraction expressed interest in introducing it soon (10%). However, considering the stage of transition of the companies, namely their level of adoption of CE' principles, most companies have partially implemented circularity (77%), while only a limited fraction (10%) claim to have fully adopted CE in their activities.

Out of the description of circular practices implemented by the 31 companies it was possible to identify 54 practices. The level of detail provided, permitted the indication of 28 practices on their specific objective, while the remaining 26, which presented a general information, on their generic aim. Note that the number of practices does not correspond to the number of companies, as respondents may describe more than one practice.

Then, respondents had to define the company's practices implemented in terms of innovation. As shown in figure 3, 77% of the respondents identified their practices as incrementally innovative (e.g., nitrogen fixation by rhizobia leguminous plants), where 50% directed towards technological improvement, 37.5% towards socio-organizational improvement whilst remaining 12.5% were unable to determine this. Conventional practices (e.g., compost production) characterize 19% of the holdings, with greater emphasis on socio-organizational improvements (50%). 4% of the companies were unable to determine the level of innovativeness of their practices. Finally, none of the companies identified their practices as radically innovative.

The level of circularity was measured from the 4 R framework: companies usually associate their activities with more than one R strategy, most relevant is the portion that associates all the Rs with its practices (23%). Considering the single Rs, the most common are re-use strategies, while the less present is reducing strategies. Nevertheless, overall reducing and re-using strategies are higher than recycling and recovering ones, determining the relatively high circularity of the companies' activities. Relating the R strategies to the level of innovativeness, both conventional and incrementally innovative practices adopt each of the 4Rs, with incrementally innovative ones more present for each strategy due to their high frequency.

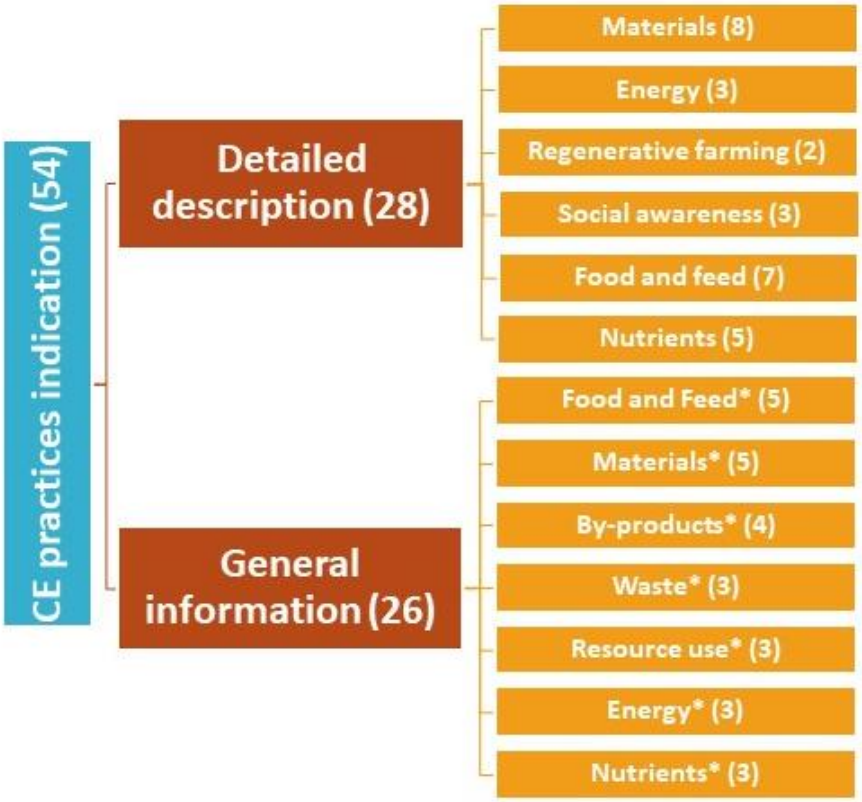
Figure 3. Level and nature of the innovativeness of the company activities (n=31).



As pointed out by figure 4, the 28 detailed practices are oriented towards the production of materials for 29%, particularly in terms of packaging (e.g., improving eco-design by combining materials that are easy to separate or recycle together, or recycling plastic packaging in the company's facilities to be incorporated into the new plastic consumed internally). 25% to the production of food and feed, in particular, to the production of food for humans (e.g., donations or the use of cheese by-products to produce butter and cream cheese). 18% is directed towards nutrient generation, especially for fertilizer production (e.g., composting, leaving

pruning in organic matter or self-fertilization of pastures). In addition, 11% of practices are targeted at improving the social awareness of stakeholders (e.g., training and monitoring of farmers' adoption of sustainability-related principles and techniques or the installation of storage sites for beverage packaging to increase recycling readiness). Energy production accounts for 11% of the sub-sample (e.g., the use of olive pits to heat boilers or steam condensed from boilers to heat cleaning water). Finally, regenerative farming techniques (e.g., free grazing of livestock) account for 7% of the practices. Of the 26 with only a general indication, 19% are directed towards obtaining food and feed by using by-products or surpluses from food production (e.g., fish and liquors). Another 19% use waste to generate or reduce materials. Around 15% of the companies surveyed aim to valorize by-products from processed products (e.g., olive oil and wine). Finally, the remaining 44% are focused on energy production, optimizing the use of resources (e.g., water), generating or rationalizing nutrients (e.g., reducing fertilizer use) and valorising various types of waste (e.g., recycling).

Figure 4. Circular practices classification per level of description and goal. In parentheses the number of practices per specific goal.



Where (*) indicates the generic aim of the practice for those that report only general information.
In parentheses the number of practices per individual category.

The strong presence of incremental practices seems at odds with Scandurra et al. (2023), who previously assessed the sector's maturity, given the significant number of conventional practices in the case studies presented in the literature. However, this divergence may be related to different perceptions of innovation among practitioners. In addition, the practice's indication allowed to identify some practices defined incrementally innovative but that are established techniques in the literature and therefore, should be classified as conventional (e.g., pruning as natural soil fertilizer, whey's valorization by reverse osmosis, or olive stones' use to heat boilers). To consider is also the role of the respondents within the company; for example, regarding the three mismatches mentioned above, the respondents belonged to the marketing and sales, management, and quality departments, thus not directly related to sustainability or CE, and this may affect their knowledge of the consistency of internal practices with circularity. Furthermore, some companies mentioned practices without an explicit link to circularity, especially concerning power generation through solar panels. Again, it is important to analyze this with the roles of the respondents; out of 5 companies that

mentioned solar panels as their only or combined practice, 40% came from production, 20% from marketing, 20% from management and the last 20% from the quality department. The presence of many non-detailed practices is also relevant; when analyzing the origin of the respondents, 54% of the general practices are related to respondents from non-CE-related departments (e.g., production, marketing and sales, or quality), so it may have influenced the ranking process. This is also related to the size of the companies, given that only large companies (in the sample) have a department dedicated to sustainability-related topics. Thus, the presence of work teams on sustainability and environmental issues promotes a better understanding of CE and its principles.

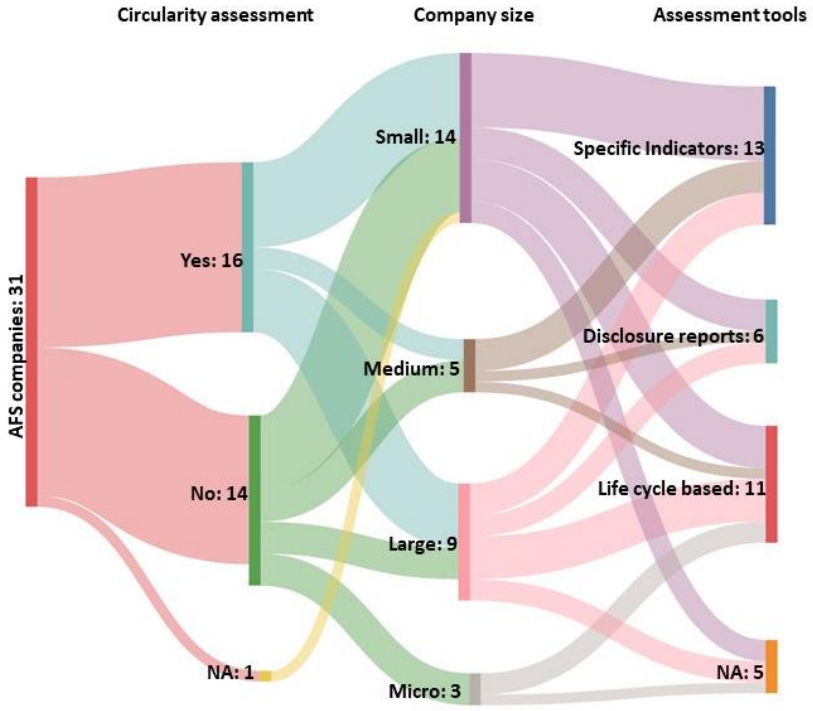
4.3 CE ASSESSMENT

The survey results showed that 52% of companies either fully or partially value circularity, 45% do not, and 3% do not know. In particular, about 67% of large companies and 58% of SMEs assess circularity, but none of the micro-enterprises. Note that the 31 companies in the sample reported 35 assessment tools since some companies adopt more than one tool in assessing circularity. Among the 16 evaluating companies, 55% adopt specific indicators, 25% life-cycle-based tools and 20% disclosure or communication reports (Figure 5).

Companies were also able to leave comments on their assessment of the CE. Notably, out of 11 associated with specific indicators, 64% did not explain the indicators used, while the remaining reported using indicators to monitor process efficiency, waste recovery, soil organic matter or CO_2 emissions. Considering the 5 Life cycle-based tools, two companies reported using carbon footprint analysis, one used Life-cycle assessment, and the remaining two gave no detailed answers. Among the disclosure reports, two companies indicated the sustainability report, one according to the Global Reporting Initiatives (GRI) standards, while the other two mention specific disclosure reports based on water and energy consumption, not specifying if for internal or external communication.

Interestingly, some companies that declare not assessing circularity have already adopted some of the proposed tools. Of the 14 that do not assess circularity, 67% adopt lifecycle-based tools, 22% specific indicators, and 11% disclosure reports; finally, the company that has no measurement information states that it submits a disclosure report; none of the companies mentioned added further details to their answers.

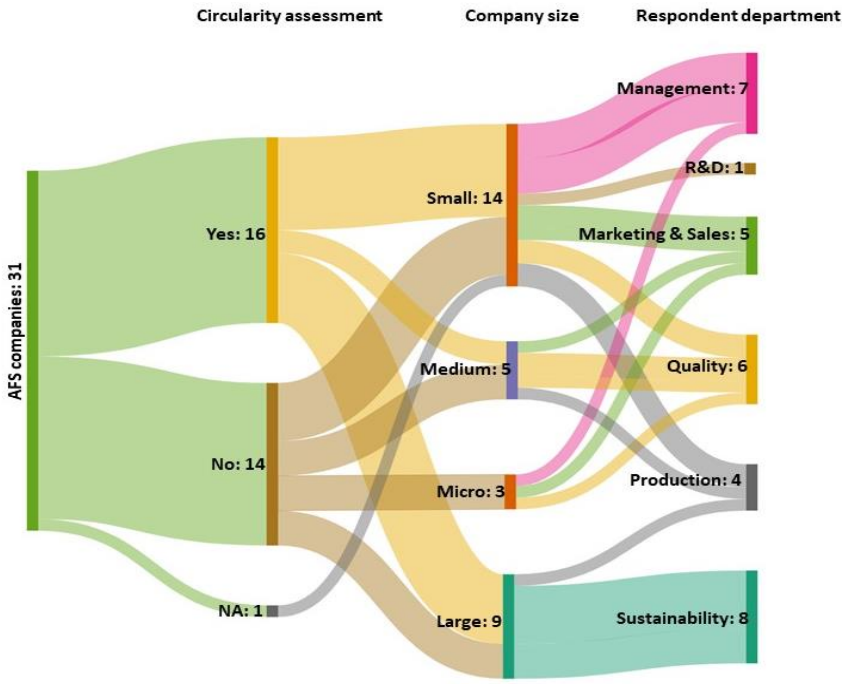
Figure 5. Circularity assessment related to company size and tools adoption (n= 31).



Hence, this suggests that companies have interpreted the question in a broader sense, so they adopted the proposed tools but have not yet measured circularity or that they have not a clear idea of circularity assessment tools. Linking the non-assessing companies to the responding departments, we found that only

21% of the respondents work in departments related to sustainability, with the remainder split between management (28%), marketing and sales (14%) and quality (14%). This figure is also related to company size, as 57% of the non-assessing companies are SMEs, 21% are micro companies, and 21% are large companies (Figure 6).

Figure 6. Assessment of circularity per size of the company and department of the respondent (n= 31).



5. Conclusion

The study investigates how CE is implemented and assessed in a convenient sample of Portuguese AFS's companies. This empirical analysis allows to deepen the findings of a previous study (Scandurra et al., 2023), focused on exploring CE practices reported in the scientific literature of the sector. Circularity is largely implemented through incrementally innovative practices with a good level of circularity, given by frequent implementation of reuse strategies. The practices identified are mainly associated to obtain materials or food and feed products. The assessment though, seems still limited in the sector, with high variability in terms of tools adopted. The most common are performance indicators, whose specific goal is often not clarified.

The CE can be the turning point for the exploitation of food flows. The mapping of circular practices is of particular importance for AFS. The lack of standardized valorisation schemes hampers the possibility of identifying strategies for the reusing or recycling of food products and residues. In addition, the classification process allows for raising awareness of circularity and its principles since, as evidenced by some practices that are not strictly circular but identified as such in the sample, there is still confusion in the sector. This concerns micro and small enterprises that do not have a sustainability department and yet are most of the Portuguese AFS companies. Therefore, the systematization of the collection practices allows operators to understand better the characteristics of the CE and to be able to replicate its example. The same goes for the innovativeness and the level of circularity assessed in the sample, as possible biases could be related to different visions between companies and academia. Most of the assessing companies adopt performance indicators covering a wide range of objectives, so there is no clear pattern for such indicators. In addition, a significant portion of the companies state that they do not measure circularity, but already adopt some circularity assessment tools. This may be due to a lack of knowledge of the available circularity assessment tools, as companies are just beginning to introduce circularity into their operations. Therefore, identifying industry-focused assessment tools is a crucial step to guiding companies towards efficient and cost-effective practices and communicating the value of their strategies to stakeholders. The study has some limitations

related to the sample size; however, it presents a representative picture of the adoption and measurement of CE in Portuguese AFS companies. The critical issues evidenced in the survey analysis will be further investigated through interviews with some companies of the sample.

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Circular economy self-assessment tool for households: A collaborative approach

Alexandre Rodrigues da Silva[1], Tomás B. Ramos[2]

[1] amfr.silva@campus.fct.unl.pt
[2] tabr@fct.unl.pt

Corresponding author: amfr.silva@campus.fct.unl.pt

Abstract.

Household daily activities, such as food acquisition, and mobility, are closely linked to sustainability impacts, including climate change, quality of life, and waste production. However, individuals still don't know how to act to better manage and improve their household sustainability performance, covering sustainable consumption, and well-being, among other related aspects. Multiple studies have been conducted to understand circular economy assessment in products, organizations, eco-industrial parks, and cities. Nonetheless, there is still a lack of knowledge regarding the assessment of circular economy practices implemented at the household level, including current strategies, and indicators. Thus, the present work aims at developing a self-assessment tool to evaluate and report the implementation of circular economy-based strategies at the household level, including the definition of consumption activities, and indicators. This study is supported by a two-stage methodology, based on a mix-method procedure, that centres co-creation with residents/ family's representatives in its approach, through the use of questionnaire surveys, and semi-structured interviews. The developed self-assessment tool will allow individuals and families to assess, communicate and reflect on their behaviours about sustainability, in the vein of circular economy. This research contributes to the debate on the role of the household in the transition towards a circular economy.

1. Introduction

Household consumption practices are associated with major environmental impacts and sustainability challenges, including climate change, freshwater eutrophication, air pollution, raw material use, acidification, well-being, and waste production (Castellani *et al*., 2019, p. 11). In this vein, food acquisition, housing – which includes construction, renovations, and energy consumption by the house -, and mobility are main drivers of impact (Castellani *et al*., 2019; Kalbar *et al*., 2018; Saleem & Ali, 2018). Although dependent on income level and age, among other factors, lifestyle practices are linked to the aforementioned environmental impacts (Kalbar *et al*., 2018, p. 268). When comparing the environmental impact in countries such as Pakistan and China, Saleem and Ali (2018, p. 121) understood that, aligned with an increase in people's income, in the past 50 years, there was a higher energy, and product consumption-based lifestyle. Thus, economic growth and consumption patterns are closely associated (Caeiro *et al*., 2012; Distefano & Kelly, 2017), namely in food (Gerbens-Leenes *et al*., 2010, p. 607), and electricity acquisition (Shi *et al*., 2020, p. 8). In this context, the concept of sustainable consumption was brought forward, centralizing the need for individuals, organizations, and nations to reduce their pressure on the environment and society (Anantharaman, 2018, p. 560).

The origin of sustainable consumption is found in the term of Sustainable Consumption and Production (SCP), which was introduced at the United Nations Conference on Environment and Development (UNCED), in Rio de Janeiro, in 1992 (Glavič, 2021, p. 14). This concept was brought forward, with Agenda 21, stating that there was a resource over-consumption (Anantharaman, 2018, p. 560). Recently, as a key global initiative, the Agenda 2030 (UN, 2016) has been promoting the concept of Responsible Consumption and Production (RCP), in the form of the 12th Sustainable Development Goal (SDG) (Glavič, 2021, p. 14); therefore, fostering all United Nations Member States to invest in this matter (Orellano *et al*., 2020, p. 12).

However, for the consumer, the main benefits are of psychological nature, as sustainable consumption takes on a symbolic role (Abdulrazak & Quoquab, 2017, p. 21). Nonetheless, through circular economy-based strategies, the consumer can also find a financial benefit, which then acts as the main driver towards a circular economy (CE) model (van Weelden *et al*., 2016, p. 750).

Following this reasoning, when linked with SCP, CE can work as one of the strategies to tackle the environmental impacts associated with consumption patterns (Goyal *et al*., 2021, p. 5 200). In a comprehensive and systematic analysis of 114 CE definitions, Kirchherr *et al*. (2017, p. 229) characterize CE as "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". In Potting *et al*. (2017, p. 5), the scope of circular economy-based strategies is expanded, including: (i) refuse; (ii) rethink; (iii) repair; (iv) refurbish; (v) remanufacture; and (vi) repurpose. Among the ones mentioned in the definition proposed by Kirchherr *et al*. (2017, p. 229). Furthermore, Potting *et al*. (2017, p. 5) ranks the strategies from linear to circular economy, prioritizing the ones that allow the consumption of fewer natural resources and a lower output in environmental pressures. In this vein, in the form of a consumer, the household takes on a central role, in enabling the CE transition (Shevchenko *et al*., 2023, p. 6). As stressed by Shevchenko *et al*. (2023, p. 6), the circular consumer holds three roles: (i) as a customer, acquire products with the minimum environmental impact and refrain from buying; (ii) as an user, careful use, and maintenance, acquire technical services and repair, and sell or donate the products if no longer needed; and (iii) as an EoL product holder, timely discard and use the appropriate circular discarding channel.

To foster CE progress at the macro, meso and micro level, performance evaluation and communication represents a core step (Droege *et al*., 2021; Sassanelli *et al*., 2019). Through a systematic literature review, Sassanelli *et al*. (2019, p. 450) understand that, in function of the CE domain, different assessment methods are used, which can highlight certain aspects of the CE model. Nevertheless, and despite the diverse range of assessment methods and approaches in CE, multiple authors underline the use of indicators to assess, monitor, and communicate CE progress (Howard *et al*., 2017; Saidani *et al*., 2019; de Oliveira *et al*., 2021). However, most developed CE indicators measure material flow or recirculated value of a system, and consequently, dominant assessment method and tools are focused on cleaner production, resource-efficiency, material stocks and flows, and product-centric areas (Droege *et al*., 2021; Droege *et al*., 2021a; Opferkuch *et al*., 2022; Opferkuch *et al*., 2023); whereas, the consumer level, including customer, user and EoL product holder (Shevchenko *et al*., 2023, p. 6), is being poorly analysed (Harris *et al*., 2021, p. 180). Nonetheless, CE indicators can foster circularity, namely in public policy decision making (De Pascale *et al*., 2021; Droege *et al*., 2021a).

In the context of Household Sustainable Consumption (HSC), Caeiro *et al*. (2012, p. 80) recommend the use of indicators to assess this matter, as communication represents a major challenge, in which the indicator system should be: "(i) easily comprehensible and meaningful to family members; (ii) developed with a bottom-up process with emphasis on public participation and empowerment; (iii) use an integrative approach among the different domains; (iv) facilitate practical dynamic behaviours, actions and routines in implementing HSC; (v) provide transparent evaluation of the HSC performance; (vi) provide guidance via illustrative best practices; and (vii) provide financial and non-financial incentives for achieving continuous HSC improvements". Thus, to foster a CE transition at the micro level, including at household and family level, empowerment can play a complementary role, since it enhances people's skills, increases community ownership, and awareness towards sustainability related issues (Marchesi & Tweed, 2021, p. 2).

However, there is a knowledge gap in how CE should be assessed at the household level. Multiple studies have been conducted to understand CE assessment at the organizational level (Sassanelli *et al*., 2019, p. 450), products and processes (Ahmed *et al*., 2022, p. 710), eco-industrial parks (Zhao *et al*., 2017, p. 2 263), and cities (Gravagnuolo *et al*., 2019, p. 3), and the role of the circular consumer was analysed (Shevchenko *et al*., 2023, p. 6). Furthermore, in the context of HSC, Caeiro *et al*. (2012, p. 80) developed an approach to define the main criteria to build HSC assessment tools based on indicators sets. Through a Life Cycle Analysis (LCA), Castellani *et al*. (2019, p. 11) determined the environmental impacts of household consumption, in Europe. With a similar objective, Peng *et al*. (2021, p. 8) defined the consumption activities of rural households. Nonetheless, little attention has been given to the assessment of CE at the household

level, similar to how regular organizations and their individuals are assessed, including their inputs, processes, outputs, outcomes/impacts, and related indicators. Moreover, in the form of a consumer, the household represents a key element, in enabling a transition towards a CE model (Camacho-Otero *et al*., 2018; Shevchenko *et al*., 2023). Therefore, the present work aims at developing a self-assessment tool to assess and report the implementation of circular economy-based strategies and practices at the household level. This includes defining circular indicators specifically tailored for householders, with support from a collaborative approach. Thus, to develop a household CE self-assessment tool, the present study aims to answer the following research questions:

i) How important are the CE practices at the household level?
ii) What are the indicators that can be used to enable the self-assessment of CE implementation into households?

This paper is structured as follows, after this chapter: (i) The literature review presents an overview of the studies conducted in the matter of Household Circular Economy (HCE) practices, in the context of the CE framework (Potting *et al*., 2017), a description of CE indicators, and a review multiple self-assessment tools; (ii) The methodological approach indicates the steps taken to evaluate the CE practices at the household level and indicators, through the use of a mix-method approach, based on a questionnaire survey and semi-structured interviews; (iii) The results are presented, with the illustration of the aforementioned components; (iv) afterwards, the discussion explores the main findings with the existing literature; and (v) lastly, conclusions, limitations, and further research are presented.

2. Overview of household circular economy assessment approaches

2.1 Household circular economy practices

At the household level, refusing strategies follow the definition proposed by Potting et al. (2017, p. 5), in which the individual abandons the function or acquires it through a different product or service. Therefore, acquiring products certified with an eco-label, as it communicates, in general, an object with a lower environmental pressures and resource consumption, enables a high circularity role for the household (Zotti & Bigano, 2019; Edbring et al., 2016). Furthermore, individuals can minimize packaging, decorative elements, and reduce the use of unnecessary accessory materials, e.g. plastic straws (Wang et al., 2022, p. 4), in the form of plastic waste (Potting et al., 2017; Reike et al., 2018; Morseletto, 2020). However, the lack of information and economic incentives, and availability of a product or service replacement for a given function, can act as a barrier, in the household transition towards a CE (Grafström and Aasma, 2021, p. 5).

Although it can be interpreted as a combination strategy of refusing and rethinking, acquiring a product, in the form of a service, fosters CE in this level, making product use more intensive (Shevchenko et al., 2023; Potting et al., 2017). Thus, using a sharing service of washing machines and dryers (Potting et al., 2017, p. 5), vehicles (Atsaja et al., 2022, p. 3), or bicycles (Henriksson and Scalzotto, 2023, p. 6), promotes environmental-friendly and CE trends, that minimize population expenses, and maximizes function accessibility (Atsaja et al., 2022, p. 3).

Reduce, re-use, recycle and recover strategies, at the household level, have been documented in environmental related concerns, regarding resource consumption and environmental pressures, including (Paparella et al., 2023; Kumar et al., 2022): (i) the consumption of energy (Adan & Fuerst, 2016, p. 1 208); (ii) the use of water (Gómez-Monsalve et al., 2022, p. 3); and (iii) waste production (Varotto & Spagnolli, 2017, p. 170). For the first, products characterized by their energy efficient design, in the use phase, allow a reduction in the consumption of resources, which can be further improved through behavioural practices (Barkhausen et al., 2022; Richter, 2010). Reduction strategies depend on the household income and livelihood strategy, family size, and end-use behaviour (Jiang et al., 2019, p. 2). Regarding the second, water consumption is constricted by multiple barriers, including lack of motivation, information, and financial incentives to engage in conservation behaviour, since water efficient products are costly (Addo et al., 2018, p. 3). McCarton et al. (2022, p. 4) proposes a strategic hierarchy to foster the transition towards the CE of water, in which reduction shows the highest priority, followed by re-use, recycle, and recover measures. At the household level, the authors recommend reduction and re-utilization practices, promoting water efficient products, and rainwater harvesting to supply non-drinking purposes. In regard of the waste domain, through a literature review, Ghisellini et al. (2016, p. 12) states that the use of materials, in the form of waste, represents one of the core elements of CE. At the household level, multiple studies have been conducted, in the context of household waste sorting and recycling behaviour, regarding organic, and electrical and

electronic equipment (Varotto & Spagnolli, 2017; Nainggolan et al., 2019; Zhang et al., 2022; Parajuly & Wenzel, 2017). In these studies, household participation represents a core element, in enabling CE and reducing the respective waste quantities. Additionally, in some situations, the product still holds a monetary value (Parajuly and Wenzel, 2017, p. 273).

Lastly, repair, refurbish, remanufacture, and repurpose strategies are linked with the extension of the lifespan of products and its parts (Potting et al., 2017, p. 5). Thus, these actions foster a slower loop, with a lower environmental pressure and resource consumption (Rizan et al., 2022, p. 781). However, Terzioğlu (2021, p. 2) found that multiple barriers restrict the individual from repairing the product, including technical, value and emotional variables. For instance, it requires time and effort, skills and knowledge, and accessibility of materials and methods. Doubts over the condition of the product, and the financial factor represent a constraint. In Morseletto (2020, p. 4), these factors are further expanded to the remaining measures, and summarized in three categories: (i) costs/availability of the procedure; (ii) product design that allows these options; and (iii) culture based on a fast-consumption mentality.

2.2 Circular economy indicators

CE indicators can be defined as a quantitative or qualitative measuring instrument of several CE strategies individually or simultaneously, accounting for the material flows, and, although with its limitations, the use phase of a product (de Oliveira and Oliveira, 2023, p. 3). In recent studies, other descriptions have been brought forward. Khadim et al. (2022, p. 5) critically reviewed multiple micro-level circularity indicators and frameworks, suggesting that most CE Key Performance Indicators (KPIs) focus on material loop, disassembly, adaptability, and reusability evaluation. From a public organization CE assessment perspective, Droege et al. (2021, p. 1 720) considers a holistic thinking approach, recommending a triple-bottom line in its framework; thus, considering the social and environmental implications of CE, and highlights the importance of stakeholder engagement. In sum, these metrics can be characterized as a method to assess the performance and progress of, and towards, a CE model (Saidani et al., 2019, p. 550).

As stressed by Saidani et al. (2019, p. 550), CE indicators enable assessment, reporting and communication across all CE levels (micro, meso, macro). In fact, multiple types of CE indicators and frameworks have been developed (Droege et al., 2021; Helander et al., 2019; Padilla-Rivera et al., 2021; Sánchez-Ortiz et al., 2020; Yadav et al., 2020; Rincón-Moreno et al., 2021). For instance, Gravagnuolo et al. (2019, p. 4) suggested a circular city assessment framework, focusing on seven sectors: (i) built environment; (ii) energy and mobility; (iii) waste management; (iv) water; (v) industrial production; (vi) agri-food; and (vii) citizens and communities. From an eco-industrial park perspective, Belaud et al. (2019, p. 970) developed a toolbox, considering a life cycle thinking approach. Similarly, product centric CE assessment frameworks tend to depend on a LCA procedure (Corona et al., 2019, p. 3). However, in the context of private organizations, Opferkuch et al. (2023, p. 8) understood that companies were also worried about sustainability trade-offs and reducing potential claims of CE-related greenwashing, among the progress and performance of implemented CE strategies. Although the continuous increase in scientific literature regarding CE assessment, Corona et al. (2019, p. 3) and Shevchenko et al. (2023, p. 7) stressed on the literature gap regarding consumer-based metrics.

Among multiple other benefits, CE assessment through indicators promote an extensive comprehension of the current state of CE. Although it depends on the evaluated level (micro, meso, macro) and on the implemented strategy and practice (e.g., refuse, rethink, repair, amidst similar others, see Potting et al., 2017, p. 5), CE indicators allow and foster benchmarking, decision making, learning and identification of improvement opportunities (Saidani et al., 2019; Sánchez-Ortiz et al., 2020). Additionally, most CE indicators show a multi scale applicability, and can be used across different industrial sectors (Rincón-Moreno et al., 2021, p. 6).

Overall, CE indicators is still an underexplored field of research with multiple limitations and challenges. In fact, as stressed by Droege et al. (2021, p. 1 720) and Harris et al. (2021, p. 177), in a scoping review, CE assessment practices mostly depend on a LCA, Material Flow Analysis (MFA) and Input/Output Analysis approach. However, these methods have numerous limitations and disadvantages, including (Droege et al., 2021; van Stijn et al., 2021; Lu & Halog, 2020): (i) time intense execution; (ii) dependence on data quality and availability; (iii) requirement of technical expertise; (iv) lack of indicator diversity; (v) greenwashing impacts; and (vi) non- applicability in ex-post assessments and certification. To measure efficiency in CE, data gathering represents a significant barrier (Sánchez-Ortiz et al., 2020, p. 5). Due to the multiple CE definitions and levels, the indicators may be poorly positioned or inadequately address the issue at hand

(Saidani et al., 2019, p. 550). According to Helander et al. (2019, p. 1 280), CE indicators aren't able to properly assess the environmental pressures derived from CE activities, recommending a complementary approach with tailored metrics. Additionally, most CE indicators focus on the analysis of a single CE activity, which can enable problem shifting and a rebound effect. Padilla-Rivera et al. (2021, p. 107) and Luthin et al. (2023, p. 6) propose the same arguments for the social impacts derived from CE activities. Moraga et al. (2019, p. 458) wasn't able to identify CE indicators capable of measuring higher circularity strategies, including refuse, rethink, and reduce. Jerome et al. (2022, p. 5) understood that most CE indicators cannot assess the use phase of a product, and lifetime extension strategies (e.g., repair, remanufacturing, repurposing, refurbish).

2.3 Household assessment tools

According to Fahim *et al*. (2019, p. 45), self-assessment can be defined as "the process of critically observing one's own self in order to assess important aspects of one's personality". Thus, it relies on the assumption that the individual can assess themselves (Elimelech *et al*., 2019, p. 262). Multiple types of household self-assessment tools have been developed, to analyse individually or aggregately the domains of sustainability (Vanham *et al*., 2019; Wu *et al*., 2021; Fang *et al*., 2016; Xie *et al*., 2020). Within the sustainability spectrum, the "footprint", based upon the original concept of ecological footprint developed by Rees (1992, p. 125), is a tool commonly used for the household or individual self-assessment (Syrovátka, 2020; Castellani *et al*., 2019). Nevertheless, it also displays other scales of application, such as cities, countries, regions, higher education institutes and private and public sector organizations (Kassouri, 2021; Pan *et al*., 2019; Lambrechts & Liedekerke, 2014; Jurić & Ljubas, 2020).

Matuštík and Koči (2021, p. 3) emphasize that an official environmental footprint definition hasn't been developed, due to the lack of methodological standardization and unification. Nevertheless, in the review elaborated by Čuček et al. (2012, p. 13), the footprint took the role of assessing social, economic, and environmental issues, converging on a triple bottom-line sustainability analysis. From an environmental perspective, footprints quantify resource use and/or emissions. Thus, it works as an aggregated indicator, or index, that assesses the pressure derived from anthropogenic activities on the environment. Furthermore, within the concept of footprint family, trade-off-based analysis becomes a possibility (Vanham et al., 2019, p. 4). As an individual or household self-assessment tool, the footprint (e.g., ecological footprint [EF]) encourages a critical self-reflection process, which may further extend into pro-environmental behaviour (Friedland & Balkin, 2022; Tolppanen & Kang, 2021).

However, multiple authors criticise the methodological weaknesses of footprints, such as the EF, associated with the construction of the indices, inability to account for some pollutants and/or calculate the ratio between land use and land availability (Kharrazi et al., 2014; Lin et al., 2015; Franz & Papyrakis, 2011; Sutcliffe et al., 2008). Among other aspects, the lack of encouragement of pro-environmental and community engagement actions in these footprints (e.g., beach cleaning, tree planting, amidst similar other environmental impact offset measures) suggest that individuals can't achieve a sustainable lifestyle (Franz & Papyrakis, 2011, p. 396). In the vein policy setting, Kharrazi et al. (2014, p. 87) acknowledge that there are methodological short comes.

The work conducted by Čuček et al. (2012, p. 13) presents a review of footprints (Table A1), namely the ones highly associated with the individual and household assessment. Furthermore, for the analysis carried out in the present research, those approaches were aligned with the CE framework proposed by Potting et al. (2017, p. 5). The footprints present a trend, in which resource flow quantification is stressed (Matuštík & Kočí, 2021, p. 3). Thus, most identified tools target consumption-based behaviours, in which refusing and reducing represent a nuclear role (Castellani et al., 2019, p. 4).

As stressed by Rondoni and Grasso (2021, p. 3), consumption behaviour greatly influences the performance assessed by environmental footprints, including the actions directly correlated with resource and/or land use (e.g., energy footprint [ENF]). Although socio-economic status influence resource consumption (Eisenmenger et al., 2020, p. 1 105), economic, and social footprints (e.g., financial footprint [FF]) don't focus on the use of raw materials; thus, not allowing an assessment of circular economy-based strategies.

Additionally, consumption and waste related footprints (e.g., consumption footprint [CSF]) provide a broader spectrum of assessment criteria, including the sharing aspects of mobility, and the EoL of consumer goods and services (Salas et al., 2022; Kok & Barendregt, 2021; Buhl et al., 2019). This allows a higher influence in the CE framework, since it considers rethinking and re-use, among the aforementioned

strategies. Assessment tools that consider the multiple phases of the life cycle of a product display a greater positive impact on the CE model (Lei et al., 2021, p. 4).

3. Methods

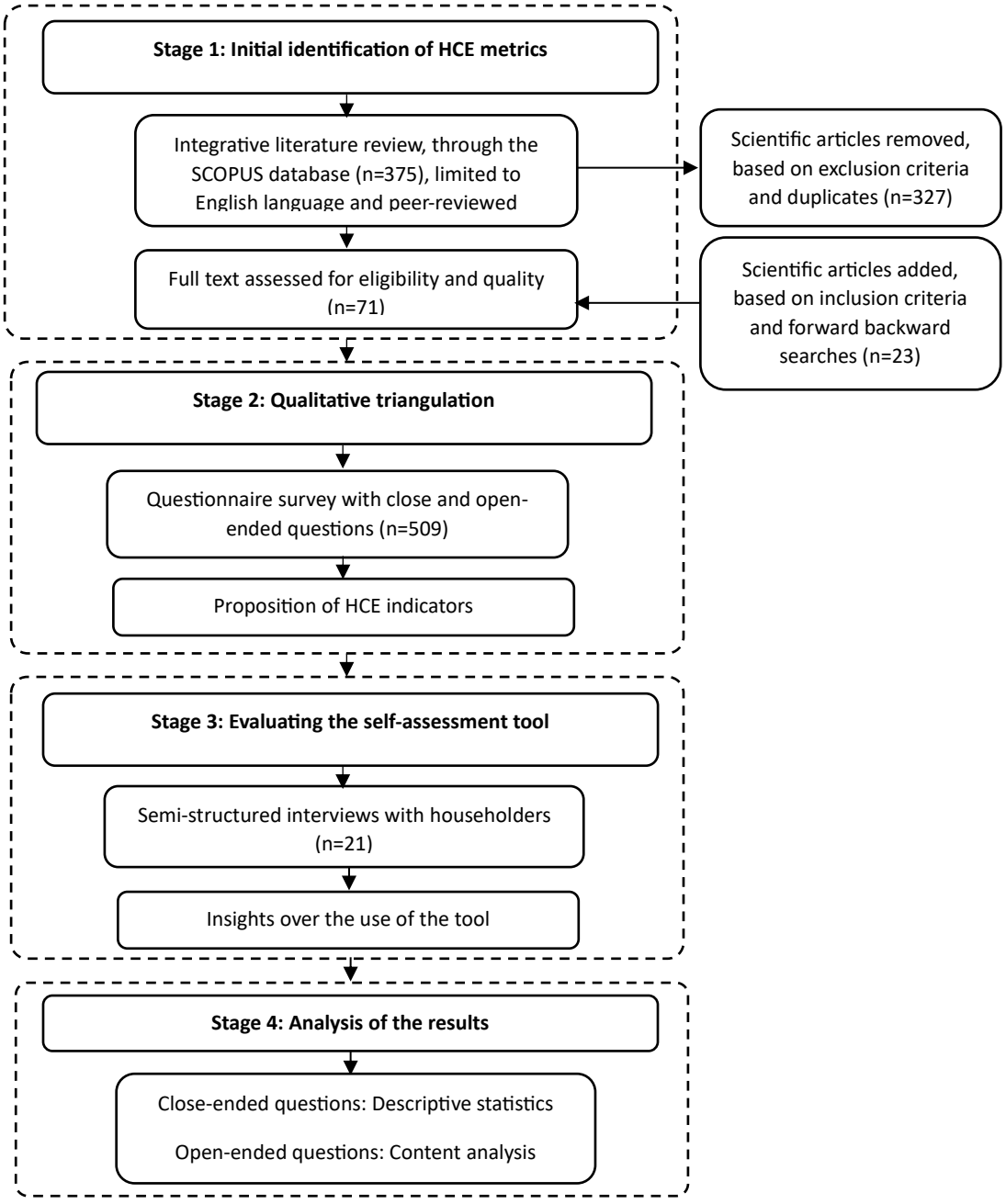
To develop the Household Circular Economy (HCE) self-assessment tool, an exploratory mix-method approach was adopted, combining the methods of an integrative literature review and sequential explanatory research design, supported by a questionnaire survey and semi-structure interviews. Denscombe (2010, p. 150) and Saunders et al. (2016, p. 198) stress that this process is highly recommended to provide an adequate answer, as both approaches complement each other. It results in a wider understanding of the aims being researched, since it offers more than one perspective. Also, it allows the collection of information, based on the lived experiences of the participants (Mayoh & Onwuegbuzie, 2015, p. 99). This methodological architecture forms the nucleus of a collaborative process recommended by Caeiro et al. (2012, p. 80) for the development of household sustainable consumption assessment tools.

In this research, residents/family's representatives (henceforth designated as householders) took the role of citizen as a co-designer of the developed assessment tool. Citizen as a co-designer can be characterized as involvement regarding the content and process of service delivery (Voorberg et al., 2014, p. 1 340). Caeiro et al. (2012, p. 80) suggested a collaborative and participatory process for the development of a HSC assessment tool, stating that it should be built on the views and opinions gathered from the stakeholder engagement, along the process. By using a collaborative approach, it can be possible to reduce the conceptual distance between the project and the benefits of its realization, enabling the shaping of the self-assessment tool in function of the stakeholder's perspective (Keeys & Huemann, 2017, p. 1 201).

Based on the literature review, the initial set of the HCE dimensions and indicators was formulated. The integrative literature review was qualitatively triangulated with the results of the quantitative empirical stage (i.e. questionnaire survey). A triangulation approach allowed a deeper understanding of the results (Saunders et al., 2016, p. 173). In the present research, it permitted the study of HCE practices and indicators.

The overall methodological approach was elaborated based on four stages (Figure 1): (i) HCE metrics were identified, from the results of the integrative literature review; (ii) the HCE indicators were qualitatively triangulated with the data collected from the quantitative method (i.e., questionnaire survey), resulting in a clustering of metrics; (iii) the self-assessment tool was evaluated with stakeholders, based on a qualitative procedure (i.e., semi-structured interviews), providing insights over the use of the tool; and (iv) the results were analysed, using descriptive statistics techniques for close-ended questions and content analysis for open-ended questions.

Figure 1. Methodological approach towards the understanding of CE practices implemented in a household, identification of CE indicators, and validation of the self-assessment tool.



3.1 Stage 1: Identifying HCE metrics

To identify the initial set of HCE metrics, an integrative literature review of scientific articles was developed. Through synthesizing and studying the existing body of papers, this approach allows the test of hypotheses and the advancement of knowledge, based on previous work (Xiao & Watson, 2019, p. 98). The Scopus database from Elsevier was selected, since it is the largest data base for scientific journals, comparable to Web of Knowledge (Valderrama-Zurián et al., 2015, p. 572). The search was conducted, using the string TITLE-ABS-KEY ((“circular econom*” OR “circularity”) AND (“indicator*” OR “indice*” OR “index*”) AND (“individual*” OR “famil*” OR “household*” OR “consumer”)), resulting in the identification of the initial set of scientific articles (n=375). These keywords were selected, as they encompass a wide range of metrics relevant to the research questions.

After the removal of duplicates, as recommended by Valderrama-Zurián et al. (2015, p. 572), 375 publications were manually screened by title and abstract, to exclude articles with content unrelated to the research questions. Furthermore, inclusion and exclusion criteria were established, in function of the research

questions, to further refine the screening process (Xiao & Watson, 2019, p. 98). Regarding the exclusion criteria, publications focusing on CE at nano, meso and macro levels or non-consumption related practices (Shevchenko et al., 2023, p. 7) were removed. Additional records were identified through forward backward searches, based on inclusion criterion related to CE assessment frameworks (n=23). A total of 71 full-text articles were assessed for eligibility and quality, since they provided an outline of HCE indicators and practices. The HCE activities were characterized in relation to the CE strategies defined by Potting et al. (2017, p. 5) and the tri-dimensional role of the circular consumer described by Shevchenko et al. (2023, p. 7), see Table A2.

3.2 Stage 2: Clustering of HCE indicators

The householders' knowledge and perceptions allow an in-depth understanding of the daily activities inherent to a household. Therefore, a survey research approach grounded on a web-based questionnaire survey was used to collect a quantitative description of the importance of HCE strategies and activities, from which HCE indicators were established. The HCE indicators were defined based on the importance level that the respondents attributed to the HCE practices and weighted by the literature.

The survey was distributed through online channels, and as stated by Bethlehem (2009, p. 276), online surveys allow access to a large pool of potential respondents, while being cost-effective and time efficient. The survey consisted of open-ended and close-ended questions. The questionnaire had 42 questions divided into three main sections (see appendix B), which were defined based on the main thematic groups of HCE strategies and activities, identified through the literature review. In particular, those sections were based on the tri-dimensional role of the circular consumer described by Shevchenko et al. (2023, p. 7), to help understand consumer behaviour in the CE. Table 1 presents a description of the main sections considered in this survey.

Table 1. Summary description of the topics covered in each section of the questionnaire survey.

Section	Description
Customer in a CE	Aimed to understand CE oriented activities conducted by the consumer, in the form of a customer. According to Shevchenko et al. (2023, p. 7), the customer should prioritize product acquisition with the least environmental impact, and, when possible, refrain from buying.
User in a CE	Structured to determine circular economy-based activities conducted by the consumer, in the form of a user. In this category, careful use and maintenance of the product, search for technical services and repair, and sell or donate the products, when no longer needed, should be the main role (Shevchenko et al., 2023, p. 7).
EoL product holder in a CE	This section goals are to define the activities conducted by the consumer, in the form of an EoL product holder. As stressed by Shevchenko et al. (2023, p. 7), the individual should timely discard the product, and use the appropriate discarding channel.

Close-ended questions were used in two situations: (i) A five-point Likert scale was designed to quantitively assess the level of importance of a HCE practice, as a customer – "When buying, do you consider important…", as a user – "When using, do you consider important…", and as an EoL product holder – "When discarding, do you consider important…". The rating was from one ("Not important at all") as the lowest to five ("Absolutely essential") as the highest. For instance, one question asked if the participant frequently avoids products with excess packaging, to understand if the refusal strategy is relevant in this situation; (ii) A binary, and multiple-choice questions were used to allow the respondents to indicate the adoption of a CE practice, and for which consumption domains (e.g., clothes, electric and electronics equipment), respectively. This type of questions enables a lower and easier survey response time, and are easier to compare (Saunders et al., 2016, p. 294). The open-ended questions were used to provide the respondent the opportunity to comment on the CE strategies they adopted, as similarly done in Klein et al. (2022, p. 7). Since it allows the participant to give a more in-depth answer, where they can use their own words (Saunders et al., 2016; Bethlehem, 2009).

The questionnaire survey was launched in May 2023, and remained for two weeks. As stressed by Saunders et al. (2016, p. 441), a two-week distribution period is deemed reasonable. Although certain household consumption domains are seasonally influenced (Spence, 2021, p. 3), the data retrieving period did not affect the results, since, unlike certain industries (Dissanayake & Weerasinghe, 2021, p. 32), most HCE practices can be applied independently of the season. A non-probability convenience sampling technique was used. Although this procedure is prone to bias and offers less accuracy to the results, it is used widely, since it provides an adequate approach to exploratory studies (Saunders et al., 2016, p. 417). In this study, it allowed the collection of insights of householders' regarding the relevance of HCE activities. It targeted the general population of individuals with 15 years or above living in Portugal, since consumers become more aware of their consumption habits, and associated consequences, in their adolescence and early adulthood (Busse & Menzel, 2014, p. 416). Other nationalities were not considered, since, in some situations (e.g., organic food products, energy, apparel), consumer behaviour depends on the cultural and sociodemographic background of the individual (Singh & Verma, 2017; Frederiks et al., 2015; Scheerder et al., 2011).

Before the aforementioned period of data collection, the survey was sent to 30 individuals from the householder's category, and academia to ensure the clarity, understandability, and validity of the questions (Bethlehem, 2009, p. 15). In fact, Bethlehem (2009, p. 15) suggests a population of 25-75 individuals, during the pre-test. Moreover, to determine the internal consistency of the responses across the five-point Likert scales used to inquire about the HCE practices implemented by customers, users and EoL product holders, the Cronbach's alpha was calculated with a threshold of 0.7 or above. The Cronbach's alpha of the first, second and third Likert scale were 0.93, 0.82, and 0.72, respectively. Thus, the questionnaire survey had a high reliability (Saunders et al., 2016, p. 451).

The questionnaire survey yielded 509 valid responses. According to INE (2023), Portugal has a total population of 9 011 878 individuals with an age equal or above 15 years. A sample size of 509 allowed for a 95 % confidence level with a margin of error of 5.0 %, which is above the minimum sample size (n=384). The minimum sample size was determined through the methodology from Bartlett et al. (2001, p. 48), for categorical survey data analysis.

3.3 Stage 3: Evaluating the self-assessment tool

Caeiro *et al*. (2012, p. 80) recommended that the indicators should be "easily comprehensible and meaningful to family members". The householders' perspective enables an in-depth understanding of the clarity of the self-assessment tool, and its influence on their everyday actions. Thus, to evaluate the understandability and operability of the self-assessment tool, semi-structured interviews with open-ended questions were conducted. This approach is a qualitative method, in which the interviewer is recommended to be flexible, and explore the ideas developed by the interviewee (Denscombe, 2010, p. 172). In this case, the interviews were conducted to gather insight over the use of the self-assessment tool and develop the final list of indicators. For instance, if the interviewee wouldn't understand an indicator, the latter would be removed or adjusted, in function of the interviewee's suggestion.

The interviewees were selected through a snowball method (Bryman, 2016, p. 188). The interviews were elaborated between 04/06/2023 and 18/06/2023, until data saturation was reached – where new data confirmed the existing one instead of adding input (Denscombe, 2010, p. 117) -, resulting in 21 interviews with an average duration of 22 minutes.

At the beginning of the interview, the participant used the self-assessment tool through the Microsoft excel software (appendix D) and provided insight over its use. As recommended Saunders *et al*. (2016, p. 388), a document was created to structure and guide the interview (see appendix C). The document consisted of 6 open-ended questions concerning the general evaluation of the self-assessment tool. All semi-structured interviews were conducted on-line, and audio recorded. This provides a cost and time-effective approach to this method (Denscombe, 2010, p. 193). Furthermore, these were transcribed, and reviewed with the respondent, as recommended by Denscombe (2010, p. 193). As stressed by Saunders *et al*. (2016, p. 393), ethical issues regarding the audio recording, confidentiality, and anonymity were considered. The interviewees were free to withdraw from the interview and ask for the deletion of the data. The interviewees approval was obtained through informed consent.

3.4 Data analysis

To analyse the results of the questionnaire survey and interviews two techniques were applied: (i) for close-ended questions, descriptive statistics was used to measure the central tendency, and dispersion of each answer, in absolute (numerical) and relative (percentual) terms (Saunders *et al*., 2016, p. 496); and (ii) for open-ended questions, content analysis, as a supplementary technique, was used to code and categorize the retrieved qualitative data (Krippendorff, 2004; Saunders *et al*., 2016). In the case of the descriptive statistics, the data showed a nominal, and ordinal nature. Hence, it required different statistical tests (Saunders *et al*., 2016, p. 496). For the nominal data, a frequency table with percentages was used to summarize the categorical data. For the ordinal variables, the mean score was used to compare the importance level of the HCE practices. According to Chu and Hwang (2008, p. 2 831), the minimum requirement to include any particular item in a study is a combined participation agreement of 75%. As stressed by Saunders *et al*. (2016, p. 442), if respondents have insufficient knowledge, they may guess at the answer or overestimate the relevance of the item. Based on these criteria, the HCE practices with a mean score under 3.75 (within the five-point Likert scale) were given a negative connotation. Regarding the open-ended questions, the tri-dimensional role of the circular consumer described by Shevchenko *et al*. (2023, p. 7) and the CE strategies described by Potting *et al*. (2017, p. 5) were used to support the content analysis of the qualitative data. In addition, five criteria were applied to evaluate the proposed indicators and respective assessment scheme, based on deductive and inductive coding: (i) usability; (ii) usefulness; (iii) indicator comprehensibility/difficulties; (iv) recommendations; and (v) meaningfulness.

A collaborative approach helps bridge the gap between theory and practice. However, communication difficulties between the general public or practitioners and researchers can undermine the results (Kieser & Leiner, 2012, p. 19). Thus, as recommended by Saunders *et al*. (2016, p. 217), the results were triangulated with the current scientific body of literature on the topic (Table A2). In this context, only the empirical data collected from the questionnaire survey that is supported by scientific literature was considered in the stage 2. For instance, HCE practices related with dietary activities showed a mean score below 3.75 but are described as one of the main pillars in CE (van Loon *et al*., 2023; Paparella *et al*., 2023; Kumar *et al*., 2022). Hence, it was accepted for stage 2.

4. Results

In this section, an overview of the HCE practices and indicators was conducted, while lining out the surveyed participants perceptions over the use of the self-assessment tool in two parts: (i) in Section 4.1, the surveyed participants profile, HCE practices and initial clustering of indicators were analysed; and (ii) Section 4.2 shows the interviewed participants characteristics as well as insights over the use of the self-assessment tool.

4.1 Overview of HCE dimensions and indicators

4.1.1 Participants profile and HCE practices

In total, 509 valid responses were received from 510 individuals. Among the participants, 38.1 % were male, 61.7 % were female, and 0.2 % were nonbinary. The largest number (37.3 %) of respondents had 15-24 years, and 19.4 % had 25-34 years. All age-groups were covered by the questionnaire survey, with individuals over the age of 65 years representing the lowest relative weight (4.5 %) (Table 2). The participants had different education levels: 15.9 % of them did not pursue an university degree, whereas 48.5 % had a bachelor's degree, 30.1 % held a master's degree, and 5.5 % obtained a PhD degree. About 63.9 % and 36.1 % reside in apartments and houses, respectively. Amidst the surveyed, 9.8 % live alone, whereas the remaining participants cohabite with one or more individuals. The majority (78.8 %) of the respondents were familiarized with the concept of circular economy, demonstrating the high level of awareness in this topic.

Table 2. Surveyed participants main characteristics.

		Respondents	
		(No.)	(%)
Gender	Male	194	38.1%

	Female	314	61.7%
	Nonbinary	1	0.20%
Age group	15 - 24 years	190	37.3%
	25 - 34 years	99	19.4%
	35 - 44 years	53	10.4%
	45 - 54 years	87	17.1%
	55 - 64 years	57	11.2%
	> 65 years	23	4.5%
Education	Non-university	81	15.9%
	Bachelor	247	48.5%
	Master	153	30.1%
	PhD	28	5.5%
Type of housing	Apartment	325	63.9%
	House	184	36.1%
Household dimension (no. of individuals)	1	50	9.8%
	2	129	25.3%
	3	146	28.7%
	4	143	28.1%
	> 4	41	8.1%
Familiarity with the concept of CE	Yes	401	78.8%
	No	108	21.2%

Table 3 presents the scoring of the surveyed HCE practices. As stressed in the methods section, the HCE practices with a mean score below 3.75 were cut-off from the initial list. However, negatively marked empirical data collected from the survey that is clearly supported by scientific literature was considered for stage 2 of this study. In this context, although HCE practices concerning dietary choices and second-hand product acquisition were scored below the cut off value, they were made eligible for stage 2, due to its relevance in promoting CE (Coutinho et al., 2017, p. 35). Among the HCE practices, 10 were considered ineligible, belonging all of them to the customer dimension. No HCE practices were removed from the remaining dimensions. Nonetheless, it should be noted that the HCE practices were excluded to prioritize the main consumption activities. To foster circularity, the eliminated HCE practices still hold a significant relevance, as stressed in multiple studies (Lu & Kwan, 2023; van Bueren *et al*., 2023; Valls-Val *et al*., 2023; Prakash & Ambedkar, 2022; Ahmed *et al*., 2023).

Table 3. HCE selected and removed practices.

Dimension	HCE practice	Mean score	Std. Deviation	Eligibility for stage 2

Customer	Acquiring eco-labelled products	3.0	0.89	×
	Reject/avoid products produced through child labour or in other abusive and objectionable ways	5.0	0.85	✓
	Search for the shop with the least negative environmental impact (with a recognised environmental certification)	3.0	0.95	×
	Search for the shop with the least negative social impact (with a social responsibility certification)	3.0	0.98	×
	Looking for the product in the form of a service	3.0	1.13	×
	Looking for electrical or electronic products with the best performance in the energy certificate	4.0	0.86	✓
	Seek out locally produced foods/food products	4.0	0.89	✓
	Reject/avoid products with excessive packaging or packaging quantities where possible	4.0	0.96	✓
	Look for bulk products or with reduced packaging quantities if packaging is unavoidable	4.0	0.97	✓
	Looking to buy second-hand rather than new products	3.0	1.17	✓
	Trying to buy repaired products instead of new ones	3.0	1.11	×
	Seek to purchase refurbished/reconditioned products (e.g. an old product that has been upgraded to current quality standards) rather than new ones	3.0	1.09	×
	Try to buy "remanufactured" products (made from parts of another product with the same	3.0	1.07	×

function) rather than new ones			
Try to buy "re-purposed" products (products that have acquired a new function) rather than new ones	3.0	1.08	×
Try to buy products made from recycled materials rather than new ones	4.0	0.98	✓
Try to buy recyclable products or products that can be dismantled	4.0	0.96	✓
Seek to purchase the product in its dematerialised format, where possible	3.0	1.13	×
Try to buy the product with the longest possible durability	5.0	0.81	✓
Look for reusable products, rather than single-use items	4.0	0.89	✓
Look for products that can be shared, when bought together	4.0	1.13	✓
Seek to rent the product rather than own it	3.0	1.17	×
Seek dietary alternatives with better environmental performance	3.0	1.25	✓
Seek to buy foods that partially replace animal-based consumption	3.0	1.29	✓
Try to satisfy the residence's energy needs through renewable sources	4.0	1.12	✓
Try to buy products that minimise energy consumption needs without losing thermal comfort	4.0	0.95	✓
Try to buy products that increase the durability of the main product	4.0	0.90	✓
Look for multifunctional products, rather than one product for each function	4.0	0.99	✓

	Try to buy products with a money-back guarantee	4.0	0.95	✓
User	Use the product in the most resource-saving way	4.0	0.79	✓
	Avoid/reject using the product if there is a more sustainable alternative	4.0	0.89	✓
	Use the product as intensively as possible	4.0	1.0	✓
	Save leftovers, to be consumed at another time, when possible, instead of discarding them	5.0	0.79	✓
	Repair the product or purchase a repair service, rather than disposing of it when necessary	4.0	0.87	✓
	Renovate/recondition the product or purchase a renovation/reconditioning service rather than dispose of it	4.0	0.88	✓
	"Remanufacture" the product or purchase a "remanufacturing" service, rather than discarding it	4.0	1.0	✓
	"Reproposing" the product or acquiring a service that allows you to "repropose" it, rather than discard it	4.0	0.93	✓
	Use the land/area of your residence to produce your food, when possible	4.0	1.1	✓
	Sell or donate the product, rather than dispose of it, if it is still in good condition and able to fulfil its function	5.0	0.85	✓
EoL product holder	Give priority to using the recycling containers, when appropriate, instead of the undifferentiated waste containers	5.0	0.80	✓
	Give priority to sending organic waste for composting, rather than using the undifferentiated waste container	4.0	1.1	✓

Give priority to using a container or special waste collection service rather than disposing of the waste in a public place or littering	5.0	0.81	✓
Separating waste at home	5.0	0.84	✓

Legend:

✓ - Eligible; and,

× - Ineligible.

In the customer dimension, the participants response showed two main tendencies: First, product acquisition with an indirect and unclear benefit, namely of a financial or environmental nature, showed a lower importance level. For instance, the acquisition of products produced or categorized based on lesser-known CE strategies (e.g. repaired/remanufactured/repurposed/ refurbished/eco-labelled products) was given a lower mean score (3.0). Whereas products with more recognizable advantages (e.g. durability, multifunctionality, reusability, recyclability, among similar others) had a higher mean score (4.0 and above). In addition, practices that involve products with direct social and environmental benefits were prioritized by the respondents. In fact, refusing practices (e.g., rejecting products produced through child labour or with excessive packaging) were highly favoured. Second, physical product ownership was an important criterion for the surveyed individuals. As shown in Table 3, dematerialization, renting and product as a service practices were classified with a lower importance level (3.0).

Among the remaining HCE dimensions (user and EoL product holder), all HCE practices were given a positive connotation. In fact, service acquisition practices to extend the lifetime of a product or its parts (e.g., repairing, remanufacturing, refurbishing, repurposing) were given a high importance. Similar eco-friendly behaviours were classified with the same mean score. For instance, for the respondents, using resource saving/more sustainable approaches in day-to-day activities (e.g., public transport or active mode of transport usage, energy, and water efficient practices) or donating/selling the product in its EoL constituted a priority. Moreover, lower circularity-based strategies, including waste separation system, recycling, and composting, were also highlighted.

4.1.2 Clustering of HCE indicators

The initial list of HCE indicators was obtained through the results of the questionnaire survey and integrative literature review (Table 4). These metrics were obtained through a qualitative triangulation between the HCE practices with a mean score above 3.75, and the CE indicators derived from the integrative literature review (see Table A2). In addition, some HCE practices required more than one indicator. For instance, for the HCE practice "*Try to buy products that minimise energy consumption needs without losing thermal comfort*", three variables were selected: (i) Comfort; (ii) Electric or electronic products acquired or replaced to reduce energy consumption; and (iii) Energy consumption *per* m^2. The present set of indicators allow the self-assessment of circular economy-based strategies at the household level, and consider key criteria defined by Caeiro *et al*. (2012, p. 80) for household indicators. Thus, it enables the evaluation of the HCE practices showcased in Table 3.

Table 4. List of HCE indicators for the self-assessment tool.

Dimension	HCE indicator	Code	Description	Reference
Customer	Socially irresponsibly produced products refused (dimensionless)	C1	Measures the frequency a customer refused to acquire a product, for socially responsible reasons (e.g. produced from child labour, poor working conditions, un-paid labour).	Padilla-Rivera et al. (2021); Bianchini et al. (2022); Blinova et al. (2023)

Electric or electronic products acquired or replaced to reduce energy consumption (no.)	C2	Describes the amount a customer acquired or replaced an electric or electronic product to reduce energy consumption, per type of product (e.g. procurement of a refrigerator, freezer, laptop, dishwasher, among similar others with high energy efficiency).	Scarpellini et al. (2020); Ahmed et al. (2023); Yazan et al. (2022); Andreou et al. (2022)
Acquisition of locally produced food (dimensionless)	C3	Determines the frequency of locally produced food purchased, relatively to the total amount of food purchased, per type of food (e.g., poultry meat, vegetables, nuts, seasonal fruit).	Bux et al. (2022); Lami et al. (2022); Trollman et al. (2021)
Products with excessive packaging refused (dimensionless)	C4	Measures the frequency a customer refused to acquire a product, due to excessive amounts of packaging.	Kovacs (2021); Otto et al. (2021); Colasante and D'Adamo (2021); Droege et al. (2021); Klug and Niemand (2021)
In bulk products acquired (dimensionless)	C5	Measures the frequency of products acquired in bulk, to reduce the amount of packaging, per type of product.	Klug and Niemand (2021); Lami et al. (2022)
Second-hand products acquired (%)	C6	Measures the share of second-hand products procured, relatively to total product acquisition, per type of product.	Kovacs (2021); Valls-Val et al. (2022); Andreou et al. (2022); Chun et al. (2022); Klug and Niemand (2021)
Products acquisition with recycled materials (%)	C7	Measures the share of products produced with recycled material acquired, in relation to total product acquisition, per type of product.	Boyer et al. (2021); Jiang et al. (2022); Lizundia et al. (2023)
Recyclable products acquired (%)	C8	Measures the share of recyclable products acquired, in relation to total product acquisition, per type of product.	Colasante and D'Adamo (2021); Lami et al. (2022)
Dismantlable products acquired (%)	C9	Measures the share of dismantlable products acquired, in relation to total product acquisition, per type of product.	Mazzoli et al. (2022); Abadi and Moore (2022)
Durable products acquisition (%)	C10	Measures the share of products acquired with durability as a priority, in relation to total product acquisition, per type of product.	Trollman et al. (2021); Abadi and Moore (2022); Baratsas et al. (2022)

Reusable products acquired (%)	C11	Measures the share of reusable products acquired, in comparison to total product acquisition (reusable and single use), per type of product.	Colasante and D'Adamo (2021); Baratsas et al. (2022); Hafsa et al. (2022)
Product sharing, among owners (dimensionless)	C12	Measures the frequency an acquired product was shared, among owners, per type of product.	Andreou et al. (2022); Ahmed et al. (2022)
Animal dietary products acquired (no.)	C13	Measures the quantity of animal dietary products acquired, per type of animal dietary product (e.g., poultry meat, beef meat, fresh seafood, eggs).	Frehner et al. (2022); Droege et al. (2021)
Non-animal dietary products acquired (no.)	C14	Measures the quantity of non-animal dietary products acquired, per type of non-animal dietary product (e.g., vegetables, seasonal fruit, tropical fruit, legumes).	Frehner et al. (2022); Droege et al. (2021)
Renewable energy consumption (%)	C15	Measures the share of renewable energy consumed to satisfy the household energy needs, in relation to total energy consumption.	Motte et al. (2023); Sadowski (2021)
Water self-sufficiency (%)	C16	Measures the share of water self-sufficiency in a household, including rainwater harvesting, water re-use and wastewater recycling, in relation to total water consumption.	Sadowski (2021); Nadal et al. (2018); Kim et al. (2022)
Energy consumption per m^2 (J/m^2)	C17	Measures energy consumption (J) per area (m^2) of the household.	Droege et al. (2021); Sadowski (2021); Kosanović et al. (2021)
Water consumption (l) per m^2 (l/m^2)	C18	Measures water consumption (l) per area (m^2) of the household.	Sadowski (2021); Kim et al. (2023); Cozzolino and Giovanni (2023)
Comfort (dimensionless)	C19	Measures how frequent an individual feels comfortable inside their household, including thermal comfort and basic sanitation.	Padilla-Rivera et al. (2021); Sadowski (2021); Kosanović (2021)
Products with increased durability (dimensionless)	C20	Measures if the customer acquired a protective equipment for the main product, to increase longevity (e.g., procurement of a phone protective cape, to promote the phones' durability), per type of product.	Yamamoto and Murakami (2021); Baratsas et al. (2022);

	Multi-functional products acquired (%)	C21	Measures the share of products with multiple functionalities, in relation to the total products that would have been needed for the same amount of functions (e.g., acquiring one Swiss blade, instead of a knife, corkscrew), per type of product.	Scarpellini et al. (2019); Trollman et al. (2021)
	Products with a take-back policy acquired (%)	C22	Measures the share of products that the customer acquired with a take-back policy, per type of product.	Baier et al. (2020); Bruno et al. (2021)
User	Energy saving usage of a product (dimensionless)	U1	Measures the frequency the user practices the most resource saving method of a product (e.g. using the dishwasher/washing machine in the lowest temperature option and when completely full).	Stamminger et al. (2020); Lami et al. (2023)
	Water saving usage of a product (dimensionless)	U2	Measures the frequency the user practices the most resource saving method of a product (e.g. using the dishwasher/washing machine when completely full).	Stamminger et al. (2020); Lami et al. (2023)
	Public transport usage (dimensionless)	U3	Measures the frequency the user travels by public transport, per public transport, instead of using a private vehicle.	Ahmed et al. (2022); Colasante and D'Adamo (2021); Lami et al. (2023)
	Active mode of transport usage (dimensionless)	U4	Measures the frequency the user travels by bicycle or by walking, instead of using a private vehicle.	Andreou et al. (2022); Lami et al. (2023)
	Carpool frequency (dimensionless)	U5	Measures the frequency the user carpooled or used a carpooling service while travelling by private vehicle.	Andreou et al. (2022)
	Time in use per product (hours)	U6	Measures the amount of time (hours) a product was used.	Droege et al. (2021)
	Leftovers rate (%)	U7	Measures the share of leftovers that are consumed, instead of discarded, in relation to total leftovers production.	Bux et al. (2022)
	Post-sale services (no.)	U8	Measures the use of post-sale services, to prolong the longevity of the original product or create a new product from the parts of the product, including repair, refurbish, remanufacture, and repurpose.	Bianchini et al. (2022); Bradley and Persson (2021); Lanaras-Mamounis et al. (2022)

	Product maintenance (no.)	U9	Measures the independent use of product or part of product lifetime extension practices, including repair, refurbish, remanufacture, and repurpose.	Lanaras-Mamounis et al. (2022)
	Product self-sufficiency (no.)	U10	Measures the number of products produced independently (e.g. gardening vegetables, producing own cosmetics).	Klug and Niemand (2021); Sadowski (2021); Nadal et al. (2018)
	Donated products (dimensionless)	U11	Measures the frequency of products that were donated in a good condition and able to fulfil its function, instead of discarded.	Shittu et al. (2021); Kréziak et al. (2020)
	Sold products (dimensionless)	U12	Measures the frequency of products that were sold in a good condition and able to fulfil its function, instead of discarded.	Shittu et al. (2021); Kréziak et al. (2020)
EoL product holder	Recycling frequency (dimensionless)	E1	Measures the frequency an EoL product holder recycles the product at its EoL.	Adu-Gyamfi et al. (2023); Ng and Yang (2023)
	Composting frequency (dimensionless)	E2	Measures the frequency an organic EoL product holder composts the organic product at its EoL.	Boesen et al. (2019); Do et al. (2021)
	Littering frequency (dimensionless)	E3	Measures the frequency an EoL product holder litters, instead of using a waste container.	Klemeš et al. (2020)
	Household waste sorting (dimensionless)	E4	Measures the presence of a waste sorting system in the consumers household.	Adu-Gyamfi et al. (2023); Nainggolan et al. (2019); Ng and Yang (2023)

As shown in Table 4, a total of 38 HCE indicators were identified. Among the indicators, 22 are integrated in the *customer* dimension, followed by 12 in the *user* dimension, and 4 in the EoL product holder dimension. To ensure the key criteria defined by Caeiro *et al*. (2012, p. 80), namely comparability and robustness, dynamic behaviours, actions and routines, target audience and type of language, and comprehensibility and communication, multiple indicators adopted a frequency and percentage-based assessment, while lining out denominators, including household area (m^2) and per capita.

Although the time horizon for the implementation of HCE practices differ in function of the product and activity, the self-assessment tool can be used by the householder or other related entity (e.g., municipality services; condominium management) as a periodic tool, e.g., every trimester, depending on socio-cultural context and needs. For instance, procuring a repairing service for a private vehicle is seldom, whereas recycling, acquiring food or using the public transport can be evaluated on a weekly basis. Thus, to tackle this issue, each metrics was tailored based on of the frequency of the activity and product. For example, for the indicator "*Recycling frequency*" the respondent was asked to consider a typical week. This approach has been similarly done in other assessment tools (e.g. Beylot et al., 2017; Salas et al., 2022; Kok & Barendregt, 2021, see Table A1).

Regarding the customer dimension, the HCE indicators focus on the evaluation of procurement practices adopted by consumers, reflecting the implementation of higher circularity-based strategies described by Potting et al. (2017, p. 5), including refuse, rethink, reduce and re-use. It provides a set of metrics that unlock the potential of lifespan extension approaches or lower circularity strategies. For instance, the acquisition of

recyclable products enables an easier upcycling or downcycling process. On the other hand, procuring dismantlable equipment allow an easier repairing, refurbishing, repurposing, or remanufacturing service; thus, underlining the influence of implementing circularity-based criteria upstream, to generate sustainable behaviours downstream.

For the user dimension, decentralization-based practices to extend the lifespan of products and its parts are a key probe in the assessment process. The nucleus of this dimension is the evaluation of public services and community engagement activities. For the former, public transport usage represents the core indicator. Regarding the latter, localized post-sale services, donating, second-hand selling, and product self-sufficiency represent the main metrics.

Lastly, EoL product holder indicators unlock the potential of materials in upcycling and downcycling activities, through waste management strategies. This set of metrics aims to reduce output flow, by providing useful applications to products and its parts at their EoL, through recycling and recycling enabling practices (i.e. household waste sorting).

4.2 Evaluating the self-assessment tool

The findings of the questionnaire survey enabled the development of a HCE self-assessment tool (appendix D) supported by indicators, which were presented in the previous section. However, to evaluate the presence of the key factors described by Caeiro et al. (2012, p. 80), including the comprehensibility and meaningfulness of the indicators, 21 semi-structured interviews were conducted with householders. Appendix E provides additional details regarding the list of interviewees. In this context, five criteria were applied to evaluate the proposed indicators and respective assessment scheme, based on deductive and inductive coding: (i) usability; (ii) usefulness; (iii) indicator comprehensibility/difficulties; (iv) recommendations; and (v) meaningfulness.

Concerning the criterion usability, the majority of the interviewees (e.g. I2; I3; I6; I11; I14; among others) were able to use the self-assessment tool with ease, stating: "Yes, it was intuitive" (I11). However, some participants noted that it was long, and, for some indicators, difficult to answer. For instance, I3 and I21 argued that "It was easy to use, although extensive" (I21). Regarding the latter, the interviewees (I7; I10; I15; I17) indicated that they were not able provide the information requested by the indicator, as a result of the lack of awareness over their own consumption habits, "I didn't know the answer for some of the questions. (…) sometimes I don't know if something has excessive packaging" (I15). This was specifically seen in the questions that aimed to collect relative values from the user, as underlined by I4 and I7: "It was easy to use; however, it would have been easier if I had ranges to select from in the questions that asked for percentages" (I7). Albeit the positive feedback, one interviewee (I12) lined out some difficulties that represented a challenge in the use of the tool: "I was able to use it more or less, but I don't think it was easy. (…) certain technical terms are being used that I do not understand".

Although for different reasons, all interviewees considered the self-assessment tool useful. The majority underlined that it was a very informative tool, helping in introspection exercises regarding daily household activities, as stressed by I2, I4, I8, I9, I10, and I11, among others: "Yes, it was useful, in the way that it increased the perception I have over my consumption habits and everything else" (I4). Interviewee I6 also added that: "It is useful to understand better, for my family and I, the activities we do around the house". In addition, some participants (I1; I10; I12; I15; I20) argued that certain habits are rooted in their daily activities, due to convenience: "I consider it useful, (…), and to remind myself of certain habits that, due to convenience, I tend to slouch" (I20).

Regarding the difficulties associated with the use of the HCE self-assessment tool, the opinions are divided among the participants: (i) The tool and indicators were easy to use, understand, and answer, albeit aforementioned difficulties associated with the lack of awareness over their consumption habits; and (ii) The metrics were challenging to comprehend, and answer. In relation with the former, some participants (I5; I7; I17) argued that: "Yes, none were particularly difficult to interpret or answer, except for the fact that I do not know my own data" (I17). However, in householders with a higher awareness over their consumption activities (I3; I11; I13; I19; I21), no challenges were identified, "(The indicators were) easy to answer and comprehend" (I21). However, in the context of latter, multiple barriers were identified (I4; I5; I6; I7; I12; I15; I16; I18): (i) Difficulty in understanding technical terms, "I am not familiarized with the concepts of all of the indicators, definition wise" (I1); (ii) Lack of information regarding consumption habits, including energy, water and/or product characteristics (recyclability, locally produced, among similar others), "For the questions regarding if a product was recyclable or (…), most of the times I do not know that or the store itself

does not make that information available" (I5); and (iii) Inability to provide a relative value, "In some situations, it was a little difficult to write a percentage value. It requires effort to think of my household activities" (I6).

However, multiple recommendations were made by the interviewees (I3; I5; I7; I10; I12; I14; I15; I16; I18; I19): (i) Provide a description/definition/example of the technical terms used, "I think that a description and providing some examples would help understand and answer the questions" (I16); (ii) Indicate reference values, "I think there should be some base information (to compare). For instance, I do not know how much water I consume, but I am more or less aware that I consume less than the average (Portuguese) person" (I7); (iii) Create ranges of values for the metrics that ask for percentages, "For the percentage questions, also have ranges, instead of a free answer" (I19); and (iv) Indicate that certain information (e.g. energy consumption, water consumption) will be needed beforehand, "For the indicators that need quantitative data, pre warn the person to bring the information" (I3). Thus, since the present amendments enable a more in-depth understanding of the HCE indicators, no metrics were removed from Table 4.

Lastly, multiple interviewees (e.g. I1; I2; I3; I4; I5; among others) found the self-assessment tool meaningful, as the participants were able to reflect over their actions and adopt new circular economy-based behaviours. As a customer, some individuals (I1; I4; I6) reflected over the lack of consciousness in procurement practices: "Yes, I understood that I give little attention to whether a product was locally or sustainably produced. (…). I realized I could have a higher environmental and social influence (in my daily habits)" (I1). For the user dimension, the participants (I1; I2; I15) underlined that certain practices are rooted in routine, due to convenience, such as private transport usage, "(…) most of the things I do are defined by routine. (This tool) forces us to think about what we do (on our daily activities)" (I2). Since most of the interviewees had already implemented EoL product holder practices, the self-reflection exercise took two roles (I8; I12; I20): (i) reviewer, "Yes, I believe, in this case, the actions I do were confirmed by the tool" (I8); and (ii) self-satisfaction, "Yes, the only thing I do not is compost. In the remaining practices, I reviewed myself with satisfaction" (I20). In addition, the majority of the interviewees (e.g. I3; I4; I5; I8; I10; among others) were willing to adopt a new circular economy-based behaviour, after using this tool. Among them, the user dimension was privileged by the participants (I14; I16; I19; I20), "There is one practice I would like to implement, which is repairing. I tend to throw away the product when it stops working and buy a new one, but I am going to start repairing" (I20).

5. Discussion

5.1 HCE practices and indicators

The present results indicate that consumers are a key enabler in driving circular economy strategies and practices. Although the *customer* dimension is the starting point in unlocking and fostering circularity-based organisations (Shevchenko *et al*., 2023, p. 7), the *user* and *EoL product holder* dimensions constituted a higher priority. This could have resulted from the inherent motivations and barriers associated with consumption practices. According to Terzioğlu (2021, p. 4) and Varotto and Spagnolli (2017, p. 173), *user* and *EoL product holder* related strategies (e.g. repairing and recycling, respectively) are driven by emotional and value aspects, including environmental and social concerns. In addition, when compared with product replacement, lifespan extension practices represent, in general, lower costs. On the other hand, procurement practices are primarily driven by economic reasons. Nonetheless, although second-hand repaired/remanufactured/repurposed/refurbished products tend to cost less, when there are clear traces of the previous owners the consumer feels reluctant to acquire them (Edbring et al., 2016, p. 11).

Among the customer HCE practices, the results suggest that products with a clear or direct financial, environmental, and/or social advantage(s) (e.g. high energy certificate, multifunctionality, durability, recyclability) are more favoured by the consumers. This finding is in line with the scientific literature. For instance, Richter (2010, p. 231) stressed that the majority of the consumers prioritize an higher energy labelled product, when acquiring dishwashers, due to financial reasons and convenience. Barkhausen et al. (2022, p. 2) and Atsaja et al. (2022, p. 7) underlined the importance of fostering the durability criteria in product design, as a result of environmental and economic metrics: On the one hand, it is more cost effective; and, on the other hand, it reduces the need for constant product replacement, avoiding toxic substances release, among other environmental benefits. Furthermore, these advantages can also derive from the implementation of the refuse practice, described in Potting et al. (2017, p. 5). Although the increasing need for consumer responsibility in procurement practices (Ghisellini et al., 2016, p. 22), lack of awareness of the

production process inherent in a product represents one of the main CE barriers (Grafström & Aasma, 2021, p. 3). However, when backed by perceivable benefits, the consumer refuses unsustainably made products; thus, increasing demand for circular economy-based market opportunities with social and environmental benefits (Grafström & Aasma, 2021, p. 3). In addition, as emphasised in multiple studies (Grafström & Aasma, 2021; Edbring et al., 2016; Ghisellini et al., 2016), product ownership was identified as an important factor for consumers, since dematerialization, renting and product as a service practices were characterized with a lower importance level. This result derives from a modern culture social norm that expresses a desire to own and is mostly connected to products that are consumed for their primary function than for products that have high associated social status (Edbring et al., 2016, p. 11). For example, albeit a bike sharing initiative addresses several sustainability challenges, including climate change and wellbeing, privately owned bicycles constitute a consumer preference (Henriksson & Scalzotto, 2023, p. 6). In fact, Edbring et al. (2016, p. 11) found that, in situations of short-term renting, consumer attitude is largely positive, since it provides the opportunity to test the product, before acquiring it. On the other hand, long-term renting is linked with a negative perception.

The present set of HCE indicators obtained by the triangulation between the integrative literature review and the questionnaire survey define a comprehensive evaluation system, considering the multiple aspects of the circular consumer defined by Shevchenko et al. (2023, p. 7) and CE strategies described by Potting et al. (2017, p. 5). On the one hand, the self-assessment tool could foster circularity in a householder lifestyle, increasing awareness and consumer responsibility. On the other hand, as a key enabler in circular economy business models and urban metabolism (Shevchenko et al., 2023, p. 7), indicators and related assessment tools aim to help consumers unlock the potential of circular economy-based management/strategies at their multiple levels of implementation (micro, meso, macro), by the aid of a bottom-up approach (Gravagnuolo et al., 2019; Corona et al., 2019).

The proposed HCE indicators are in line with current trends that aim to challenge the LCA approach in circular economy assessment practices (e.g. Droege et al., 2021; Padilla-Rivera et al., 2021), which tends to be more expensive, highly dependent on data quality, and technical expertise (van Stijn et al., 2021; Lu & Halog, 2020). The present tool addresses these issues, by providing a relatively simple and context-dependent evaluation process, as seen in other frameworks (see, e.g., Ramos et al., 2021; Droege et al., 2021; Saidani et al., 2019). Although the present list of metrics was collaboratively designed for consumers self-assessment, Rincón-Moreno et al. (2021, p. 4) suggest that most CE indicators show a multi scale applicability. Thus, the present framework can be adapted to other levels, including organisations, cities, regions, or nations, since – according to Opferkuch et al. (2023, p. 7) and Gravagnuolo et al. (2019, p. 2) – all are concerned with smarter product or service use, product/resource acquisition, extending the lifespan of products and its parts, and the useful application of materials (following the descriptions of Potting et al., 2017, p. 5).

The self-assessment tool development depended on a collaborative approach with householders. Therefore, the process allowed the consumers to indicate the most important aspects of their consumption practices, especially their demands. This process is in line with similar studies: (i) in CE corporate disclosure, see Opferkuch et al. (2023, p. 7); and (ii) in CE assessment for public sector organisations, see Droege et al. (2021, p. 1 721). Therefore, results indicate, within the CE context, what constitutes a priority for the consumer; and what needs to be bridged to foster circularity.

Moreover, despite being part of the CE nucleus (Paparella et al., 2023; Kumar et al., 2022), second-hand acquisition, and less animal-dependent dietary choices were scored with a lower importance level. This could have resulted from the use of a collaborative approach; and thus, the communication difficulties between the general public and practitioners/researchers (Kieser & Leiner, 2012, p. 19). However, to ensure the comprehensibility and meaningfulness of the HCE indicators and self-assessment tool, semi-structured interviews were conducted.

5.2 Self-assessment tool insights

Results indicate that the self-assessment tool and HCE indicators were relatively simple to understand and respond to, providing opportunity for equitable benchmarking. This feedback is in line with the overall consensus over the characteristics needed for a self-assessment tool (Matuštík & Koči, 2021; Caeiro *et al*., 2012): (i) comprehensibility; and (ii) meaningfulness. In relation with the former, context provision (Vanham *et al*., 2019, p. 3), selecting a comprehensive set of questions around the object of evaluation (Franz & Papyrakis, 2011, p. 398), and making the general design, and data input clear and fun (Kok & Barendregt, 2021, p. 7) is highly recommended, fostering communication and empowerment for more sustainable

lifestyles (Kok & Barendregt, 2021, p. 7). These types of features should be carefully considered during the initial stages of planning and implementation of the CE self-assessment tool.

Although some individuals are willing to overlook certain difficulties and the extensiveness of the metrics, the majority aims to explore and compare their daily activities, in a given context (Kok & Barendregt, 2021, p. 7). Regarding the latter, results suggest that the self-assessment tool was highly meaningful, as an informative and self-reflection aiding mechanism. In fact, multiple interviewees were interested in adopting new circular economy-based practices into their lifestyle. These findings are in line with the works of Kok and Barendregt (2021, p. 7) and Buhl et al. (2019, p. 77), which underlined that people were more willing to engage in pro-environmental behaviour after using a sustainability-based self-assessment tool, when compared to the general public.

However, some difficulties were mentioned regarding understandability of technical terms, length of the evaluation process, and consumer lack of awareness over their own procurement habits, including data availability for metrics that aim to collect relative values. Similar challenges have been noted by multiple authors (Kok & Barendregt, 2021; Syrovátka, 2020; Tolppanen & Kang, 2021; Kharrazi *et al*., 2014). For instance, Kok and Barendregt (2021, p. 7) indicate that a trade-off between completeness and usability exist. Buhl *et al*. (2019, p. 77) also argue that lack of information hinders one's ability to evaluate themselves. Furthermore, a discrepancy in opinions was found over the self-assessment tool difficulty. According to Kok and Barendregt (2021, p. 7) this could have resulted from the participant's profile: environmentalists are willing to put more effort into getting more accurate results; whereas the general public does not want to spend a lot of time on data entry without any clear beneficial outcome.

5.3 Theoretical and practical implications

Multiple insights were drawn from this study, from a theoretical perspective. First, the self-assessment tool aims to break some of the CE barriers defined by Grafström and Aasma (2021, p. 5), specifically the social/cultural challenges, by increasing consumer awareness and enthusiasm, acceptance for circular economy models, and overall knowledge of a more sustainable lifestyle. Hence, it aims to expand on the number of HCE practices that can be implemented by a householder. Based on the integrative literature review (Table A2), no study has compilated a list of circular economy practices that could be executed by consumers at household level. Shevchenko *et al*. (2023, p. 7) described the tri-dimensional role of the consumer in the CE. In addition, multiple authors (e.g. Paparella *et al*., 2023; Addo *et al*., 2018; Edbring *et al*., 2016; Terzioğlu, 2021; Varotto & Spagnolli, 2017) have studied single aspects of CE at the consumer level, including resource (e.g. water, energy, food), acceptance of circular economy-based business models (e.g. sharing, renting, second-hand consumption), and individual circular economy strategies (e.g. repairing, recycling, reducing, re-using). However, to the best of our knowledge, so far, no study has developed a list of HCE practices and/or associated it with the consumer importance level.

Second, the list of HCE indicators (Table 4) attempts to resolve some of the limitations and challenges integrated in the CE indicators field of research, including the gaps identified by Moraga et al. (2019, p. 458), Jerome et al. (2022, p. 5), and Shevchenko et al. (2023, p. 7). Regarding the first, the authors were not able to identify CE indicators capable of measuring the higher circularity strategies described by Potting *et al*. (2017, p. 5). Among the HCE metrics, two indicators (e.g. "*Socially irresponsibly produced products refused*" and "*Products with excessive packaging refused*") were defined to measure the refuse strategy. For the second, the researchers mentioned that most CE indicators cannot evaluate the use phase of a product, and lifetime extension strategies. Similarly, among the HCE indicators, three metrics that can address those issues were proposed (e.g. "*Time in use per product*" and "*Post-sale services*"). In relation with the third, the authors emphasize the significant lack of metrics for the consumer, in the CE context. The present research proposes several tailored HCE indicators to address this gap.

Third, the results provide a set of recommendations to improve the comprehensibility and meaningfulness of the proposed self-assessment tool. These suggestions can be used in the development of future similar mechanisms. The interviewees emphasized that the indicators should be more intuitive, by providing a description of technical terms, indicate reference values, to enable benchmarking with the national average, and create ranges of values for the metrics that ask for percentages, to facilitate the user's ability to answer. These findings are in line with other research, namely the work of Kok and Barendregt (2021, p. 7), where among the aforementioned suggestions, also underlines that a self-assessment tool should also mention clear financial and health benefits associated with the implementation of these practices. In addition, householders are interested in receiving advice to improve performance, in function of the answers.

From a practical perspective, several implications/lessons can be drawn from this study. In particular, the proposed HCE tool could support local organisations and municipalities in understanding what consumers prioritize in the circular economy scope, and help future HCE assessment initiatives, conducted at municipal, parish, neighbourhood, condominium, or other specific scale. This could also enable tailored product design and business opportunities that follows CE strategies, as emphasized by Schevchenko et al. (2023, p. 7), and plans and programs that foster circularity in cities, according to Gravagnuolo et al. (2019, p. 3). Thus, it aims to bridge the gap between householders and entities/plans/programs, as mentioned by Grafström and Aasma (2021, p. 5).

6.Conclusions

Household consumption practices are linked with multiple sustainability challenges, including climate change and well-being. However, individuals still don't know how to act, and feel little motivation to change certain habits, since most procurement practices are driven by economic reasons. CE can work as one of the strategies to tackle these issues, by providing a financial incentive to more sustainable lifestyles. This explanatory study aimed to develop, through a collaborative approach, a self-assessment tool that aided households in adopting HCE practices, by: (i) understanding the importance level consumers allocate to certain activities, within the CE vein; and (ii) describing a set of metrics that can help householders communicate, and gain awareness over their acquisition strategies. Furthermore, it provided several insights over the use of the self-assessment tool that can support the construction of future similar mechanisms.

A collaborative research process was adopted to develop and optimize the set of HCE indicators, grounded on comprehensibility and meaningfulness criteria. First, a list of HCE practices was built. The findings derived from the questionnaire survey suggested that certain *customer* activities do not constitute a priority for the consumer, as a result of economic barriers, lack of trust in second-hand products, and a modern culture social norm. On the other hand, *user* and *EoL product holder* practices showed a higher importance level since most activities are easier to implement by consumers and are not challenged by the aforementioned arguments. Based on a triangulation approach that combined an integrative literature review and a questionnaire survey, the aforementioned list reflected multiple metrics. Second, to refine the assessment framework, semi-structured interviews were conducted. The results obtained through this procedure demonstrated that the self-assessment tool was meaningful, as multiple interviewees were willing to adopt new HCE practices. Nonetheless, although complemented with recommendations, several difficulties were identified. According to the participants, the main challenge was the lack of awareness over their own consumption practices, resulting in the inability to provide the information asked by certain HCE indicators.

The householder's participation was a key component in the development of the self-assessment tool. In addition to the aforementioned reasons, the collaborative approach helped bridge the gap between the conceptual model and the benefits of its realization. Moreover, this study aimed to solve certain limitations linked to the CE indicators field of research. First, it proposes several metrics that enable assessment opportunities of higher circularity strategies, including refuse, and rethink. Second, it conceptualizes a first attempt to develop an evaluation HCE tool for consumers. Third, it provides multiple recommendations to support the construction of future similar mechanisms or to put the proposed tool into practice. Fourth, it could guide organisations and municipalities in the development of products and services, within the CE scope, that satisfy the consumers priorities.

However, several potential limitations inherent to the methodological approach could have constrained this study, including bias, sample size, oversimplification of certain aspects, and under coverage.

Future research should be conducted to further expand the underdeveloped field of circular economy at the consumer/household level, especially in the assessment field. In the development of this research, multiple underexplored gaps were identified, including: (i) what are the drivers and barriers for the consumer in the circular economy; (ii) how can the user of the self-assessment be scored (i.e. what are the relative weights of each metric); (iii) how would a multi stakeholder approach help bridge the conceptual and practical gap between households and organisations and municipalities; and (iv) when single-studied, how could each circular economy strategy or HCE dimension be evaluated. The findings of this research document aim to foster investigation in these levels, to: (i) On the one hand, help consumers find more sustainable and financially approachable lifestyles, through the lens of the CE; and (ii) On the other hand, unlock innovation, drive investment, and create jobs, based on a CE approach, in private and public sector organisations.

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Appendixes
Appendix A
Table A1 - Individual and household self-assessment tools within the scope of CE: R0 = Refuse; R1 = Rethink; R2 = Reduce; R3 = Re-use; R4 = Repair; R5 = Refurbish; R6 = Remanufacture; R7 = Repurpose; R8 = Recycle; and R9 = Recover (see Potting *et al*., 2017 and Čuček *et al*., 2012).

Tools	Circular economy framework										Description	Reference
	R0	R1	R2	R3	R4	R5	R6	R7	R8	R9		
Blue footprint	P	×	P	×	×	×	×	×	×	×	Determines the impact of water usage by individuals and cities on the world's freshwater resources. Considers the water consumption, resource stress and water quality. Hence, it measures the depletion of surface and groundwater resources during the production of goods and services.	Čuček *et al*. (2012) and Chai *et al*. (2020)
Carbon footprint	P	P	P	×	×	×	×	×	×	×	Measures the amount of CO_2e emitted over the full life cycle of a process or product. Thus, within the household, it calculates the amount of CO_2e that is emitted into the atmosphere based on the energy, product and service consumption and transportation.	Čuček *et al*. (2012) and Zeng *et al*. (2021)
Crop land footprint	×	×	P	×	×	×	×	×	×	×	Quantifies the necessary land area to produce the crops consumed by a population.	Čuček *et al*. (2012) and Dietz *et al*. (2007)
Consumer footprint	P	P	P	P	P	P	×	×	×	×	Calculates the environmental impacts derived from the consumers' choices and consumption patterns.	Salas *et al*. (2022)
Ecological footprint	P	P	P	×	×	×	×	×	P	×	Assesses the human demand for land and water ecosystems, by paring the human consumption of resources and waste production with the natural capital capacity to regenerate. Therefore, it estimates the user's/household's ecological footprint based on the	Čuček *et al*. (2012) and Kok and Barendregt (2021)

											individual/family lifestyle and consumption patterns.	
Energy footprint	P	×	P	×	×	×	×	×	×	×	Determines the sum of all areas used to sequestrate CO_2 emissions from the consumption of non-food and non-feed energy. Thus, it is the necessary area to absorb the Greenhouse gases (GHG) emissions derived from the sum of the energy intensities and expenditures of all the household consumption sectors.	Čuček *et al*. (2012), Fang *et al*. (2014) and Min and Rao (2017)
Financial footprint	×	×	×	×	×	×	×	×	×	×	Measures an individual expenses, by analysing their retirement funds, investments, insurance, tax and estates.	Čuček *et al*. (2012)
Fishing-Ground footprint	×	×	P	×	×	×	×	×	×	×	Quantifies the area needed to produce the fish and seafood products for human consumption. Thus, integrating demand for inland and marine water ecosystems in the needs to support aquaculture and seafood restocking.	Čuček *et al*. (2012) and Solarin *et al*. (2021)
Forest footprint	×	P	P	P	P	×	P	×	×	×	Calculates the volume of timber and forest area required to satisfy the consumption of households.	Čuček *et al*. (2012) and Staelens (2022)
Human footprint	P	×	P	×	×	×	×	×	×	×	Assesses the energy quantities, resources, and products consumed by an individual throughout their life. Hence, it measures land transformation, population density, grazing density, human access and electrical power infrastructure.	Čuček *et al*. (2012) and Yin *et al*. (2020)
Health footprint	P	×	P	×	×	×	×	×	×	×	Determines the individual's health, and its effect on those around, by targeting consumption and non-consumption-based risk factors (diet, physical inactivity, tobacco smoking, alcohol).	Čuček *et al*. (2012) and Harrison *et al*. (2011)
Material footprint	P	P	P	P	P	×	×	×	P	×	Quantifies the use of materials from a consumption perspective, associating the extracted and used raw materials to its domestic demand. In its assessment, it integrates six components: i) nutrition; ii) construction and housing; iii) consumer goods; iv) mobility; v)	Vanham *et al*. (2019) and Buhl *et al*. (2019)

											leisure activities; and vi) vacations.	
Nitrogen footprint	P	P	P	×	×	×	×	×	×	×	Measures the total amount of reactive nitrogen (N_r) released to the environment as a product of an individual activities, namely: i) food; ii) housing; iii) transportations; and iv) goods and services.	Čuček *et al*. (2012) and Leach *et al*. (2012)
Phosphorous footprint	P	×	P	×	×	×	×	×	P	×	Assesses the phosphorous (P) imbalance within crops, integrating the required P concentration and the P loss to the environment.	Čuček *et al*. (2012) and Dhar *et al*. (2021)
Work environment footprint	×	×	×	×	×	×	×	×	×	×	Determines the number of lost days at work per unit of product, by analysing eight variables: i) Fatal accidents; ii) Total number of accidents; iii) Central Nervous System (CNS) function disorder; iv) Hearing damages; v) Cancer; vi) Musculo-skeletal disorders; vii) Skin diseases; and viii) Psycho-social diseases.	Čuček *et al*. (2012) and De Benedetto and Klemeš (2009)
Water footprint	P	×	P	P	×	×	×	×	P	×	Quantifies the total volume of direct and indirect freshwater used, consumed, and/or polluted to produce the goods and services acquired by individuals or communities or produced by the business. It integrates three components: blue, green, and grey water footprints. These represent the consumption of surface and ground water, rainwater, and the volume of water necessary to dilute the pollutants to water quality standards, respectively.	Čuček *et al*. (2012) and Fan *et al*. (2019)
Waste footprint	P	×	P	×	P	×	×	×	P	P	Calculates the amount of waste produced by sourcing ingredients and materials, manufacturing and processing, and transportation. Within the household consumption scale, it represents the sum of the waste derived from economic activities associated with the demand for goods and services, and the postconsumer waste.	Čuček *et al*. (2012) and Beylot *et al*. (2017)

Legend:
P - Direct relation; and,
×- No relation.

Table A2 – List of HCE indicators.

Title	Author(s)	Year	Description	10R	Consumer role
The potential of local food, energy, and water production systems on urban rooftops considering consumption patterns and urban morphology	Toboso-Chavero et al.	2023	Sustainability, environmental, social and economic indicators, including resource self-sufficiency.	Rethink	User
When Do Supply Chains Strengthen Biological and Cultural Diversity? Methods and Indicators for the Socio-Biodiversity Bioeconomy	Saes et al.	2023	Basic sanitation.	N.A.	User
Key Corporate Sustainability Assessment Methods for Coal Companies	Blinova et al.	2023	Environmental, social and governance indicators, including packaging materials, child labour, among others.	Refuse, rethink, reduce	All
Circularity indicators and their relation with nutrient use efficiency in agriculture and food systems	van Loon et al.	2023	Input/Output analysis-based indicators.	N.A.	N.A.
Product Design Evolves to Implement Circular Economy Principles	Lizundia et al.	2023	Circularity indicators, including repairability, use of recycled materials in the manufacture of the product. Also, considers lifetime extension, re-use of product parts or recyclability of materials.	Re-use, repair, remanufacture, recycle	User, EoL product holder
Construction waste recycling in the circular economy model	Mikhno et al.	2023	Disassembly related metrics, waste sorting, recycling.	Recycle	User, EoL product holder
Development of a system model to predict flows and performance of regional waste management planning: A case study of England	Ng & Yang	2023	Recycling rate, household waste sorting.	Recycle	EoL product holder
Developing circularity, renewability, and efficiency indicators	Motte et al.	2023	Share of renewable sources.	Refuse, rethink, reduce	Customer

for sustainable resource management: Propanol production as a showcase					
How to map industrial waste metabolism at a geographical level? A proposal for a composite indicator	Gambarotto et al.	2022	Repair of equipment's.	Repair	User
An Evaluation of Circular Economy Development in the Baltic States	Jakubelskas & Skvarciany	2022	Circularity, waste, and environmental related indicators, including packaging, renewable energy, recycling, re-use.	Refuse, reduce, re-use, recycle	All
Does Carbon Footprint Play a Relevant Role in Food Consumer Behaviour? A Focus on Spanish Beef	Lami et al.	2022	Locally produced food, use of bicycles, public transport, packaging, efficient use of products (energy, water), bulk products, recyclable products.	Refuse, rethink, reduce, re-use, recycle	All
The (un)shared responsibility in the reverse logistics of portable batteries: A Brazilian case	Castro et al.	2022	Legal, socioeconomic, organizational, operational, and working indicators, including use of protection equipment.	Reduce	Customer
Evaluation of harvesting urban water resources for sustainable water management: Case study in Filton Airfield, UK	Kim et al.	2022	Water management indicators, including rainwater harvesting, greywater recycling, reusable water, resource saving behaviour.	Reduce, re-use, recycle	User, EoL product holder
Measuring product-level circularity performance: An economic value-based metric with the indicator of residual value	Jiang et al.	2022	Circularity metrics, including products produced with recycled materials.	Reduce	Customer
Performance assessment of circular driven sustainable agri-food supply chain towards achieving sustainable consumption and production	Kumar et al.	2022	Sustainability indicators, including green material consumption, resource utilization, waste management, employee wellbeing.	Refuse, rethink, reduce, recycle, recover	All
Assessing and Developing Circular Deep Renovation Interventions towards Decarbonisation: The Italian Pilot Case of	Mazzoli et al.	2022	Circularity metrics, including disassembly, materials' origin, and reusability, repairable, refurbish able, remanufactured, recyclable.	Reduce, re-use, repair, refurbish, remanufacture, recycle	All

“Corte Palazzo” in Argelato					
Is there a need for new kitchen design? Assessing the adaptative capacity of space to enable circularity in multi residential buildings	Ollár et al.	2022	Circularity metrics, including refurbish, rethink.	Rethink, refurbish	User
Innovative Development of Circular Systems While Ensuring Economic Security in the Industry	Kuzior et al.	2022	Circularity indicators, including change in duration of use, recycling, resource conservation, resource intensity.	Reduce, recycle	User, EoL product holder
Selection of Circular Proposals in Building Projects: An MCDM Model for Lifecycle Circularity Assessments Using AHP	Abadi and Moore	2022	Circularity metrics, including disassembly, longevity, embed recycled materials, reduce material input, efficient use, repair, repurpose.	All	All
How to Monitor the Transition to Sustainable Food Services and Lodging Accommodation Activities: A Bibliometric Approach	Bux et al.	2022	Leftovers rate, locally produced food, among other food related indicators.	Refuse, reduce, re-use	Customer, user
Stakeholder Assessment on Closing Nutrient Cycles through Co-Recycling of Biodegradable Household Kitchen Waste and Black Water between Rural and Urban Areas in South India	Fendel et al.	2022	Ecological, social, technical, economical, and connective indicators, including waste sorting.	Recycle	EoL product holder
A Framework to Assess Social Indicators in a Circular Economy Perspective	Bianchini et al.	2022	Tactical objectives and operational social-based indicators, including child labour.	Refuse	Customer
Clarify the nexus between life cycle assessment and circularity indicators:	Saidani et al.	2022	Circularity and LCA indicators, including re-use rate.	Re-use	Customer

a SETAC/ACLCA interest group					
Practical solutions for circular business models in the fashion industry	Dragomir & Dumitru	2022	Circularity indicators for apparel, including type of fibre procurement, recyclability, water re-use, greywater recycling social conditions with production, excessive packaging among others.	Refuse, reduce, re-use, recycle	All
Improved Copper Circularity as a Result of Increased Material Efficiency in the U.S. Housing Stock	Wang et al.	2022	Circularity indicators, including energy label.	Refuse	Customer
Consumer strategies towards a more sustainable food system: insights from Switzerland	Frehner et al.	2022	Consumer food-based indicators, including meat consumption reduction.	Reduce	Customer
In silico assessment of household level closed water cycles: Towards extreme decentralization	de Walle et al.	2022	Water circularity indicators, including rainwater harvesting, water re-use, greywater recycling, among others.	Rethink, reduce, re-use, recycle	User, EoL product holder
Key metrics to measure the performance and impact of reusable packaging in circular supply chains	Betts et al.	2022	Circularity indicators, including remanufactured, re-use, repurposed, recyclable, compostable products.	Reduce, re-use, remanufacture, repurpose, recycle	All
Portfolios of sustainable practices for packaging in the circular economy: an analysis of Italian firms	Cozzolino & Giovanni	2023	Environmental indicators, including energy and water consumption.	Reduce	User
Consumer attitude and acceptance toward fish fed with insects: a focus on the new generations	Baldi et al.	2021	Food-based indicators.	Reduce	Customer
Implementation of the New European Bauhaus Principles as a Context for Teaching Sustainable Architecture	Sadowski	2021	Thermal comfort indicators, renewable energy share, energy efficiency of buildings, greywater recycling and rainwater harvesting, vegetable planting, self-production of food.	Rethink, reduce, re-use, recycle	All
Measuring spatial access to the recovery networks for WEEE:	Bruno et al.	2021	Take-back service, as well as spatial access to WEEE networks indicators.	Reduce	User

An in-depth analysis of the Italian case					
Framework for Comparative Evaluation of Car-Sharing Alternatives for Urban and Suburban Regions: Case Study of Mumbai, India	Das et al.	2021	Car-sharing and carpool related indicators, including accessibility.	Rethink	User
A Circularity Indicator Tool for Measuring the Ecological Embeddedness of Manufacturing	Trollman et al.	2021	Circularity metrics, including locally and ethically sourced products/resources, remanufactured, refurbished, repurposed, repair, longevity, multiple functions (multi-functionality), among others.	All	All
Smart Waste Management System as a Sustainable Social Enterprise Model	Nasar et al.	2021	Use time of products, such as vehicles.	Reduce	User
Energy Refurbishment of Family Houses in Serbia in Line with the Principles of Circular Economy	Kosanović et al.	2021	Circularity metrics for energy efficiency, including refurbishment and thermal comfort, energy consumption.	Reduce, refurbish	User
Selection and evaluation of a septage management concept for islands: The case study of Brač Island	Margeta	2021	Environmental, social, economic, and technical indicators, including access to basic sanitation.	Reduce, re-use	User
Social circular economy indicators: Selection through fuzzy delphi method	Padilla-Rivera et al.	2021	Social circular economy-based indicators, including child labour, sanitation, thermal comfort, labelling.	Refuse	Customer
Recirculation potential of post-consumer /industrial bio-based plastics through mechanical recycling - Techno-economic sustainability criteria and indicators	Briassoulis et al.	2021	Circularity indicators, including biodegradability, waste sorting.	Recycle	EoL product holder
Social Life Cycle Assessment of Product Value Chains Under a Circular	Reinales et al.	2020	Social-based circularity indicators, including products produced with recycled materials.	Refuse	Customer

Economy Approach: A Case Study in the Plastic Packaging Sector					
Indicators to Measure Efficiency in Circular Economies	Sánchez-Ortiz et al.	2020	Circular economy metrics for efficiency.	Refuse, reduce, re-use, recycle	All
The Drivers of Sustainable Apparel and Sportswear Consumption: A Segmented Kano Perspective	Baier et al.	2020	Sustainability-based indicators for apparel, including take-back policy.	Refuse	Customer
A review of micro level indicators for a circular economy – moving away from the three dimensions of sustainability?	Kristensen & Mosgaard	2020	Circularity metrics, including recycling, remanufacturing, re-use, resource efficiency, disassembly, lifetime extension, waste management, EoL management, and multidimensional indicators.	Reduce, re-use, remanufacture, recycle	User, EoL product holder
Creating sustainable value through remanufacturing: Three industry cases	Jensen et al.	2019	Environmental, economic, and social indicators for remanufacturing, including after-use service acquisition for remanufacturing.	Remanufacture	User
Bio-Based Products: Suggestions for Ecolabel Criteria and Standards in Line with Sustainable Development Goals	Wurster et al.	2019	Indicators for labelling.	Refuse	Customer
Developing a set of sustainability indicators for product families based on the circular economy model	Mesa et al.	2018	Circularity metrics, including multi-functionality of a product.	Rethink	Customer
Rooftop greenhouses in educational centers: A sustainability assessment of urban agriculture in compact cities	Nadal et al.	2018	Circularity indicators, regarding food self-production, rainwater harvesting, thermal comfort.	Rethink, reduce	User
Developing a reparability indicator for electronic products	Flipsen et al.	2016	Indicator for repairing (self and service acquisition)	Repair	User
Reducing waste management challenges: Empirical assessment of waste	Adu-Gyamfi et al.	2023	Waste sorting indicators in corporate employees	Recycle, recover	EoL product holders

sorting intention among corporate employees in Ghana					
Dynamic capabilities and environmental accounting for the circular economy in businesses	Scarpellini et al.	2020	Multi-functional products, equipment or products replaced to energy consumption reduction	Refuse, rethink, reduce	Customer
A Comprehensive Sustainability Assessment of Battery Electric Vehicles, Fuel Cell Electric Vehicles, and Internal Combustion Engine Vehicles through a Comparative Circular Economy Assessment Approach	Ahmed et al.	2023	Energy consumption, water consumption, recyclability rate, energy source utilization percentage, emissions produced, technology readiness level, vehicles' efficiency, total cost of ownership, national incentives, vehicles' lifetime, range on full tank/charge, range anxiety, recharging/refuelling time and number of available refuelling/recharging stations	Reduce, repair, refurbish, repurpose, recycle	All
DECISION-SUPPORT TOOLS FOR SMART TRANSITION TO CIRCULAR ECONOMY	Yazan et al.	2022	Energy certificates	Reduce	Customer
Assessing Lifestyle Transformations and Their Systemic Effects in Energy-System and Integrated Assessment Models: A Review of Current Methods and Data	Andreou et al.	2022	Ratio of private to public transport, avoidance of airplanes in favour of trains, use of active modes of transport (bicycles, walking), carpool commuting , car-sharing schemes, eco-driving practices (lower speeds), conservation of hot water, recycling, re-using, extending lifetime of consumer goods	Rethink, reduce, re-use, repair, repurpose, refurbish, remanufacture, recycle	All

The circular economy and bioeconomy in the fashion sector: Emergence of a "sustainability bias"	Colasante & D'Adamo	2021	Use of frequency for variables: recycling frequency, avoid buying products from companies that do not respect the environment in their production cycles, frequency of acquisition of products with little packaging or recyclable packaging, use of public transports, acquisition of products in packs that can be refilled/re-used, acquisition of re-usable	All	All
Co-development of a framework for circular economy assessment in organisations: Learnings from the public sector	Droege et al.	2021	Set of CE indicators for public sector organisations	All	All
The lifestyle of sustainability: Testing a behavioral measure of precycling	Klug & Niemand	2021	Refusal of overpackaged products or of products due to environmental or social reasons, acquisition of products in bulk stores (stores for self-filling, self-bottling), prioritizing sustainability made products, self-production of products (cultivating peppers at home, producing one's own cosmetics, etc.), package re-using, full use of products without waste production (e.g., food)	Refuse, rethink, reduce, re-use, recycle	All
Food packaging and sustainability – Consumer perception vs. correlated scientific facts: A review	Otto et al.	2021	GWP, recycling rate of packages, re-use rate of packages, biodegradability of packages	Re-use, recycle	Customer
CIRCULAR FASHION FROM THE PERSPECTIVE OF YOUNG CONSUMERS – MEASUREMENT AND MANAGERIAL RELEVANCE	Kovacs	2021	Acquisition of long-lasting clothes, repurposing clothes, clothes made from sustainable fabrics, second-hand acquisition, purchasing less, rent clothes, clothes give away or swap	Rethink, reduce, re-use, repurpose	All

Tools for assessing qualitatively the level of circularity of organisations: Applicability to different sectors	Valls-Val et al.	2023	Set of indicators for different aspects of CE in an organization, including purchasing, transform, use, reintroduce, rethink, waste management, among others	All	All
What will lead Asian consumers into circular consumption? An empirical study of purchasing refurbished smartphones in Japan and Indonesia	Chun et al.	2022	Re-use/resold a smartphone, refurbished smartphone acquisition, environmentally friendly products prioritization	Re-use, refurbish	Customer, user
Consumer Demand for Circular Products: Identifying Customer Segments in the Circular Economy	Boyer et al.	2021	Acquisition of products with recycled materials, acquisition of products with refurbished/re-used parts	Re-use, refurbish, recycle	Customer
Product obsolescence and its relationship with product lifetime: An empirical case study of consumer appliances in Japan	Yamamoto and Murakami	2021	Measure to improve physical durability of a product, encourage repairing, improve modular upgradability	Reduce, repair, refurbish	Customer, user
A quantitative and holistic circular economy assessment framework at the micro level	Baratsas et al.	2022	Set of CE indicators for reduction of material losses/residuals, reduction of input and use of natural resources, increase in share of renewable resources & energy, reduction in emission levels and increase the value durability of products	All	All
Durability of washing machines under real life conditions: Definition and application of a testing procedure	Stamminger et al.	2020	Average energy or water consumption of a washing machine in function of the load and selected temperature	Reduce	User
Community repair in the circular economy – fixing more than stuff	Bradley and Persson	2021	Repairability index	Repair	User
The development of an index for assessing the circularity level of eco-labels	Lanaras-Mamounis et al.	2022	Eco-Label circularity index, considers reduce, repair, sustainability, refurbish/remanufacture, safe disposal indicators	Reduce, repair, refurbish, remanufacture, recycle	All
DEMONSTRATING EEE RECOVERY FOR REUSE IN A	Shittu et al.	2021	Re-usable, donated, re-sold products	Re-use	User, EoL product holders

DISTINCT URBAN MINE: A CASE STUDY					
The destiny of replaced technological products: The influence of perceived residual value	Kréziak et al.	2020	Return the product instead of throwing, sell privately, return for a discount, recycle, give away	Re-use	EoL product holders
Plastics: friends or foes? The circularity and plastic waste footprint	Klemeš et al.	2020	Plastic re-use, mechanical recycling and chemical recycling	Re-use, recycle	EoL product holders
Environmental sustainability of liquid food packaging: Is there a gap between Danish consumers' perception and learnings from life cycle assessment?	Boesen et al.	2019	Return or refill package, package made of environmentally friendly materials (renewable sources, recycled material, biodegradable, compostable), package can be repurposed into other activities (storage)	Refuse, rethink, re-use, repurpose	Customer, user
A systematic review of research on food loss and waste prevention and management for the circular economy	Do et al.	2021	Energy and water consumption, waste sorting, among others	Reduce	Customer, user

Appendix B – Questionnaire Survey

This questionnaire was developed in the scope of the master thesis "Circular Economy Self-Assessment Tool for Households: A Collaborative Approach" that is being developed by Alexandre Rodrigues da Silva, student of the Integrated master's in environmental engineering (School of Sciences and Technology, NOVA University of Lisbon (SST NOVA), Portugal) and supervised by Prof. Dr. Tomás B. Ramos (FCT NOVA, Portugal).
The questionnaire is anonymous. However, there is some personal information collected, including age, gender, level of education, type of household and number of people in their residence. This information is necessary to characterise the respondents. The data will be used in aggregate form, never explicitly identifying respondents. Your answers will be entirely confidential, ensuring the security of the information collected, in strict compliance with the General Data Protection Regulation (GDPR). If you have any questions, you can direct them to the data protection officer, by emailing amfr.silva@campus.fct.unl.pt.
Your participation in this study is very important but completely voluntary, and you can withdraw from the questionnaire at any time, as well as request the correction or cancellation of the data already provided.
This survey should take about 3 to 5 minutes of your time, where you will provide your opinion based on your life experiences. There are no right or wrong answers.
Therefore, we would like to confirm that you understand the objectives and scope of this questionnaire, as well as how the data collected are collected, processed, and analysed, and whether you agree to participate in this study.
□ Yes, I agree
□ No, I disagree
Welcome!
Thank you for agreeing to participate in this survey on developing a self-assessment tool that fosters circular economy progress. We appreciate your insights.
Personal information
Please provide some information about yourself. This is necessary to understand the profile of the

respondents.
1.1 What is your age group?
□ 15 - 24 years old
□ 25 - 34 years old
□ 35 - 44 years old
□ 45 - 54 years old
□ 55 - 64 years old
□ > 65 years old
1.2 What is your gender?
□ Female
□ Male
□ Non-binary
□ Other
□ Prefer not to indicate
1.3 What is your level of education?
□ High School
□ Bachelor's Degree
□ Master's Degree
□ Doctorate
1.4 In what type of residence do you live?
□ Apartment
□ Townhouse
1.5. How many people live in your residence?
□ 1
□ 2
□ 3
□ 4
□ > 4
1.6. Are you familiar with the concept of Circular Economy (CE)?
□ Yes
□ No

2. 'Customer' in a circular economy
This section aims to understand the level of importance you attach to circular economy (CE) strategies that can be used as a customer, namely in the process of purchasing products/resources for your home. In the context of CE, the customer has the role of purchasing products/resources (e.g. food, energy, water, clothing, household tools, electrical and electronic equipment) with minimal environmental impact, and refraining from purchasing when possible (Shevchenko et al., 2023).
2.1. Please indicate the degree of importance attached to the following situations:
"When you buy a product/resource, do you think it is important..."

	1 Not important at all	2 Of little importance	3 Of average importance	4 Very important	5 Absolutely essential
2.1.1. Acquiring eco-labelled products?	□	□	□	□	□
2.1.2. Reject/avoid products produced through child labour or in other abusive and objectionable ways?	□	□	□	□	□

2.1.3. Search for the shop with the least negative environmental impact (with a recognised environmental certification)?	□	□	□	□	□
2.1.4. Search for the shop with the least negative social impact (with a social responsibility certification)?	□	□	□	□	□
2.1.5. Looking for the product in the form of a service?	□	□	□	□	□
2.1.6. Looking for electrical or electronic products with the best performance in the energy certificate?	□	□	□	□	□
2.1.7. Seek out locally produced foods/food products?	□	□	□	□	□
2.1.8. Reject/avoid products with excessive packaging or packaging quantities where possible?	□	□	□	□	□
2.1.9. Look for bulk products or with reduced packaging quantities if packaging is unavoidable?	□	□	□	□	□
2.1.10. Looking to buy second-hand rather than new products?	□	□	□	□	□
2.1.11. Trying to buy repaired products instead of new ones?	□	□	□	□	□

2.1.12. Seek to purchase refurbished/reconditioned products (e.g. an old product that has been upgraded to current quality standards) rather than new ones?	□	□	□	□	□
2.1.13. Try to buy "remanufactured" products (made from parts of another product with the same function) rather than new ones?	□	□	□	□	□
2.1.14. Try to buy "re-purposed" products (products that have acquired a new function) rather than new ones?	□	□	□	□	□
2.1.15. Try to buy products made from recycled materials rather than new ones?	□	□	□	□	□
2.1.16. Try to buy recyclable products or products that can be dismantled?	□	□	□	□	□
2.1.17. Seek to purchase the product in its dematerialised format, where possible?	□	□	□	□	□
2.1.18. Try to buy the product with the longest possible durability?	□	□	□	□	□
2.1.19. Look for reusable products, rather than single-use items?	□	□	□	□	□
2.1.20. Look for products that can be shared, when bought together?	□	□	□	□	□

2.1.21. Seek to rent the product rather than own it?	□	□	□	□	□
2.1.22. Seek dietary alternatives with better environmental performance?	□	□	□	□	□
2.1.23. Seek to buy foods that partially replace animal-based consumption?	□	□	□	□	□
2.1.24. Try to satisfy the residence's energy needs through renewable sources?	□	□	□	□	□
2.1.25. Try to buy products that minimise energy consumption needs without losing thermal comfort?	□	□	□	□	□
2.1.26. Try to buy products that increase the durability of the main product?	□	□	□	□	□
2.1.27. Look for multifunctional products, rather than one product for each function?	□	□	□	□	□
2.1.28. Try to buy products with a money-back guarantee?	□	□	□	□	□

2.2. If you answered positively to question 2.1.10. "Try to buy second-hand rather than new products", which of these products did you buy second-hand?
□ Electrical and/or electronic equipment
□ Vehicle(s)
□ Clothing and/or other textile products
□ Home furnishings (e.g. sofa, chairs, tables)
Other(s) _____
2.3. Do you think it is important to stop or avoid purchasing a product or service or to reduce consumption in general for environmental or social reasons (e.g. avoid/reduce the consumption of animal products or the frequency of car and air travel)?
□ Absolutely essential
□ Very important

□ Of medium importance
□ Not very important
□ Not at all important
2.4. If you have comments on other good procurement practices you have adopted, please write here:
_____
_____

_____
3. 'User' in a circular economy
This section aims to understand the level of importance you attach to Circular Economy (CE) strategies that can be implemented as an user, namely in the use of products/services. In the context of CE, the user has the role of carefully using and maintaining the product, seeking technical and repair services, and selling or donating the products if they are no longer needed (Shevchenko et al., 2023).
3.1. Please indicate the degree of importance attached to the following situations:
"As an user of a product/resource, do you think it is important..."

	1 Not important at all	2 Of little importance	3 Of average importance	4 Very important	5 Absolutely essential
3.1.1. Use the product in the method that allows the greatest economy of resources (for example, use the washing machine when it is full and whenever possible with the lowest temperature)?	□	□	□	□	□
3.1.2. Avoid/reject using the product if there is a more sustainable alternative (e.g. avoid using the printer if it is possible to scan the document; use the bicycle, walk, or use public transport instead of own car where possible)?	□	□	□	□	□
3.1.3. use the product in the most 'use-intensive' way possible (e.g. share the tools with family, friends, or	□	□	□	□	□

neighbours, rather than each purchasing their own)?					
3.1.4. Save leftovers for consumption at another time, when possible, rather than discarding them?	□	□	□	□	□
3.1.5. Repair the product or purchase a repair service, rather than disposing of it when necessary?	□	□	□	□	□
3.1.6. Renovate/recondition the product or purchase a renovation/reconditioning service (e.g. re-upholster a sofa) instead of discarding it?	□	□	□	□	□
3.1.7. Remanufacture the product or acquire a remanufacturing service instead of discarding it (e.g. use parts of a product that has been discarded or that you intend to discard)?	□	□	□	□	□
3.1.8. 'Repurpose' the product or purchase a service that allows you to 'repurpose' it, rather than discard it (e.g. turn an old t-shirt into a cleaning cloth, rather than discard it)?	□	□	□	□	□
3.1.9. Use the land of your residence to produce your	□	□	□	□	□

food, when possible?					
3.1.10. Sell or donate the product, rather than dispose of it, if it is still in good condition and able to fulfil its function?	□	□	□	□	□

3.2. If you have comments on other good practices in product/resource use and maintenance that you have adopted, please write here:

_____

_____

_____

4. "End-of-life product holder" in a circular economy

This section aims to understand the activities you practice as an end-of-life product holder. In the ambition of the Circular Economy (CE), the individual should dispose of the product in a timely manner and use the most appropriate final destination channel (Shevchenko *et al*., 2023).

4.1. Please indicate the degree of importance attached to the following situations:
"When disposing of a product, do you find it important..."

	1 Not important at all	2 Of little importance	3 Of average importance	4 Very important	5 Absolutely essential
4.1.1. Give priority to the use of recycling containers, where appropriate, rather than the undifferentiated waste containers (e.g. use the recycling container for plastic when you want to dispose of plastic rather than the undifferentiated waste container)?	□	□	□	□	□
4.1.2. Give priority to sending organic waste (e.g. food scraps, plant pruning's) for composting, rather than using the undifferentiated waste container?	□	□	□	□	□

4.1.3. Give priority to using a container or special waste collection service rather than disposing of the waste in a public place (e.g. using a container rather than leaving the waste in the street, beach, park, library)?	□	□	□	□	□
4.1.4 Do you separate your waste at home?	□	□	□	□	□

4.2. If you have comments on the timely disposal of a product and the use of other good disposal practices you have adopted, please write here:

_____
_____
_____
_____

Appendix C – Semi-structured interviews guide

Introduction: Thank you for voluntarily participating in this interview on the evaluation of the household circular economy self-assessment tool.
The purpose of this interview is to collect information on the use of the self-assessment tool, understand whether the indicators are clear and adequately communicate circular economy progress.
Your participation in this study is very important but completely voluntary, and you can withdraw from the questionnaire at any time, as well as request correction or cancellation of data already provided.

1. Personal Information

- What is your age group?
- What gender do you identify with?
- What is your level of education?
- In what type of residence do you live?
- How many people live in your household?
- Are you familiar with the concept of circular economy?

2. Evaluation of the self-assessment tool

After using the self-assessment tool,

- Were you able to use the tool?
- Is it easy to use?
- Do you find it useful?
- Did you find the indicators easy to understand? If not, which were the most difficult to interpret?
- What would make the indicator(s) easier to understand?
- While using the self-assessment tool, were you able to reflect on the actions you take as (i) customer, (ii) user and (iii) end of life product holder? If yes, will you consider implementing circular economy practices in your household?

Appendix D – Self-assessment tool

HCE dimension	Product/resource	Question	Answer
General information		Where do you live?	Country name

		What is your age group?	>64; 55-64; 45-54; 35-44; 25-34; 15-24; <15
		What gender do you identify with?	Male; Female; Non-binary; Other; Prefer not to answer
		What is your highest completed education?	PhD; Master; Bachelor; Secondary school; Middle School; Primary School
		How many people do you live with?	>4; 4; 3; 2; 1; 0
		What type of house do you live in?	Single-Family; Semi-Detached; Multifamily; Town home; Apartment; Condominium; Co-op; Tiny home
		What is the approximate surface area of your house (m^2)?	>400; 301-400; 201-300; 101-200; 51-100; <50
		Are you familiarized with the concept of circular economy?	Yes; No
Customer	Food	How often do you procure?	Almost always; Often; Sometimes; Seldom; Never
	Eggs		
	Yoghurt		
	Cheese		
	Plant based milk		
	Milk		
	Soy-based substitutes		
	Beef meat		
	Pork meat		
	Poultry meat		
	Fresh seafood		
	Shelf-stable seafood		
	Pasta		
	Cereal grains		
	Biscuits and cakes		
	Chocolate		
	Pre-prepared meals		
	Bread		
	Bottled mineral water		
	Coffee		
	Tea		
	Beer		
	Wine		
		How often did you acquire locally produced foods?	Almost always; Often; Sometimes; Seldom; Never; I don't know

		How often did you reject food produced in socially irresponsible ways?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		How often did you reject food products with excessive packaging?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		How often did you acquire these products in bulk?	Almost always; Often; Sometimes; Seldom; Never; I don't know
	Electric and electronic products	How many do you own, currently?	>4; 4; 3; 2; 1; 0
	Refrigerator + freezer		
	Additional freezer		
	Air conditioning system		
	Oven		
	Laptop		
	Coffee maker		
	Kettle		
	Dishwasher		
	Washing machine		
	Tumble dryer		
	Tv screen		
	Vacuum cleaner		
	Hair dryer		
	Mobile phones		
	Vehicle		
	Moped or motorcycle		
	Heat pump		
	Radiator		
	Microwave		
	Stove		
	Printer		
		How often did you reject electric or electronic products produced in socially irresponsible ways?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		How often did you reject electric or electronic products with excessive amounts of packaging?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		What percentage of these products were acquired to increase your energy efficiency?	%
		What percentage of these products were acquired in second-hand?	%

		What percentage of these products were produced with recycled material?	%
		What percentage of these products are recyclable?	%
		What percentage of these products are dismantlable?	%
		What percentage of these products were acquired with durability as a priority?	%
		What percentage of these products were co-acquired?	%
		What percentage of these products have a take-back policy?	%
		Did you acquire a product to increase the longevity of another product?	Yes; No
		How often did you acquire the locally produced version of these products?	Almost always; Often; Sometimes; Seldom; Never; I don't know
	Clothing	How many did you procure?	>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0
		Waterproof shoes	
		Sport, leisure, or fashion shoes	
		T-shirts	
		Blouses	
		Trousers	
		Jeans	
		How often did you reject electric or electronic products produced in socially irresponsible ways?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		How often did you reject electric or electronic products with excessive amounts of packaging?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		What percentage of these products were acquired in second-hand?	%
		What percentage of these products were	%

		produced with recycled material?	
		What percentage of these products are recyclable?	%
		What percentage of these products were acquired with durability as a priority?	%
		What percentage of these products have a take-back policy?	%
		How often did you acquire the locally produced version of these products?	Almost always; Often; Sometimes; Seldom; Never; I don't know
	Other products	How many times do you procure?	>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0
	Newspapers		
	Books		
	Cosmetic products		
	Hygiene products		
		How many do you own, currently?	>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0
	Kitchen items		
	Bicycle		
	Couch		
	Chairs		
	Tables		
	Desks		
	Beds		
		How often did you reject electric or electronic products produced in socially irresponsible ways?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		How often did you reject electric or electronic products with excessive amounts of packaging?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		How often did you acquire these products in bulk?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		What percentage of these products were acquired in second-hand?	%
		What percentage of these products were produced with recycled material?	%

		What percentage of these products are recyclable?	%
		What percentage of these products were acquired with durability as a priority?	%
		What percentage of these products have a take-back policy?	%
		How often did you acquire the locally produced version of these products?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		What percentage of these products are re-usable, instead of single use?	%
		Did you acquire a product with its multifunctionality in mind?	Yes; No
	Housing	Total energy consumption (kWh)	>10 000; 8 001-10 000; 6 001-8 000; 4 001-6 000; 2 001-4 000;0-2 000; I don't know
		Renewable energy consumed (%)	%
		Level of thermal comfort	Almost always; Often; Sometimes; Seldom; Never
		Water consumption (m^3)	>120; 101-120; 81-100; 61-80; 41-60; 21-40;1-20; 0
		Rainwater harvested (m^3)	>120; 101-120; 81-100; 61-80; 41-60; 21-40;1-20; 0
		Water re-used (m^3)	>120; 101-120; 81-100; 61-80; 41-60; 21-40;1-20; 0
		Wastewater recycled (m^3)	>120; 101-120; 81-100; 61-80; 41-60; 21-40;1-20; 0
		Access to basic sanitation	Yes; No
User		When you're using a product (e.g. dishwasher), how often do you use it in the most energy saving method?	Almost always; Often; Sometimes; Seldom; Never; I don't know

		When you're using a product (e.g. dishwasher), how often do you use it in the most water saving method?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		When doing your daily activities (e.g. commuting), how often do you use public transportation?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		When doing your daily activities (e.g. commuting), how often do you use a bicycle?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		When doing your daily activities (e.g. commuting), how often do you go by foot?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		When doing your daily activities (e.g. commuting), how often do you carpool?	Almost always; Often; Sometimes; Seldom; Never; I don't know
		What percentage of your food leftovers do you consume?	%
		How many times do you procure a repairing service or do it yourself?	Service acquisition: [>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0]; Did it myself: [>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0]
		How many times do you procure a refurbishing service or do it yourself?	Service acquisition: [>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0]; Did it myself: [>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0]
		How many times do you procure a remanufacturing service or do it yourself?	Service acquisition: [>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0]; Did it myself: [>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0]
		How many times do you procure a repurposing service or do it yourself?	Service acquisition: [>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0]; Did it myself: [>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0]
		How many products (type of product) do	>25; 20-25; 15-19; 10-14; 5-9; 1-4; 0

		you produce yourself (e.g. gardening vegetables, producing own cosmetics)?	
		How often do you donate products in a good condition and able to fulfil its function, instead of discarding?	Almost always; Often; Sometimes; Seldom; Never
		How often do you sell products in a good condition and able to fulfil its function, instead of discarding?	Almost always; Often; Sometimes; Seldom; Never
	Electric and electronic products	How many hours did you use the?	>60; 45-60; 30-44; 15-29; 1-14; 0
	Refrigerator + freezer		
	Additional freezer		
	Air conditioning system		
	Oven		
	Laptop		
	Coffee maker		
	Kettle		
	Dishwasher		
	Washing machine		
	Tumble dryer		
	Tv screen		
	Vacuum cleaner		
	Hair dryer		
	Mobile phones		
	Vehicle		
	Moped or motorcycle		
	Heat pump		
	Radiator		
	Microwave		
	Stove		
	Printer		
EoL product holder		How often do you recycle?	Almost always; Often; Sometimes; Seldom; Never
		How often do you compost?	Almost always; Often; Sometimes; Seldom; Never
		How often do you litter?	Almost always; Often; Sometimes; Seldom; Never
		In your household, do you separate your waste per type of waste?	Yes; No

Appendix E – Interviewees characteristics

		No. of respondents	% of respondents
Gender	Male	10	47.6%
	Female	10	47.6%
	Nonbinary	1	4.8%
Age group	15 - 24 years	8	38.1%
	25 - 34 years	7	33.3%
	35 - 44 years	1	4.8%
	45 - 54 years	1	4.8%
	55 - 64 years	4	19.0%
Education	Non-university	2	9.5%
	Bachelor	14	66.7%
	Master	5	23.8%
Type of housing	Apartment	9	42.9%
	House	12	57.1%
Household dimension (no. of individuals)	1	2	9.5%
	2	5	23.8%
	3	9	42.9%
	4	3	14.3%
	> 4	2	9.5%
Familiarity with the concept of CE	Yes	9	42.9%
	No	12	57.1%

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The on-going project FLOWTEX (Dynamic FLOW diagrams for circular TEXtile) in the textile district of Prato (Italy): implementation and future perspectives

LEONARDO BORSACCHI*, GABRIELE FELIGIONI°, ALESSANDRO FERRINI^, CAROLINE LOCKWOOD§

*°^§ *ARCO (Action Research for CO-Development) – PIN, University of Florence, Piazza G. Ciardi 25 – 59100 Prato, Italy*

**leonardo.borsacchi@pin.unifi.it* *ORCID 0000-0001-6334-6146;*
°gabriele.feligioni@arcolab.org; *^alessandro.ferrini@apptecsrl.com;*
cello.lockwood@fulbrightmail.org

Corresponding author: Leonardo Borsacchi leonardo.borsacchi@pin.unifi.it

ABSTRACT

The textile sector is one of the most impactful at the global level. It is responsible for a significant amount of CO_2 emissions and waste generation, with a strong impact on climate change. The Italian textile district of Prato is one of the largest Italian industrial districts and one of the most important textile and clothing production centres in the world. Since the post-war period, textile waste management has represented one among the main drivers for textile district development: recovery and recycling of natural fibres from rags and used clothes were the basis for the Prato's yarn and textile industry. Prato has been always a model of innovation in this sector having historically based its industrial fortune on the reuse of waste from the textile process and on the reuse of second-hand clothing from all over the world. The evolution of materials technologies, together with the progressively changing market demands have led to a profound transformation both in industrial processes and in the use of materials and the district is nowadays involved in new paradigms of digitalisation and sustainability. To comply with sales specifications and as evidence within certification's schemes, enterprises are carrying out the Life Cycle Assessment of its production process. In many cases, however, these studies could be unrepresentative of the actual environmental impacts associated with the steps in the production process, which is not standardized and involves a great deal of variability in starting materials and in the combination of production steps. This paper presents the preliminary results of an action-research, still in progress, called FLOWTEX (Dynamic FLOW diagrams for circular TEXtile). The project is financed by national and local funds, aiming to support technological transition of the textile sector. The action-research involves four enterprises, dealing with textile recycling, representing different steps in the chain. The proposed innovation is the creation of an IT platform capable of combining process data to: i) adopt digital solutions for data collection and process and product control by enterprises; ii) obtain effective information (i.e., environmental indicators) from the production steps, in order to return flowcharts and to get an inventory database to carried out future LCA. The data acquisition and calculation model are carried out by dialoguing with the enterprise's ERPs. so that information on the specific process/product is returned in real time, or by manual input. The pilot platform can be implemented in the future to carry out comprehensive LCA studies that will be able to combine inventory and process data. At the district level, the implementation of the technology along the supply chain, creating industrial symbiosis phenomena, could make it more sustainable, generating good circular practices and reducing environmental impacts. The project covers primarily SDG 12 (Responsible consumption and production), but it contributes also to implementing SDGs 8 and 9. This study will show the critical issues that have emerged and the prospects that will be addressed and developed in the continuation of the project.

Keywords: circular economy; textile; recycling; IT solutions; sustainable supply chain

INTRODUCTION

This paper presents the preliminary results of an action-research, started in 2022 and still in progress, called FLOWTEX (Dynamic FLOW diagrams for circular TEXtile). The project is financed under the framework of PRISMA— an allocation of national and local funds which aim to support the technological transition of the textile sector. The action-research involves four enterprises in the textile district of Prato, Italy. The involved enterprises deal with textile recycling and they represent different steps in the chain. This paper will illustrate the critical issues that have emerged as well as the prospects that will be addressed and developed in the continuation of the project. At the district level, implementating the proposed IT solution along the supply chain could effectively measure the level of sustainability reached by recycled textile process, quantify reduced environmental impacts, as well as analyse the adoption of circular practices.
PRISMA - PRato Industrial SMart Accelerator - aims to create infrastructure dedicated to aiding technology transfer activities for enterprises based in Prato. PRISMA's activity is to investigate and support the innovative potential of emerging technologies - Internet of Things, Artificial Intelligence, Blockchain and 5G - and apply them to the textile-fashion and made in Italy sector. The project, funded by the Italian Ministry of Economic Development, aims to foster the creation and acceleration of new businesses in this field and further transfer the developed solutions to companies in the sector. PRISMA has the overall objective of making Italian textile-fashion—the globally predominant representative of Made in Italy — more competitive and efficient by generating new businesses and skilled jobs through technology transfer. The specific objectives of the project include but are not limited to: the establishment of a new technology transfer center called "PRISMA House of Technology"; the implementation of joint research and experimentation (R&D) projects between universities, research centers and companies for the development of new solutions based on emerging technologies and 5G for the benefit of Made in Italy; the creation and acceleration of start-ups in the areas of Internet of Things, Artificial Intelligence and Blockchain to support the textile-fashion sector; technology transfer to manufacturing enterprises in support of innovation, competitiveness and employment.
The general objective of the FLOWTEX project is to carry out experimental research through the creation of an innovative information technology platform capable of combining process data and their characterizing environmental impacts, returning flowcharts and life cycle studies. For this study the focus will be the production process involving the mechanical recycling of wool to produce new fabric.

LITERATURE REVIEW

Since the post-war period, Prato, the third largest city in Central Italy, the textile waste management has represented one of the main drivers of the textile district development: recovery and recycling of natural fibre from rags and used clothes were the basis of Prato's yarn and textile industry. The Prato industrial district has been extensively studied in previous literature (Becattini, 2001; Smyth & French, 2009; Dei Ottati, 2014, 2018; Lan & Zhu, 2014; Lazzeretti & Capone, 2017; Ong & Freeman, 2017). Prato has always been a model of innovation in textile recycling having historically based its industrial fortune on the reuse of waste from the textile process and from second-hand clothing. Nowadays, Prato is considered one of the largest industrial districts in Italy, the largest textile center at the European level and one of the world's most important hubs to produce woolen yarns and fabrics. According to the local Chamber of Commerce, in 2022 the active enterprises in the Province of Prato consists of 6336, divided into 1738 in Textile and 4598 in Clothing. It should be noted that the textile district of Prato includes not only municipalities in the province of Prato (Municipalities of Cantagallo, Carmignano, Montemurlo, Poggio a Caiano, Prato, Vaiano, Vernio) but also some neighbouring municipalities in the provinces of Pistoia and Florence. Prato is a reference area for ready-to-wear fashion and made-in-Italy clothing, to such an extent that "Prato ready-to-wear fashion" is renowned throughout Europe. Table 1 shows specific data on the numerosity of Textile and Clothing firms in the municipalities of Province of Prato.

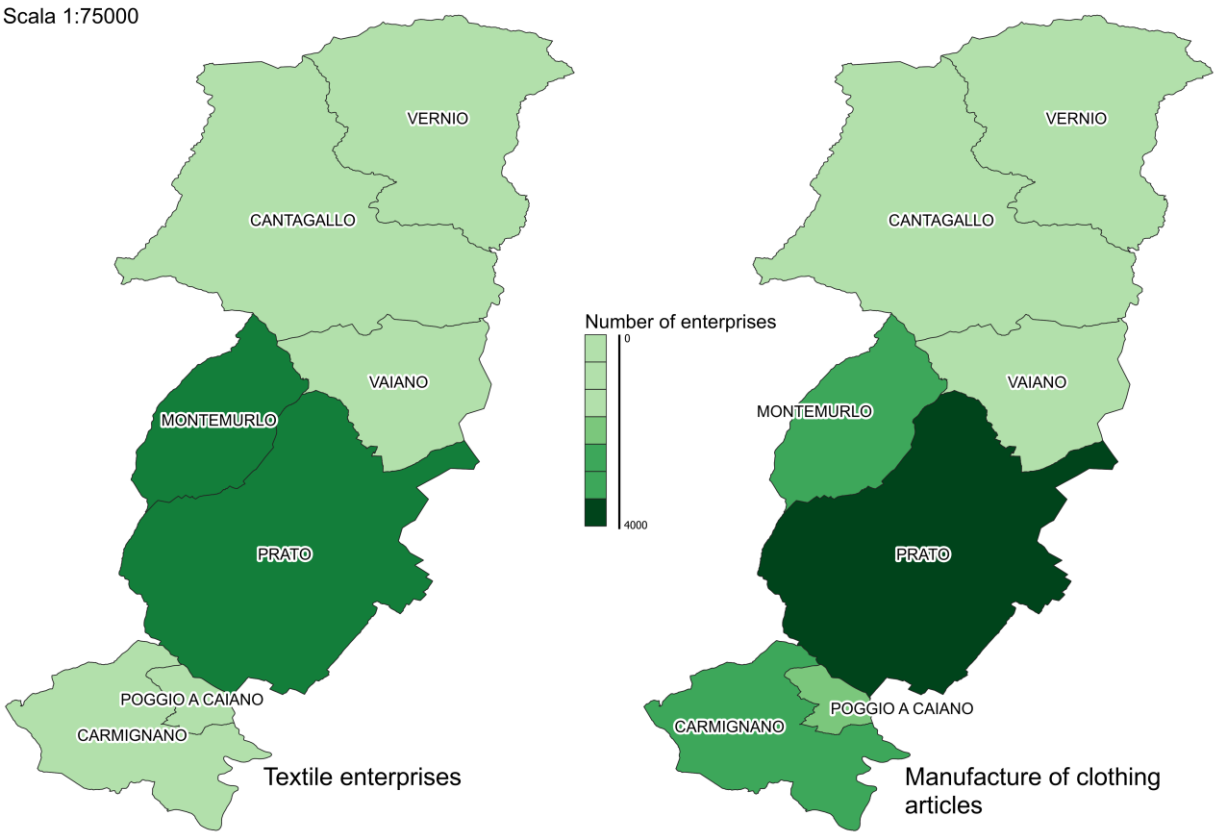
TABLE 1. Active enterprises in Textile-Clothing in the Province of Prato

	Textile enterprises	Manufacture of clothing articles; manufacture of leather and fur articles	TOTAL enterprises in Textile-clothing (of which craft enterprises)	TOTAL enterprises in the municipality (of which craft enterprises)
Cantagallo	26	1	27 (10)	204 (73)
Carmignano	84	220	304 (209)	1,333 (595)
Montemurlo	473	259	732 (462)	2,459 (1046)
Poggio a Caiano	31	123	154 (115)	906 (425)
Prato	1,024	3,973	4,997 (3055)	23,058 (7,339)
Vaiano	83	20	103 (52)	699 (269)
Vernio	17	2	19 (15)	346 (138)
TOTAL	**1738**	**4598**	**6336 (3918)**	**29005 (9885)**

Source: Authors' elaboration from official statistics provided by Chamber of Commerce of Pistoia and Prato (2022)

Prato's production system is characterized by a plethora of production stages divided among numerous micro and small-medium enterprises— more than half of which are craft enterprises. For these reasons, the Prato textile-clothing district constitutes the main point of reference for sourcing for many international fashion brands: quality, technique, speed, creativity, flexibility, highly specialized services, and ad hoc infrastructures are all essential competitive factors for a production system increasingly based on excellence and linked to the luxury supply chain (as also demonstrated by the high incidence of "Made in Prato" in the products of major global brands and at international fashion and haute couture fairs) (Borsacchi et al., 2018). According to data outlined in Table 1, there are more Textile enterprises than Clothing enterprises in the municipalities of the Val di Bisenzio (Cantagallo, Vaiano, Vernio) and the municipality of Montemurlo. For centuries, the Bisenzio Valley has been the ideal location for the area's first textile mills, which could use the motive waterpower of the Bisenzio River. Many companies initially located in Prato have decided to move to the municipality of Montemurlo, both for reasons of affordability of property leases and for proximity to some of the contextual services present. If we consider the municipalities of Prato, Poggio a Caiano and Carmignano, however, we notice a prevalence of Clothing sector enterprises (see Figure 1). It should be noted that these enterprises are almost Chinese-owned, while Textile enterprises remain almost exclusively Italian-owned. In fact, new players have entered the textile industry context: since the '90s a Clothing district, handled mainly by the Chinese community, has settled in Prato's industrial areas, siding the traditional Textile activity. Chinese-owned firms that are characterized by a high dynamism (Irpet, 2015) and widespread use of illegal work and non-compliant with safety and taxation (Dei Ottati, 2014). Entrepreneurs and employers' associations expressed the need to assess the compliance of production processes with applicable laws and regulations in order to pursue improvement (Biggeri et al., 2022) and build stronger relationships within the local community based on transparency and trust (Borsacchi et al., 2016). Nowadays, Textile enterprises produce fabrics for the garment industry: upholstery textiles, yarns for the knitting industry, knitted products and garments, non-woven fabrics, and special textiles for industrial uses. The evolution of materials technologies, together with the progressively changing market demands, has led to a profound transformation of both industrial processes and materials use (Borsacchi et al., 2018).

FIGURE 1. Distribution of textile/clothing enterprises in the municipalities of the province of Prato



Source: Authors' elaboration from official statistics provided by Chamber of Commerce of Pistoia and Prato (2022)

At the global level, the emerging demand for sustainability and circularity in supply chain management and commodity production pushes for organizations to be held responsible for their environmental and social performances. The transition to circular economy can represent a challenge, especially for organisations whose processes, technologies and supply chains were initially structured as a linear model. Transformation requires a set of investments in appropriate technologies and processes such as training or reskilling workers. According to the principles of circularity, there is a broad range of potential uses of by-products as second raw materials. Despite this, there may be technological, economic, or legislative constraints that hinder the use of by-products. Today, the reasons for the sustainability suggest to rapidly switching to the circular paradigm (Ghisellini, Cialani, & Ulgiati, 2016). The textile industry is characterized by the consumption of high levels of resources like water, energy, chemicals, and fibre materials, placing high pressure on the environment. Since the end of the 20th century, textile manufacturers and end-users are committed to public and private entities in multiple initiatives to reduce textile waste and to promote textile recycling and re-use. Europe rejects 6 million tons of garments per year and only 25% are recycled (WRAP, 2017). For instance, sustainability-driven research and innovation will primarily concern the production processes and product development and addresses six key topics: i) recycling in textile and waste disposal; ii) water consumption and energy saving, sustainable company organizations; iii) new sustainable chemistry, including reduction of chemical substances; iv) smart textiles and new ways of production; v) eco-creativity, natural fibres, short value chains; vi) new materials and new applications (RESET, 2018). The European Union, with key acts such as the European Green Deal of November 2019 and the New Circular Economy Action Plan of March 2020, has defined a strategy that puts the values and principles of circularity and sustainability at the centre of economic regulatory policies. and sustainability. Within this strategy, textiles are the object of significant attention on both the production and consumption sides.

Recycling in the textile-fashion sector can take place through different methodologies: mechanical, chemical, and thermal recycling. Each method applies specific technologies, uses different sources, and results in various impacts on the environment. According to a recent study published by the European Commission, mechanical recycling is among those with the lowest environmental impact. The environmental impacts of other technologies, such as thermal recycling, require further investigation (European Commission, 2022).
Fashion brands have long since begun to add increasingly stringent environmental requirements into their purchasing specifications, most often going beyond the applicable mandatory obligations. These specifications also include additional social responsibility requirements. Textile companies are often also required to provide life cycle studies of their productions. While based on a standardized methodology, these studies show some reliability limitations when referring to the typical textile production process. In fact, the results from individual Life Cycle Assessment (LCA) studies have only limited significance for a life cycle assembly of textiles since there are too many diverging parameters particularly in quality aspects. Even the same fabric produced with different process technology, or on different equipment or with different formulas, will result in different impacts (Nieminen et al., 2006).
In the case of the production process in Prato, the district's typical horizontal structure of dividing the different stages between different micro and small-medium enterprises, and the resulting difficulty of acquiring timely data, is relevant to the LCA study as it requires unique tactics for data collection. Added to this is the impossibility of standardizing the flexible production. Each item can thus be made through a multiplicity of technological and production combinations, each of which is the responsibility of a specific enterprise that is part of the supply chain. Thus, it is possible to understand the limitation of an LCA study, which, regardless of the quality of the data collected, only can refer to a single specific item. Collection of high-quality data on environmental impact of fibre and textile production is the key factor in the conduction of an effective LCA study. The results of individual LCA studies have a limited meaning to that whole studied, i.e., they cannot assume a general meaning, since too many parameters can diverge in the process phases, in the materials employed, and in the use of resources (energy, water, etc.). Therefore, an LCA analysis done for the same fabric but produced with different technologies and inputs will give a different result (Bacci, 2009). According to COST 628 Action, the following indicators for LCA in textile have been identified (Table 2):

TABLE 2. Indicators for LCA in textile

Indicators
1. Energy consumption (Mj/kg)
• Fiber production
• Spinning
• Weaving
• Wetting
2. Transportation (km/kg)
3. Raw material (g/kg)
• Renewable
• Not renewable
4. Water consumption
• Fiber production
• Industrial processing
5. Industrial emissions to air (g/kg)
• NO_x
• SO_x
• CO_2
• VOC
• HC
• Dusts
• Fine dusts

6. **Industrial emissions to water (g/kg)**
    - pH
    - °C
    - COD
    - P total
    - K total
    - Cl^-
    - AOX extension
    - Cr
    - Cr (Vl)
    - Cu
    - Zn
7. **Use of dangerous substances**
    - Fiber production
    - Industrial processing
8. **Work environment**
    - Noise level
    - Temperature
9. **Recyclability (%)**
10. **Product quality**

Source: COST 628 (2006)

Basing their expertise on the mechanical recycling of used rags and used clothing, especially woolen ones, companies in the Prato textile district need to demonstrate the sustainability of their production processes using reliable tools. For the reasons mentioned above, LCA studies may not be suitable. As well as being laborious for the data collection phase and expensive, the LCA studies require specialists for their implementation. By combining the needs of enterprises and the elements of research and innovation, an IT solution was thought to be developed through action-research and financed by the PRIMA programme.

METHODOLOGY

The action-research is involving four textile organisations located in Prato which represent a typical supply chain from textile waste sorting to the finished fabric. COM.I.STRA is a textile company specializing in the regeneration of wool fiber and the marketing of fabrics made mainly from recycled fibers. The FLOWTEX project aims to incorporate the entire recycled supply chain: COM.I.STRA participates for the stages from the selection of used clothes and preparation to the mechanical recycling of the fiber, to the design and sale of fabrics and yarns for the fashion and home furnishing sectors. The other partners in the project, cover the other stages of the supply chain: Filatura Omega S.r.l. for carding and spinning; Lanificio Nova Fides S.P.A. for weaving; Tintoria Martelli S.r.l. for the dyeing stages on new and regenerated fibers and on finished garments.

The current action-research project involves a strong collaboration and communication with the relevant organizations. The development and implementation of an innovative IT platform involves the following tasks:

i) gathering and organizing process and product data from participating enterprises and related supply chain entities,
ii) creating the pilot platform using Python and the Django web framework,
iii) collecting data from external databases through API integration and allowing authorized users to manually enter missing data,
iv) managing the master records of participating organizations with different levels of authorization, and
v) creating and managing transformation units for each step of the process necessary for the creation of recycled products.

The platform will be thoroughly tested there are plans to initiate discussions with accredited certification bodies to validate the platform as a recognized tool for standardised management systems. This task involves

cross-cutting collaboration with local government, employer associations, trade unions, and environmental associations.

RESULTS AND DISCUSSION

As mentioned above, the Prato district is currently involved in the new paradigms of digitization and sustainability on which the competitive advantage of companies and supply chains will be based. The variability of inputs and the modularity of phases and productions characterizing the district, including those made from recycled materials, make the supply chain flexible and responsive to the demands of principals and customers (constituting a strength of the district), but make life cycle assessment (LCA) studies unrepresentative. However, LCA information is required both when complying with sales specifications and as evidence for obtaining and maintaining industry certifications. Among the most widely used tools in recycled textile supply chains, including at the request of fashion brands, is Global Recycle Standard (GRS) certification.

In 2021, 214 textile organisations were engaging with GRS certification in the province of Prato (authors' elaboration from Global Recycle Standard database). Many of them are regrouped in the non-profit association AS.T.R.I. (Italian Textile and Recycling Association) which was initiated in order to increase the value of regenerated textiles made in Prato. The association cooperates with international societies for ecological sustainability. After engaging in ongoing discussions with entrepreneurs in the textile recycling sector, further challenges pertaining to LCA studies within the context of Prato's district have come to light. These challenges can be summarized as follows: Firstly, the current scope of LCA studies is constrained to specific product families, disregarding the variability present in recycled material quality and the intricacies of various production processes. Secondly, there exists a notable deficiency in the integration between LCA evaluations, process flowcharts, and the GRS documentation system. This lack of cohesive linkage undermines the effectiveness of comprehensive sustainability assessments. Thirdly, the prevalence of fragmented supply chains compels multiple organizations to maintain their own distinct GRS documentation systems. This situation contrasts with the potential for streamlining operational and documentation procedures across diverse entities, fostering greater efficiency and collaboration. Lastly, smaller entities within the supply chain exhibit inadequate utilization of digital solutions for overseeing processes and maintaining product quality. This deficiency inhibits the realization of optimal performance and control, underscoring the need for wider adoption of digital tools throughout the sector.

In technical specifications, brands have begun to ask for more information regarding the environmental sustainability of productions. With the FLOWTEX platform, organisations will be able to have this information for each item automatically with reliable and specific production data.

To regenerate wool several processes, have to be carried out. To obtain new recycled fiber the initial stages of the supply chain are crucial. The most important stages are: i) Collection; ii) Selection; iii) Carbonisation; iv) Rag-tearing. Fabric scraps, both traditional textile and knitwear, are systematically collected and then grouped by typology and origin. Scraps are firstly sorted by quality (considering the type of materials and fineness) fibres' properties, and the provenience of the garments (paletot, suit, woman-man etc.., knitwear, underwear). Later they are grouped by colour shade. Selected wool scraps are carbonized to remove all cellulose parts/fibers. Carbonization is a chemical process performed on scoured wool or combining wastes to eliminate vegetable matter which is treated with mineral acid (this has no effect on animal fibres). After carbonisation, scraps are subjected to the rag-tearing process. This process is employed to reclaim fibres from rags, and it consists in tearing /fraying fabric scraps and then grinding them into staples suitable for subsequent manufacturing steps. Rag-tearing can be done wet or dry. Materials obtained by rag-tearing operation are mixed according to quality and colour of the destination (ensimage procedure). The material is then passed into a machine called "Lupa" (transl. wolf) with long and sharp metallic teeth that frays the scraps once more. This step is propaedeutic for the carding process. The subsequent stages of spinning, warping, weaving, and finishing take place in the same way as for virgin fibres. In the case of recycled wool, dyeing of the yarn or fabric is generally not necessary.

At the actual stage of the FLOWTEX project, we are pursuing the development of the digital platform. For the design and the implementation of the IT platform under study, process and product data from participating enterprises have been rationalized. In fact, the level of detail to reach is the one of a processing step/activity, often associated with a machine. Considering a piece of machinery as a single processing unit can facilitate in identifying and collecting the environmental data associated with that specific step or activity. The whole production process and its possible combinations and variables should be considered when defining the

processing units. This mapping phase should be extended to the entire supply chain represented by the target enterprises involved. This phase is the one that caused the most delays compared to the timeline initially designed for the project. Data can come from different sources. The cases of data acquisition identified were:
(i) fixed data, contained in a database or in literature.
(ii) fixed data from enterprise's ERP.
(ii) variable data coming from machinery (from automatic detection or by means of sensors).
(iii) variable data from enterprise's ERP.
(iv) variable data added manually by an operator. This feature is intended to keep the usable dataset constantly updated. It will also be useful in situations where the company is poorly digitized (absence of an ERP or impossibility of real-time communication of control and process data).
The pilot platform is developed in Python using the Django web framework which provides basic functionality such as authentication, connection to a database, and other functions useful for service development. The platform enables data collection via API (Application Program Interface) from databases selected during the design phase. The platform will provide APIs to allow other applications to enter data.
As mentioned above, the processing unit is the block that corresponds to a single operation, performed by a machine or a person, within a process. It will be possible to create, through a graphical interface, the process necessary for the creation of recycled products using the previously created processing units. Each enterprise will be able to structure each step according to its needs. For each functional processing unit, the platform will be able to provide information about the materials needed, energy loads, and resources used. This data may be acquired automatically (e.g., taken from ERP, the company's management system) or entered manually and remain stored in the platform's database for later queries. Others may be acquired in real time. In fact, the IT platform will be capable of combining data from the different stages of the production process and the related environmental indicators, returning graphical representations of flowcharts and information to carry out life cycle studies, as consistent and reliable as possible.
With reference to the LCA indicators for textiles shown in Table 2, the indicators associated with the stages/activities (processing units) of collection and sorting, to carding, are shown in Table 3.

TABLE 3. Data collection per step/indicator

	PURCHASE AND TRANSPORT OF RAGS	COLLECTION AND SORTING	RAG-TEARING	"LUPA"	CARDING	…
Energy consumption (Mj/kg)	0	0	0	0	0	…
Fiber production	0	Yes	Yes	Yes	0	…
Spinning	0	0	0	0	Yes	…
Weaving	0	0	0	0	0	…
Wetting	0	0	0	0	0	…
Transportation (km/kg)	Yes	0	0	0	0	…
Raw material (g/kg)	0	0	0	0	0	…
Renewable	0	0	0	0	0	…
Not renewable	0	0	0	0	0	…
Water consumption	0	0	0	0	0	…
Fiber production	0	0	Yes	0	0	…
Industrial processing	0	0	0	0	0	…
Industrial emissions to air			Yes			…
(g/kg)	0	0		0	0	
NO_x	0	0	0	0	0	…
SO_x	0	0	0	0	0	…
CO_2	0	0	0	0	0	…
VOC	0	0	0	0	0	…
HC	0	0	0	0	0	…
Dusts	0	0	0	0	0	…

Fine dusts	0	0	0	0	0	…
Industrial emissions to water			Yes			…
(g/kg)	0	0		0	0	
pH	0	0	0	0	0	…
°C	0	0	0	0	0	…
COD	0	0	0	0	0	…
P total	0	0	0	0	0	…
K total	0	0	0	0	0	…
AOX extension	0	0	0	0	0	…
Cr	0	0	0	0	0	…
Cr(Vl)	0	0	0	0	0	…
Cu	0	0	0	0	0	…
Zn	0	0	0	0	0	…
Use of dangerous substances	0	0	0	0	0	…
Fiber production	0	0	0	0	0	…
Industrial processing	0	0	0	0	0	…
Work environment	0	0	0	0	0	…
Noise level	0	0	0	0	0	…
Temperature	0	0	0	Yes	Yes	…
Recyclability (%)	0	Yes	Yes	Yes	Yes	…
Product quality	0	0	0	0	0	…

Source: Author's elaboration

Once validated, the IT platform be able to combine data to return flowcharts consistent with the production of the produced item. The platform will calculate the environmental loads associated with each phase of the flow using data acquired in real time or entered directly (or drawing on previously stored data) providing a result with a good level of reliability. It will then be possible for the organization to print a report with the specific flowchart of that individual item and the calculation of its environmental loads. This set of data could be also useful as inventory for further LCA studies. In fact, the FLOWTEX platform aims to provide enterprises with a quick and immediate tool providing environmental diagnostics and flowchart representation. This tool is not intended to replace a complete LCA study but instead is intended to be complementary or useful to facilitate the inventory stages.

Such outputs may also constitute evidence in accordance with GRS. A certified organization could potentially use the environmental and process data out from the IT platform for many other purposes. An organization can use data to track the amount of recycled material used in its products, but they can also monitor the environmental impact of their production processes and adjust reduce their carbon footprint. By analysing the data an organization can identify trends and patterns in its environmental practices, leading to continuous improvement. It is important to note that the GRS certification requires organizations to have a system in place for tracking materials throughout the supply chain. Data could contribute to ensure that this system is accurate and transparent. Finally, using reliable environmental and process data can help organizations demonstrate their commitment to sustainable practices, promoting their corporate social responsibility and reputation.

CONCLUSION

The textile district of Prato is involved in the new paradigms of digitalization and sustainability on which the competitive advantage of companies and supply chains will be based. The variability of raw materials and the modularity of production stages that characterize the district make the supply chain flexible and responsive to the demands of customers and fashion brands (constituting a strength of the district). The aim of FLOWTEX is to provide the Prato recycled textile supply chain a new organizational and management tool. The project is still in progress and is expected to be completed by the end of 2023.

Once developed, tested and released, the IT platform, with a standardized calculation methodology, will be able to combine inventory and process data obtained in real time in order to obtain outputs consistent with daily production. In the future, a dialogue may be implemented with other digital platforms developed for the Prato textile district. The potential for technology transfer may also include textile companies not primarily involved in the remanufacturing supply chain. At the level of the Prato district, the implementation of FLOWTEX along the supply chain could make it more sustainable, generating good practices at the level of circular economy and innovation.

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How intensive aquaculture is facing the challenge of the transition to a circular economy: evidence from a literature review.

Cozzolino Maria[1*], Salomone Roberta[2], Mondello Giovanni[3], Gulotta Teresa Maria[4]

[1] *Department of Economics, University of Messina, Piazza Pugliatti 1, 98122 Messina, Italy*
[2] *Department of Economics, University of Messina, Piazza Pugliatti 1, 98122 Messina, Italy*
[3] *Department of Economics, University of Messina, Piazza Pugliatti 1, 98122 Messina, Italy*
[4] *Department of Engineering, University of Messina, Piazza Pugliatti 1, 98122 Messina, Italy*

*Corresponding author's e-mail address: macozzolino@unime.it

Abstract. Aquaculture is a fast-growing agribusiness sector that can help feed the world's population. However, this sector also challenges the sustainability of terrestrial and aquatic resources and ecosystems. Indeed, current aquaculture production methods are not environmentally sustainable in the long term, and more targeted transformations are needed to make aquaculture more sustainable. In this regard, a promising strategy to save resources and reduce the environmental impacts of aquaculture is the circular economy (CE). In this context, this study aims to shed light on how intensive aquaculture is facing the challenge of circular transitioning. A literature review is carried out to examine the empirical CE practices/strategies implemented by aquafarms in scientific literature. In particular, the analysis focuses on identifying the main: a) geographic area where the practices were adopted; b) types of products proposed; c) characteristics of the environmental farmed system; d) which of the 4Rs is used in CE practices. The results show that interest in applying CE practices to the aquaculture sector has grown with the main aim of effectively managing waste and by-products, enhancing them and creating synergies with other sectors. In addition, the analysis highlights that the geographical diffusion of CE practices is not heterogeneous and still limited to specific areas.

1. Introduction

The world population reached 8 billion in 2022 and is estimated to grow to one billion over the next 15 years (FAO, 2022), posing formidable challenges in ensuring secure and affordable food production for the coming years. Aquaculture, which involves the farming of aquatic animals and plants, has the potential to play a crucial role in meeting this challenge and supporting world food supply and guaranteeing nutritional quality (Gephart *et al.*, 2017). Specifically, this article focused on the intensive farming of aquatic organisms, which implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Therefore, intensive aquaculture involves high stocking densities and feeding rates in order to maximise production (FAO, 1998). Although aquaculture has experienced rapid growth, providing 47% of aquatic food for human consumption in 2020 (FAO, 2022), it presents different environmental challenges that should be resolved to reach a more sustainable production. One of the main issues is the high demand for animal protein from wild fish for producing fishmeal and fish oil, which can deplete several natural resources and increase greenhouse gas emissions (Barange *et al.*, 2018).

Further challenges are those related to waste management (such as production and slaughter water) and by-products, as all the raw material, edible or inedible, leftover following the preparation of the main product (such as trimmings, skins, heads, frames, bones with attached flesh, viscera, blood, (Stevens *et al.*, 2018). Therefore, it is necessary to develop farming systems that increase fish production with efficient waste management in order to limit environmental degradation from aquaculture waste and ensure its sustainability

(Dauda *et al.*, 2019). In addition, by producing more with less, aquaculture could become more sustainable and resilient in the face of environmental challenges (European Commission, 2021a).

As the circular economy (CE) is a promising strategy that aims to reduce waste and pollution, keep products and materials in use for a long time and regenerate natural systems, it could be an opportunity in aquaculture to increase its environmental sustainability (Kundu *et al.*, 2022). Indeed, applying CE principles to aquaculture could offer potential solutions to improve its sustainability and resilience. Although aquaculture could represent a key sector for advancing the CE agenda (Regueiro *et al.*, 2022), it has not been included among the economic activities included in the first Circular Economy Action Plan (CEAP1) (European Commission, 2015).

Furthermore, the aquaculture sector faces many challenges and barriers to adopting CE practices. Indeed, its applicability requires the identification of more efficient waste management strategies and more efforts by policy makers to overcome socio-economic, logistical and legislative barriers (Regueiro *et al.*, 2022; Cooney *et al.*, 2023). All of them could undermine the sustainability and competitiveness of the sector. To address these issues, the aquaculture sector must adopt strategies and models to valorise its wastes and by-products, enable it to use resources effectively, and minimise environmental impacts.

In this context, this study carried out a bibliometric and systematic literature review (SLR) of the existing literature on CE and aquaculture to address the following research questions: (1) What are the scholars' interests in the concept of CE in aquaculture? (2) What are the key challenges and opportunities for applying CE principles in practice? To answer these research questions, different data are extracted to identify a potential link between the practical CE options and the possibility of encouraging fish farmers to reduce resource use, reuse, recycle and recover their waste and by-products, consistently with the paradigm of the waste hierarchy. In addition, to identify a correlation with the geographic distribution of CE practices and which areas attracted academic interest, the different countries involved in the analysis were categorised according to the FAO's 27 main fishing areas.

2. Literature Reviews

Aquaculture is a key sector for meeting the growing global demand for seafood, and it has important economic and social benefits (FAO, 2012) However, aquaculture also faces significant environmental challenges, such as weak regulations, poor planning and management, and excessive expansion (Smith *et al.*, 2010; Ahmad *et al.*, 2022). These challenges have resulted in negative environmental impacts, such as waste generation, water pollution, and by-product accumulation (Edwards, 2015; Ottinger, Clauss and Kuenzer, 2016; Stevens *et al.*, 2018). Most of the existing literature has focused on managing these impacts in compliance with waste regulations (Dauda *et al.*, 2019) or adopting best practices and certifications to reduce them (Nhu *et al.*, 2016). Another environmental issue related to aquaculture is the overfishing of wild fish stocks for feed production (Naylor *et al.*, 2002; Huysveld *et al.*, 2013), which has prompted some researchers to propose alternative feed sources based on plant ingredients (Malcorps *et al.*, 2019). But, in this context, there is a lack of studies that explore the potential of the CE to address the environmental challenges of aquaculture in a more holistic and innovative way. Indeed, aquaculture is a sector that can benefit from the CE, which aims to reduce waste, reuse resources, and regenerate natural systems (Campanati *et al.*, 2022). However, most of the existing research on aquaculture focuses on technical aspects, such as improving feed efficiency (Hoerterer *et al.*, 2022). These approaches do not fully capture the CE principles, which also involve redesigning business models, enhancing biological diversity, and restoring ecosystems (Ellen MacArthur Foundation, 2013). Furthermore, aquaculture was largely overlooked in the first Circular Economy Action Plan (CEAP1(Scarlet, 2013)) adopted by the European Union in 2015. It was only in 2019, with the Green Deal (European Commission, 2019), that aquaculture was recognized as a key sector for achieving climate neutrality and environmental sustainability. In 2021, the European Commission (European Commission, 2021b) explicitly included the CE as one of the strategic options for developing a resilient and competitive European aquaculture

3. Methodology

This section outlines the methods employed in conducting a bibliometric and systematic literature review on CE and aquaculture in line with the study's research questions. These methods are chosen because they complement each other. Bibliometric analysis is a quantitative method to evaluate the scientific production

and the impact of a research domain (Donthu *et al.*, 2021). The study used: a) the performance analysis technique to know the number of publications per year, the number of papers per journal, and the journal search topic; b) science mapping for co-words analysis; c) network analysis to quantify and visualise patterns and relationships between scientific publications, helping to identify trends and links between keywords related to specific topics. Meanwhile, a systematic literature review involves identifying, evaluating, and synthesising research findings to summarise similarities and discrepancies of current literature to support evidence-based practice (MacDonald, 2014; MacFarlane, Russell-Rose and Shokraneh, 2022). The Preferred reporting items for Systematic Reviews and Meta-Analysis (PRISMA) protocol (Page et al., 2021) is followed to identify the sample of papers to be reviewed and ensure transparency, consistency, and robustness of the literature review process. The following subsections describe the applied i) search strategies, ii) screening processes and iii) data collected and methods for analysing and reporting data.

3.1 Search strategy

To find relevant papers, the keywords "Circular economy" and "aquaculture" are searched in titles, abstracts, and keywords of documents. The searches were conducted in Scopus and Web of Science in January 2023 using the search queries listed in **Table *14***.

Furthermore, the literature review includes only peer-reviewed articles and reviews, published in English in the last eight years (2015-2022), starting from 2015 when the CEAP1 was published. This is to examine whether, even without a direct and explicit reference to aquaculture, the CE has influenced and oriented the research in the aquaculture sector.

Table 14: Search strategy for the literature review

Protocol used	The Preferred Reporting Items for Systematic Review and Meta-Analysis (**PRISMA**) is selected as the formal guideline to provide a standard peer accepted methodology to increase the consistency and replicability of the analysis.
Database and Query	**SCOPUS** - TITLE-ABS-KEY ("aquaculture" AND "circular economy" OR "circularity" OR "CE") Web of Science (**WoS**) Core collection: TS=(((aquaculture) AND ("circular economy" OR circularity OR
Time frame	**2015-2022** - The last update check was at the end of **January 2023**
Inclusion criteria	Language: English; Doc Type: Articles and Review

Using these search queries, 389 papers were identified. Then, all the bibliometric data were downloaded in MS-EXCEL and using the function "eliminate duplicates" based on title, authors and DOI, 147 papers were removed.

3.2 Screening processes

The remaining 242 papers were screened first based on information included in the abstract and then reading the full text of the papers, as highlighted in **Figure *21***, to identify only those that meet specific eligibility criteria. Mainly, the sample includes only papers a) where CE practices were related to production process activities, e.g., the use of alternative feeds (insect feeds, feed from by-products), or the use of recycling and water treatment technologies, and b) where the CE practices adopted in other production sectors using aquaculture waste and discards (feed, pharmaceutical, building, textile, etc.).

The Preview, Question, Read, Summary (PQRS) methodology was applied during the screening processes to keep the selection of papers focused on CE in aquaculture. This methodology consists of four steps:

1. Preview: Skim through the article to get a general idea of the main topic and structure.
2. Questions: Form questions based on the title, headline, and introduction of the article.
3. Read: Read the article attentively and try to answer the questions formed.
4. Summary: Write a summary of the main points and findings of the article.

During the first screening process, 68 papers were excluded based on information included in abstracts and keywords for several reasons. The main reasons for the exclusion of papers were:

1. the absence of the terms used into the search queries in their titles, abstracts, or keywords,

2. the acronym CE (circular economy) referred to different concepts (e.g., the circular shape of equipment and tanks used in some aquaculture facilities, or CE referred to citizen engagement).

Then, the full texts of the 174 papers were read during the second screening process to include papers that deal with CE practices in aquaculture, or with products that can be obtained from aquaculture waste and by-products or with sustainable materials to promote greater environmental sustainability in aquaculture (e.g., the use of innovative feeds). Papers not considered relevant for the study were 75. They were excluded for the following main reasons:

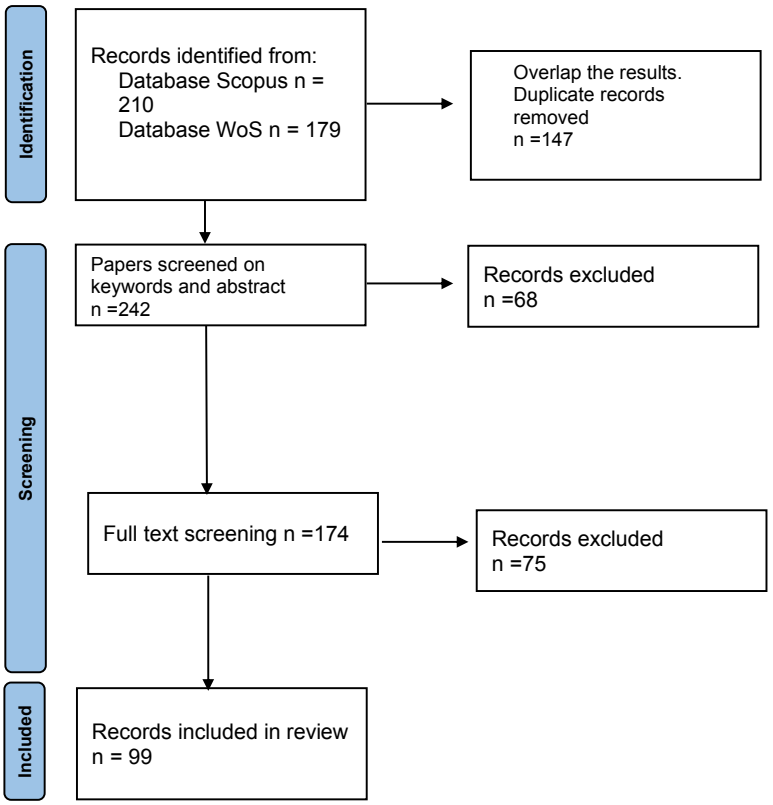
a) they focused on aquaculture but dealt with the medical and pathological implications of fish flesh contamination, and did not mention the link with the circular economy,

3. they did not propose CE practices or strategies in aquaculture sector.

Some papers were also excluded because they dealt with the biological and chemical aspects of fish fed with innovative feeds, which was not the focus of this review. Finally, a sample of 99 papers was selected and considered relevant for the present research questions.

A database (DB) was created in MS Excel to record the relevant information from each paper, including the reasons for excluding any source at each stage of the selection process. All the information was extracted and summarised in a table to facilitate the comparison and analysis of the studies.

Figure 21:Literature search procedure flow (PRISMA protocol)



3.3 Data collection and analysis.

Two types of data were extracted to answer the research questions for conducting the bibliometric and systematic analysis. In addition, from the sample of papers, 80 CE practices were identified.

For the bibliometric analysis, the bibliometric data such as journals, year of publication and keywords are extracted directly from Scopus and WoS databases. They were analysed using: SciVAL to identify a) the trend of publications in the above-mentioned time frame, b) the number of papers per Journals; c) the main research topics of Journals linked to the sample and VOSviewer for conducting a Co-occurrence and Network Analysis of keywords. The Co-occurrence technique allows analysing the frequency and co-occurrence of words in a set of publications, such as journal articles, books, or conference proceedings. In contrast, the

network analysis allows the examination of the relationships and strengths of the keywords the authors used to describe their papers.
Meanwhile, the second group of data were extracted from the full texts of the papers and includes information on: i) topic (feed, wastewater, waste, by-products, food, biochemical components, energy), ii) water environment (marine, freshwater, both), iii) species, iv) geographical area, v) waste hierarchy strategies (4Rs). These data were analysed through a systematic analysis to identify:

a) the main area of investigation, such as i-Resource enhancement/Reduction; ii-Waste management/Reduction; iii- By-product utilisation;
b) the geographic location of the circular economy option implementation. Thus, the countries were aggregated by borrowing the subdivision that FAO uses to distribute the main fishing areas;
c) the rearing water types, whether marine, freshwater or both;
d) the product type that the circular economy practice targets to support an eco-friendly transition (by-products, feed, wastewater treatment, waste, extraction of components for nutraceuticals, construction, etc.). This is to identify new potential areas for CE practices that can offer future opportunities for aquaculture growth and environmental impact reduction.

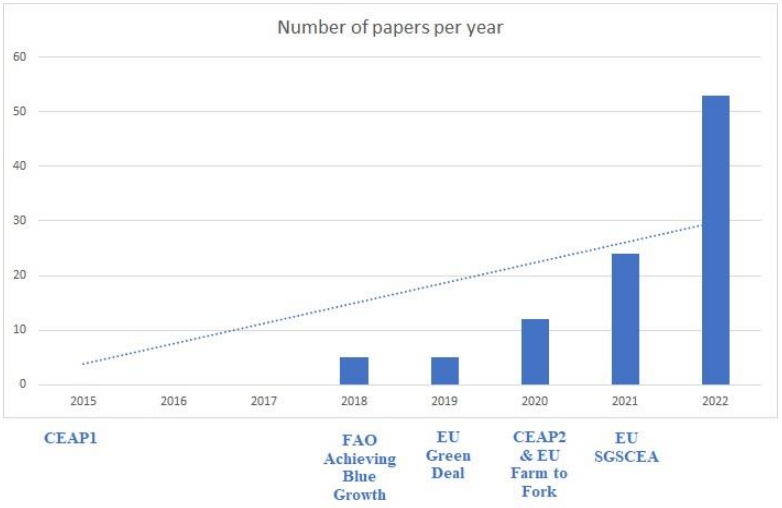
4. Results and Discussion

The bibliometric and systematic analysis results and discussions are presented in the next two subparagraphs. Therefore, regarding the bibliometric analysis, the results are reported on the number of papers per year, the journals with the greatest number of papers and research topics covered, the co-occurrence between keywords, the network analysis, which reveals a greater presence in the papers of CE, aquaculture, and sustainability. Meanwhile, for the SLR, the results are presented based on the geographical distribution of the CE practices distinguished by rearing waters. This is to intercept emerging geographic areas concerning the transition to the CE; moreover, the current CE practices driven by the 4Rs of the waste hierarchy have been analysed.

4.1 Bibliometric Analysis

CE studies in aquaculture are a dynamic field that has greatly advanced in recent years with various research topics. The analysis considers eight years (from 2015 to all of 2022) and shows the increasing trend in the number of articles that address CE in aquaculture (**Figure *22***). The results indicate that CE in aquaculture is a recent topic, as the first articles appeared only in 2018. In the following years, the papers tend to increase, likely due to a growing global interest in the Blue Growth Initiative (FAO, 2018), which requires aquaculture to revise the business and adopt innovative strategies, to enhance the utilization of aquatic resources with improved economic, environmental and social outcomes. In this regard, the strategies proposed in Blue Growth include aquaculture sector to create value from waste and renewable resources (Pauli, 2010). Furthermore, first, the Green Deal (European Commission, 2019) and, subsequently, the new Circular Economy Action Plan (CEAP2) with the Farm to Fork Strategy (European Commission, 2020), have gradually attracted more attention from the international academic community. These policies promote a transition to a low-carbon, circular and bio-based economy, where aquaculture can play a key role. In this regard, 2021-2022 has been the most prolific two-year period of articles, where more than 80% of papers are concentrated, growth linked to a tailoring strategy for competitive aquaculture 2021-2030 (SGSCEA). This strategy outlines the main objectives and actions for developing a sustainable and resilient European aquaculture sector.

Figure 22: Number of papers per year of publication (Source: authors elaboration of SCOPUS and WoS data)

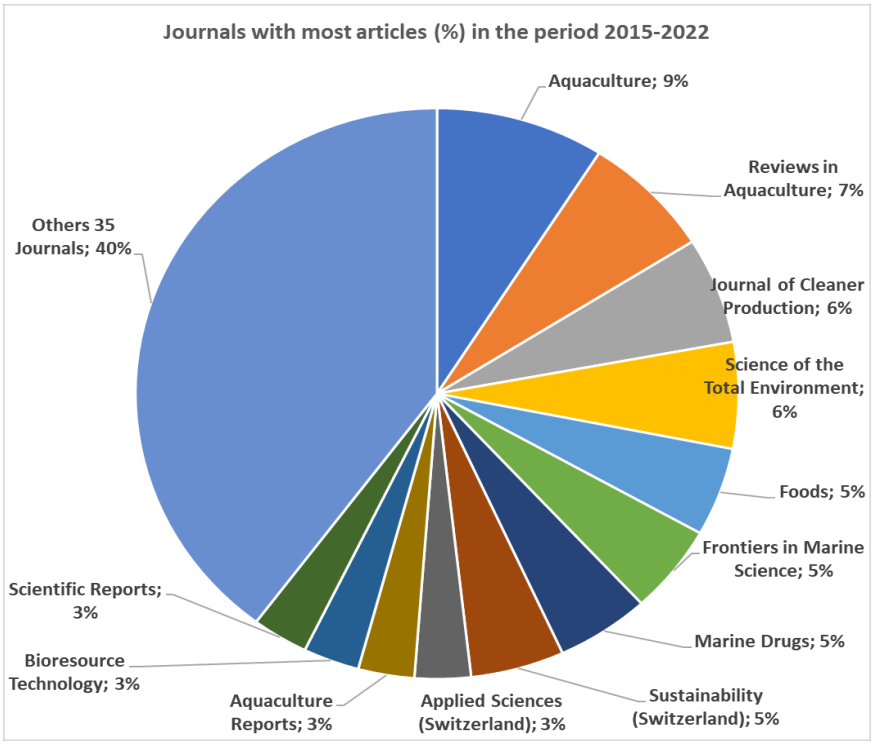


The analysis reveals that the literature on CE in aquaculture is relatively limited and clustered in 47 scholarly journals (**Figure 23**), with 12 journals accounting for about 60% of the sample. Furthermore, four journals are specifically dedicated to aquaculture and aggregate 20% of sampled papers.

In this regard, two journals that have aquaculture in their title, are the leading ones in number of papers published, respectively "Aquaculture" with nine (9% of the sample) and which mainly deal with innovative feed obtained with vegetable proteins (Fernandes *et al.*, 2022; Marques *et al.*, 2022) or soil amendment from waste (Lopes *et al.*, 2021), but also referring to innovative production system, such as integrated multitrophic aquaculture (IMTA) (Cutajar *et al.*, 2022) and valorisation of waste in nutraceutical sectors (Piazzon *et al.*, 2022).

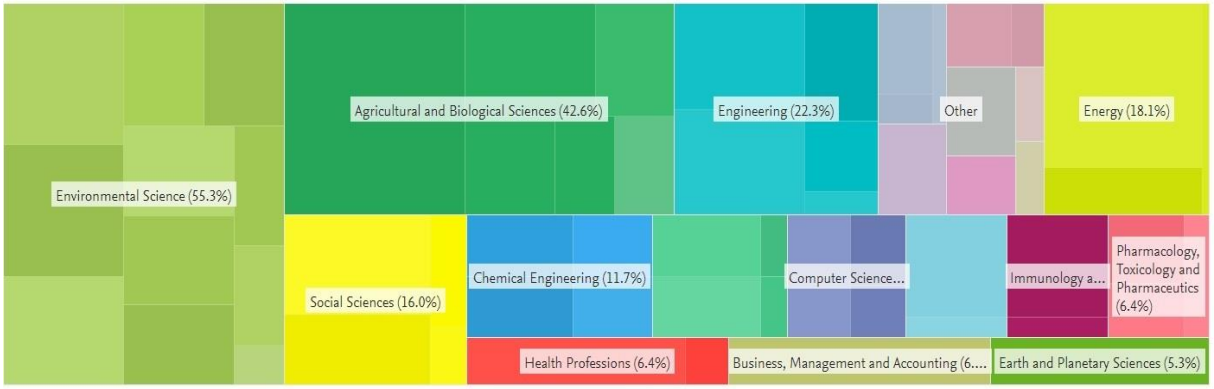
Meanwhile, in the journal "Reviews in Aquaculture" (7% of the sample), reviews are mainly reported about the applications of the use of by-products and waste valorisation (Morris, Backeljau and Chapelle, 2019; Zhan, Lu and Wang, 2022), and about nutrition and animal feed. These arguments trace the main hot spots scholars propose to mitigate through CE principles applied in aquaculture practices. Two other journals, "Science of the Total Environment" and "Journal of Cleaner Production" published 6% and 5% of the sample respectively. Both journals largely present papers on the valorisation of by-products with circular practices more aimed at marine water systems (Villar-Navarro, Garrido-Pérez and Perales, 2021; Napolitano *et al.*, 2022).

Figure 23: Coverage (%) of papers per journal with at least three articles (Source: SCOPUS and WoS)



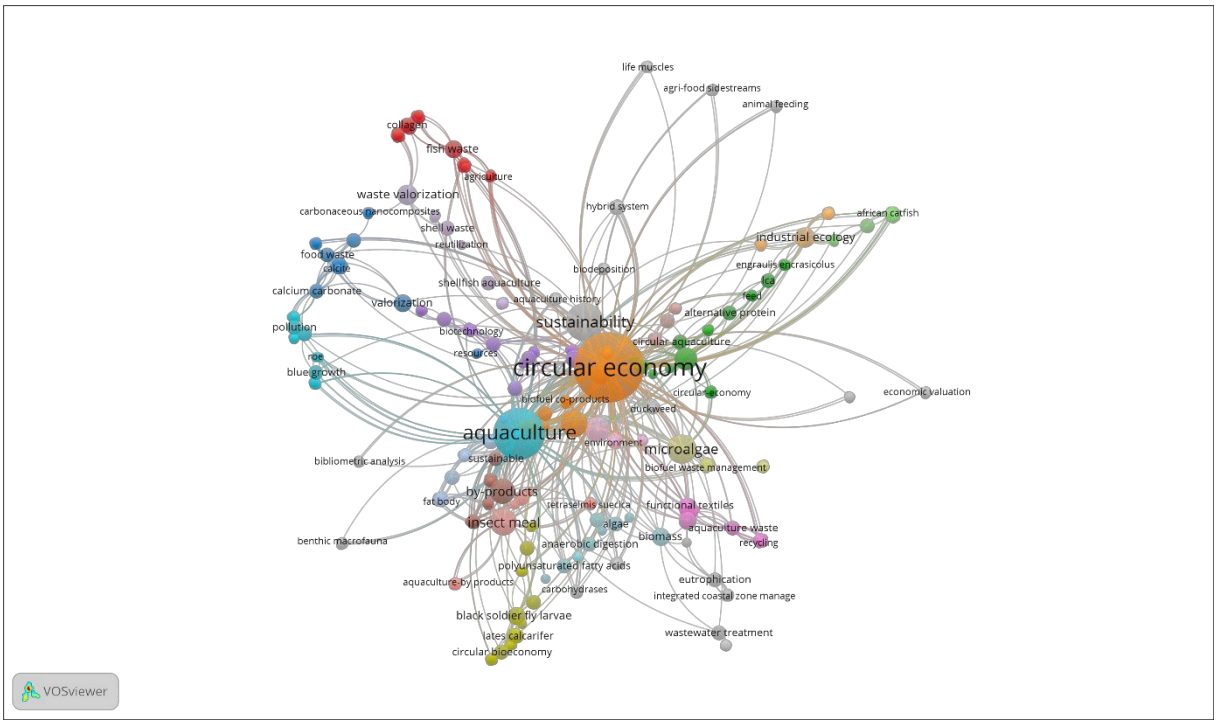
The subject areas of the journals, in relation to scholarly output (**Figure *24***), mainly focus on environmental sciences and agricultural and biological sciences. This confirms the researcher's high interest in evaluating CE for aquaculture from different points of view, e.g., waste management and treatment processes to mitigate the pressure of aquaculture on natural resources as well as use waste, algae, or insects to offer innovative and sustainable feeds to farmers.

Figure 24: Publication share by Subject Area (Source SciVal)



In addition, the presence of several subject areas underlines the concept that CE in aquaculture is a complex phenomenon involving multiple dimensions and perspectives. Indeed, scholars focused on different aspects of CE depending on a) the scale of the system, b) the interaction with other systems, c) the goals of the study, and d) the importance they assign to the critical issues they aim to address and resolve.
The network analysis (**Figure *25***) shows that the main keywords are the circular economy (occurrence=179), aquaculture (occurrence=132), and sustainability (occurrence=132). From this emerges a co-occurrence cluster, "sustainability", even though it was not selected among the keywords used for searching the articles in this literature review.

Figure 25: Bibliographic Coupling Network Visualization of the 99 papers. (Source: VOSViewer)



Furthermore, the co-occurrence between aquaculture, CE and the blue economy, which aims to use the seas and oceans and their coastal communities in a sustainable way, has emerged (San Juan, Bogdanski and Dubois, 2019). Indeed, the European Union considers the blue bioeconomy as any economic activity associated with the use of renewable aquatic biological resources for the production of products (Eroldoğan *et al.*, 2022), and aquaculture is a key component of the EU's blue growth strategy (European Commission, 2012). It can have significant positive effects on water quality, for example, by increasing mussel farming, which can facilitate the reduction of the eutrophication status of the Oceans and is an important contribution to circularity (Kotta *et al.*, 2020). Similarly, CE is also mentioned in conjunction with blue growth and aquaculture by the FAO, because CE is seen as an opportunity to support both the reduction of used non-renewable marine resources and emitted waste in the Oceans (FAO, 2018).
Moreover, another co-occurrence emerged from the network analysis concern and includes the management and valorisation of waste and livestock by-products (Lopes *et al.*, 2021; Magnabosco *et al.*, 2021), the possible uses of by-products and wastewater for the production of insects or algae (Ahmad, W. Hassan and Banat, 2022), which are linked to papers dealing with the opportunities to integrate livestock diets with innovative feeds based on insect and algae meals, rather than feed by discards on sea urchins or soy meals (Ciriminna *et al.*, 2021; Albrektsen *et al.*, 2022). Furthermore, the network of connections unites the three main clusters with energy efficiency (Ruiz-Salmón *et al.*, 2020; Thomas *et al.*, 2021; Cooney *et al.*, 2023) and industrial ecology through low-emission of eco-industrial park for algal production (Tumilar *et al.*, 2021), and with integrated circular farming models -as proposed by (Cornejo-Ponce *et al.*, 2020)- or connected to the production of alternative proteins both for human and animal consumption (Kandyliari *et al.*, 2020). These themes and topics form a complex and dynamic network of interactions, demonstrating the multidisciplinary and systemic nature of CE.

4.2 Systematic Analysis

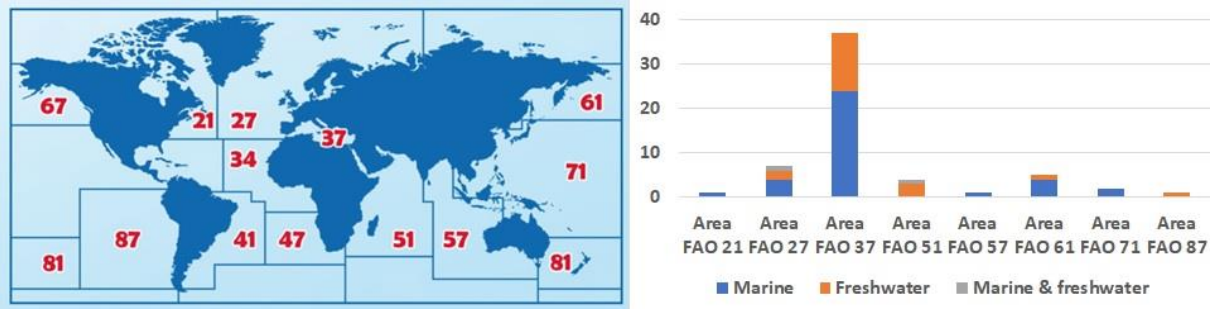
The SLR is carried out to explore how chosen articles depicted CE applications in aquaculture. The results were clustered according to: a) the country where CE was implemented; b) the aquatic ecosystem of cultivation (marine, fresh, mixed); c) which of the 4Rs of the waste hierarchy was adopted; d) CE practices for the main area of investigation (by-product, waste treatment, resource reduction, resource improvement, water treatment and, energy).

4.2.1 Distribution of papers by rearing water and geographical FAO Area

In the SLR analysis, the explicit indication to the geographical area allowed the identification of 58 circular economy practices concerning aquaculture that were tested in different countries grouped according

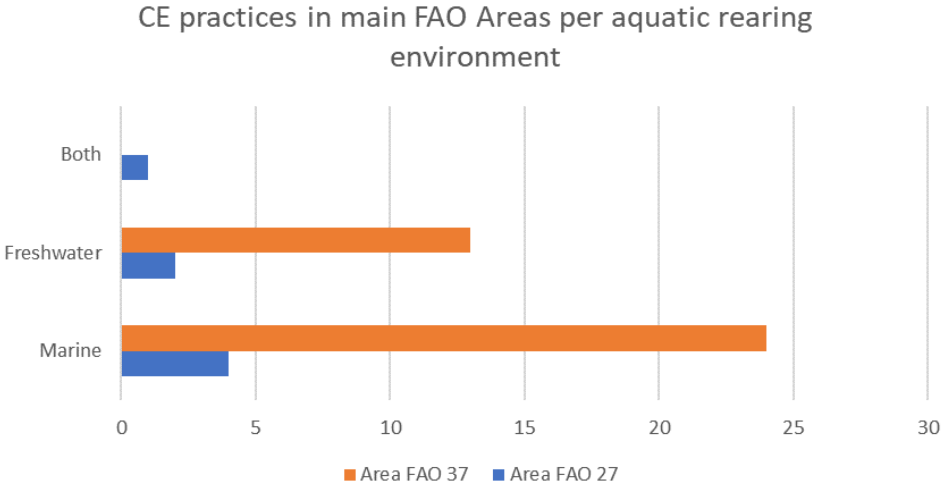
to FAO areas of the world (**Figure *26***). Most of the research and recommendations in aquaculture have focused on practices applicable to marine settings (62%). Practices that are relevant for both freshwater and marine settings mainly deal with waste and by-product management and the improvement of various components, such as the extraction of omega-3 for human consumption or the extraction of collagen (Malcorps *et al.*, 2021). Furthermore, the result for geographic distribution and rearing waters confirms that the definition of specific CE strategies in a specific area should be addressed, in order to take into account the correct local impact categories and to promote potential CE activities in the aquaculture (Regueiro *et al.*, 2022).

Figure 26: CE practices in main FAO Area (Source: Authors elaboration)



Although 80 practical CEs were extracted in the SLR analysis, those with explicit indication of the geographical area were 58, and they were applied in different aquatic rearing environments. Furthermore, it emerges that the 58 CE practices were concentrated in two main FAO areas (**Figure *27***): Mediterranean (FAO Area 37) and North-East Atlantic (FAO Area 27), accounting for 64% and 12% of CE practices, respectively.

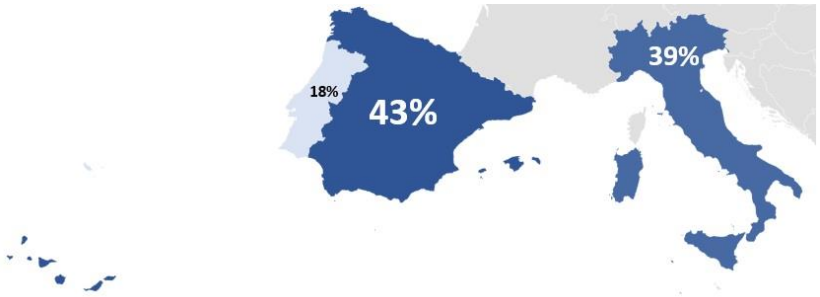
Figure 27: CE practices per the Mediterranean and North-East Atlantic per different aquatic rearing environments (Source: Authors elaboration)



In the Atlantic area, Norway is leading the way in producing salmon, with 33% of global production (FAO, 2022), but also facing some challenges in reducing its environmental impact on marine ecosystems. Some of the challenges are lice infestations, fish escapes, disease transmission, nutrient enrichment, and algal blooms (Gudbrandsdottir *et al.*, 2021). In the Mediterranean area more than 80% of CE practices referred to three countries (**Figure *28***), Spain (43%), Italy (39%) and Portugal (13%). The papers show a variety of practices to mitigate the negative effects of aquaculture and to promote circular economy (Campanati *et al.*, 2022; Chary, Brigolin and Callier, 2022). Some of these practices are producing algae-based feed (Deng *et al.*, 2021; Pereira *et al.*, 2022), using treated wastewater as fertilisers (Lopes *et al.*, 2021; Mraz, Jia and Roy,

2022), or recycling water in closed systems (RAS) (Villar-Navarro, Garrido-Pérez and Perales, 2021), and in bio and nutraceutical production processes (Gatto and Re, 2021; Mutalipassi *et al.*, 2021; Ferreira, Rauter and Bandarra, 2022).

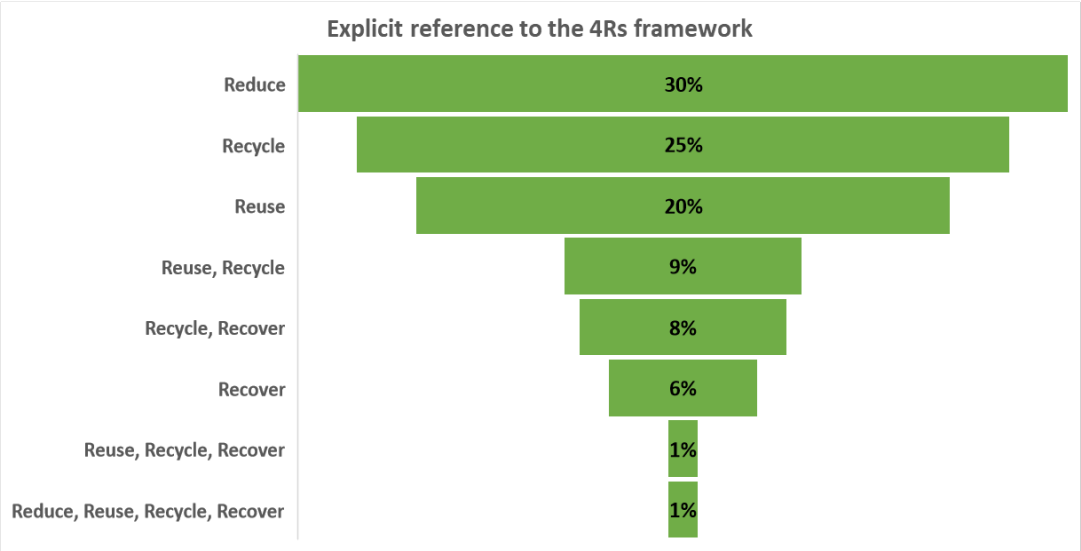
Figure 28: Breakdown of CE practices among the countries of the Mediterranean area (Source: Authors elaboration)



4.2.2 Current CE practices driven by the 4Rs of the waste hierarchy.

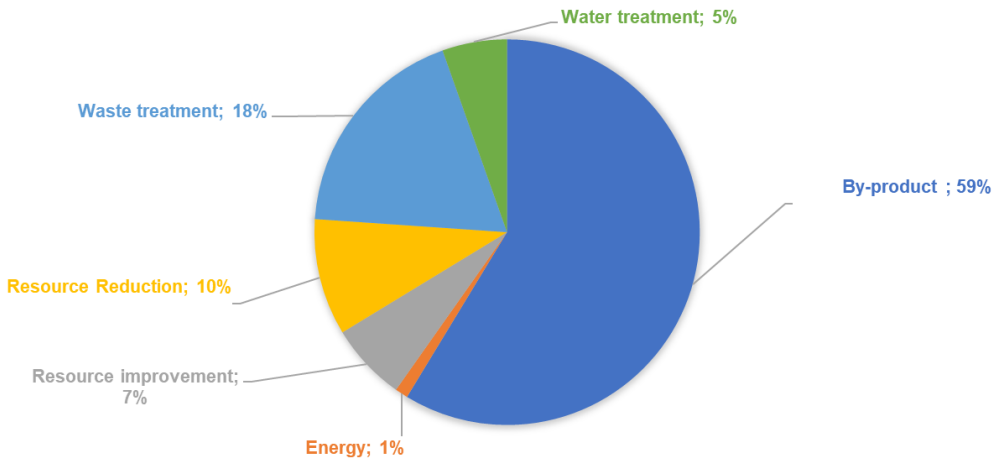
One of the major environmental challenges facing the aquaculture industry is the disposal of waste materials. According to a recent study (Cooney *et al.*, 2023), the waste generated by aquaculture operations ends up in landfills, contributing to greenhouse gas emissions, leachate contamination and land degradation (Dauda *et al.*, 2019). This is not only unsustainable but also wasteful since aquaculture waste contains valuable nutrients and organic matter that could be reused or recycled (Iacovidou *et al.*, 2017). The SLR showed that 30% of the papers explicitly refer to the application of one or more of the 4Rs of the waste hierarchy; indeed, the results showed that most of the papers viewed CE practices to address the challenge of producing more with less use of natural resources (**Figure *29***). They suggested production models that use biomass growth diets with less fishmeal and fish oil, which are responsible for depleting wild biomass (Pleić *et al.*, 2022). These diets are based on recycled sources, such as algae-based flours from wastewater (Nguyen *et al.*, 2022), or flours from by-products (Piazzon *et al.*, 2022), or alternative sources, such as insect flours (Petereit *et al.*, 2022) that are supplied by upstream actors in the aquaculture process. The core business can then redesign the production system (Deng *et al.*, 2021; Napolitano *et al.*, 2022), taking into account both the aquatic environment and the species produced. The recycling strategy also includes downstream actors who collect waste and by-products from the production chain. Moreover, the papers that investigated the reuse of waste mainly focused on the treatment of production water in recirculating aquaculture systems (RAS) (Campanati *et al.*, 2022) or the reuse of solid and liquid waste for growing other aquatic species in the same production areas, such as integrated multitrophic aquaculture (IMTA) (Sanz-Lazaro and Sanchez-Jerez, 2020). Reuse involves the core business around the technological production system and is influenced by both upstream (technology providers) (Boffa *et al.*, 2022) and downstream actors in the aquaculture farming chain (Cutajar *et al.*, 2022).

Figure 29: CE practices driven by 4Rs waste hierarchy. (Source: Authors elaboration)



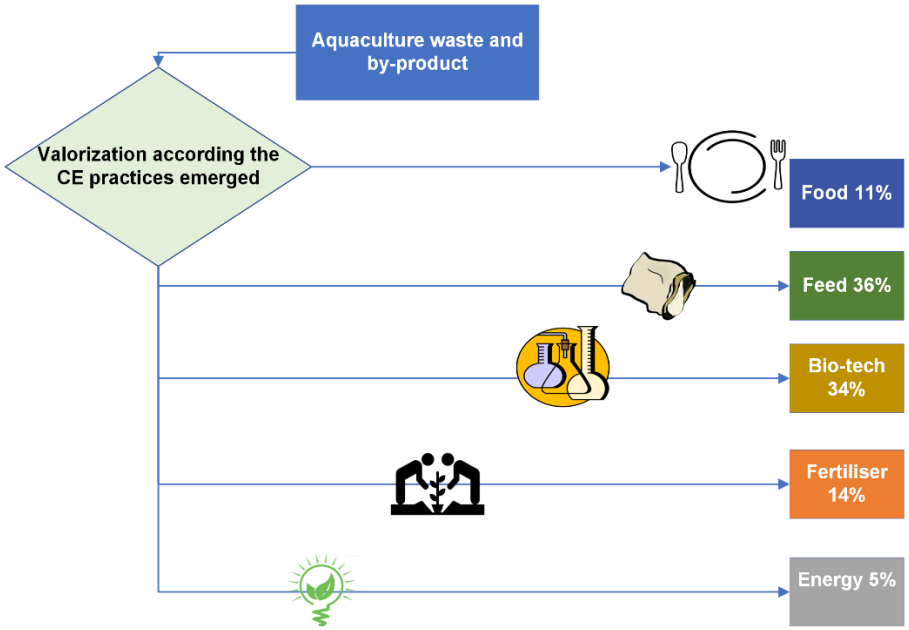
Moreover, most of the CE practices in aquaculture focus on only one of the 4Rs (reduce, reuse, recycle, recover), which limits the potential of circularity. Therefore, CE practices that concentrate on only one of the 4Rs are predominant (>80%), but there is also a diversity of practices across the levels of the production chain. The CE approach is gaining attention in the aquaculture sector, and it can offer significant benefits to the sector. However, there are still many challenges to overcome, such as the management of by-products and waste (**Figure *30***). According to a SLR, these are the main drivers for exploring CE in aquaculture, accounting for 59% (by-product) and 18% (waste treatment) of the studies, respectively.

Figure 30: CE practices for the main area of investigation (Source: Authors elaboration)



According to SLR, about 60% of the papers that addressed CE in aquaculture focused on the recycling of by-products, either as inputs for other industries high value products, such as nutraceutical, biotech industry (34%) and food (11%), or as feed (32%) for other aquatic species (**Figure 31**). Therefore, this result is the main area of academic research which, through the use of by-products, will be able to contribute to considering circular production models in aquaculture for the extraction of unused components (Kundu et al., 2022) .

Figure 31: Evidence from systematic reviews (SLR) about by-product uses. (Source: Authors elaboration)



5. Conclusion

This study examines how intensive aquaculture, which involves cultivating aquatic organisms for human consumption under controlled and defined conditions, can adopt more eco-friendly approaches by applying CE principles to its practices. Thus, the study contributes to the knowledge of how CE is implemented in aquaculture and how it can help to shift from a linear to a more sustainable and competitive production model. The bibliometric analysis reveals an increasing trend of publications on CE in aquaculture, which indicates scholars' interest in the concept of CE in aquaculture (RQ1). Scholars who have dealt with the concept of CE in aquaculture have published papers mainly appearing in journals that focus on environmental science. The keyword sustainability is frequently used in the publications and associated with CE and aquaculture. Meanwhile, the SLR revealed several CE practices that aim to valorise by-products and waste from the aquaculture sector. These practices respond to the challenge of reducing the dependence on fish resources from overexploited stocks, which are often used as feed ingredients. By applying recycling and reuse strategies, valuable molecules such as collagen, Omega3, and proteins can be extracted from by-products and waste and used for various purposes in the feed, pharmaceutical, and nutraceutical industries. These molecules have benefits for both human and animal health and nutrition. In addition, the SLR on CE in aquaculture shows that most CE practices are focused on one of the 4Rs: reducing the consumption of natural resources. Moreover, the Mediterranean region has been the most active in developing and testing CE practices, both for freshwater and marine aquaculture. For this, a CE approach in aquaculture can offer opportunities for growth and sustainability, by reducing, reusing, and recycling waste and by-products as inputs for aquaculture or other sectors production. This is the research question (RQ2) that this study addressed, finding evidence of outcomes regarding the potential of aquaculture to become more circular and environmentally friendly. Thus, the findings suggest that most of the CE practices are driven by only one of the 4Rs, and that there is a lack of integration and synergy among them. Therefore, a possible direction for future research is to investigate the barriers and enablers that affect the adoption of CE practices that involve more than one of the 4Rs in aquaculture. Moreover, future research may also examine how the geographical location of facilities and the type of aquatic rearing environments used, influence the implementation of CE practices in this sector. Although this work has advanced the understanding of the opportunity for aquaculture to transition to the CE, it also has some limitations. One of these is the lack of a framework on the tools used for environmental assessment of CE practices in aquaculture. This will be addressed in a future study with an improved methodology. Another limitation is the lack of economic and social data from CE practices, reflecting the gap in the literature reviewed.

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Posters

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UPCYCLING AND CIRCULAR ECONOMY IN CULTURAL AND CREATIVE INDUSTRIES

LEONARDO BORSACCHI*, GIULIA LIPPI°

** ARCO (Action Research for CO-Development) – PIN, University of Florence, Piazza G. Ciardi 25 – 59100 Prato, Italy
*leonardo.borsacchi@pin.unifi.it ORCID 0000-0001-6334-6146; °giulia.lippi@arcolab.org
Corresponding author: Leonardo Borsacchi leonardo.borsacchi@pin.unifi.it

ABSTRACT

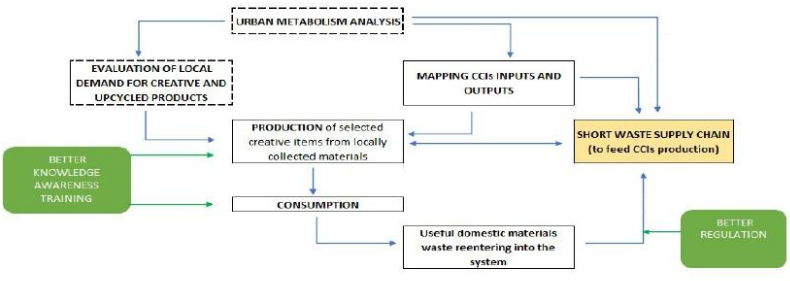
According to many definitions, upcycling, within the framework of circular economy practices, is the way to reuse waste materials by creating something new that is more valuable than the original materials. It is configured as a cost and energy-saving production method that involves the creative reuse of waste products or materials to obtain new and more valuable items. Upcycling is becoming a trend, showing a growing increase in popularity. It involves, among others, the re-use of old homewares by means of small do-it-by-yourself, and thus, it is likely to be adopted within the production processes of Cultural and Creative Industries (CCIs). This paper may be a useful tool to lay the foundation for an overall strategy that looks for a new model of production, especially at the urban level, which respects local traditions as well as the territories. The CCIs sector is increasingly growing, bringing out opportunities for new jobs, collaborative economy, social innovation, start-ups, and urban regeneration. It is often sponsored as a booster for sustainable development since it relies more on human input, rather than on materials ones, thus it may relieve the pressure on the environment. Thus, this work targets local authorities and industries as main users. With a wide review and analysis of good practices offered by the manual, cities and industries may learn about the different solutions that can be adopted, considering their specific urban and economic features, such as the socio-economic fabric, the availability of raw materials and technologies, or the position along the global supply chain. The paper may provide suggestions to CCIs to achieve SDGs' goals. Upcycling within CCIs, which is the main topic of the manual, covers primarily SDG 11 (Sustainable cities and community) and SDG 12 (Responsible consumption and production), but it contributes also to implementing SDGs 8 and 9 (decent work and economic growth, Industry, Innovation, and Infrastructure, respectively). This work has been developed within the framework of the ENI CBC MED project "INNOMED-UP - Promoting UPcycling in Circular Economy through INNovation and education for creative industries in MEDiterranean cities" involving partners in Greece, Italy, Tunisia, Palestine, Jordan.

Cultural and Creative Industries are those industries that use culture as input and have a cultural dimension, although their outputs they are mainly functional, they include architecture and design, which integrate creative elements into broader processes, as well as subsectors such as graphic design, fashion design or advertising" (European Commission, 2010).

Precondition for an effective implementation of upcycling system at the urban level

Awareness and knowledge of the material: A deep understanding of the materials is needed in order to safely reuse them, and to know what is possible to do with those materials and so on. Legal constrains and products' standardisation may hinder upcycling activities. Upcycling involves the reuse of different materials to make unique products. upcycled products may do not respect international standards (i.e. ISO). This could lead to the impossibility of trading those products in the global market.
Deep understanding of local context and supply chain: To map local supply chain, local availability of secondary raw materials, local productions and cluster, local needs and demand. Through a deep context analysis is possible to orient the upcycling production to local needs, thus facilitating the matching between supply and demand
Community awareness with respect to upcycled products: Often people tend to view upcycled and recycled products as low-quality goods. To foster community awareness social networking and communication/information tools are needed. Local communities could be directly engaged within the upcycling framework, providing it a real understanding of what upcycling is and involves, how it works, and what are the main benefits. Local community thus should be involved on knowledge-exchanges, networking activities with productive firms and other educational tools (e.i. events, workshops etc.).
System of incentives and Communication: Local authorities may implement a system of incentives to orient industries towards a circular thinking. For example, VAT could be reduced for upcycled product. Upcycled products are not standardised by nature. Their uniqueness may constitute a strength. Emphasising this uniqueness may help firms on widening their market.

The model is organised in the following :
- Urban Metabolism analysis;
- Elaboration of local CCIs' need map;
- Planning of a short waste supply chain;
- Setting up administration tools to foster upcycling supply and demand;
- System evaluation and monitoring



TRACK 5
Production, consumption and innovation

5e. Sustainable consumption and consumers

Abstracts

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Carbon lock-in trap in low income families: can we make the carbon neutral transformation inclusive?

Prof. Maria Csutora[1], PhD Gabor Harangozo[2]
[1]Corvinus University of Budapest, Budapest, Hungary. [2]Corvinus University of Budapest, Budapest, India

PROF. MARIA CSUTORA

PHD GABOR HARANGOZO

Abstract

Household heating is responsible for a large share of energy consumption and carbon emissions in many regions of the world. Technological solutions are widely available to improve efficiency and thus reduce consumption/emissions. However, many household consumers are fallen into the trap of lock-in and are not able to benefit for those solutions. Carbon lock-ins can be manyfold (Unruh, 2002, Seto et al., 2016): behavioral (related to habits and norms), deprivation related (lower income consumers simply do not have the financial assets to invest in efficiency), technological (related to the major characteristics of buildings and infrastructure), industrial (dominant standards in the energy industry) or institutional (resistance against phasing out regulation hindering efficiency). Escaping from the carbon lock-in trap could bring triple benefits (environmental, social and economic) (Csutora et al., 2021). Through analyzing comprehensive statistical databases (Eurostat and Odyssee) and the dataset of a representative household-level energy consumption survey (EU Enable project), we detected evidence for different types of lock-ins in many countries, especially for the lower income deciles. In specific cases, this may lead to U-shaped curves when expenditures on heating-related energy is assessed, meaning that lower income consumers pay more compared to middle classes. When carbon footprints of heating-related energy consumption is calculated, this mismatch seem to evaporate in most cases, but other environmental and health issues (as a result of higher share of firewood within the lowest income consumer group, questionable quality many times) arise. Household heating related carbon lock-in is difficult to overcome, however understanding the drivers of different lock-ins may help in developing more specific policy support (e.g. deprivation lock-in may seek for normative subsidies, where even low income consumers have chances to participate; while behavioral lock-in may be overcame by better education). This submission is organically related to several UN SD goals and targets, with a special focus on 7.1., 7.3., 12.2., 12.8., 13.2. and 13.3. It is also closely (actually by definition) related to three key themes and thus the overall goal of the ISDRS 2023 (people, planet, prosperity) as efforts to overcome the household heating related lock-ins among the lower income consumer groups deliver triple dividend (environmental through lower carbon emissions, social and economic through decreased energy bills).The research was supported by the 143542 OTKA project.

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PHENOMENON OF THRIFTING FASHION IN INDONESIA: IS IT A SUSTAINABLE FASHION?

MURZAL ZAIDAN[1], ANNALISA YAHANAN[1], ZULKIFLI S MUKTI[1], YOSE RIZAL[1], A.S. CLARISSA P AULIA[2]
[1]Faculty of Law, Universitas Sriwijaya, Palembang, Indonesia. [2]Faculty of Community Health, Universitas Sriwijaya, Palembang, Indonesia

M U R Z A L Z A I D A N

Abstract

Annalisa Yahanan, Murzal Zaidan, Zulkifli Moekti, Yose Rizal, AS Clarissa P Aulia

Faculty of Law, Universitas Sriwijaya, Indonesia

Clothing is one of the primary needs of human life which serves to protect the body and beautify the appearance of the body or fashion. Changes in fashion occur more quickly than changes in culture as a whole. For this reason, those who always want to keep up with the latest fashion developments, will always change fashions, with one of their strategies is to buy branded imported used clothes. In Indonesia, imported used clothing is prohibited under its positive law. This research aims to prove that such sustainable fashion can damage the environment. In addition, the purpose of this study is to analyze the regulations that prohibit imported used clothes from entering Indonesian territory. The results of the study show that imported used clothes as illegal goods can damage the environment. This is because not all imported used clothes can be used, and the remaining unsold used imported clothes will become a pile of waste in Indonesia. Thus, it can be said that Indonesia is used as a dumping ground for imported used clothing waste that can pollute the environment. Meanwhile, regulations that prohibit imported used clothes from entering Indonesian territory as illegal goods, in fact, seem do not work. Many imported used clothes are found entering Indonesian territory. The reason is partly because there are so many captivating use imported second-hand clothes. In addition, control from the Government regarding illegally imported used clothes is still weak. For this reason, control of the sale of imported used clothes as illegal goods entering Indonesia needs to be increased by imposing strict sanctions to the parties involved.

Keywords: thrifting; illegal; environment; midden; sustainable fashion

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A study on redesigning laptops for mobile office scenarios in the post-epidemic era

Luyao Chi, Wenrui Li

Anhui University, Hefei, China

Abstract

Abstract: The arrival of the new crown pneumonia forced many businesses around the world to go through an initial phase of shock and reaction changes in the way they work, making it necessary to quickly consider implementing remote online, mobile working methods to carry out their work. However, with the turnaround of epidemic prevention and the introduction of national policies related to epidemic prevention, we have entered the post-epidemic era, but the diversified office approach is an opportunity for companies to stimulate the emergence of innovation and win competition and stand out, which not only breaks the original office concept and accelerates the transformation and upgrading of corporate offices and efficiency, but also brings an innovative way of life and experience to people, creating Sustainable development of service innovation. Based on the "user-centered" design thinking in service design, this article focuses on the user's desire, motivation, experience and other aspects to study how people can read and reply emails, write texts, record meetings and other lightweight work in the post-epidemic era, and effectively use fragmented time. To this end, this paper investigates the redesign of laptops in the mobile office scenario. Firstly, the SET method is used to identify opportunity points from three aspects: social, economic and technological, and the scenario is further determined in the journey of high-speed rail and airplane; Persona, user experience journey map and service scenario are used to analyze user needs, and competing products are analyzed for the portable office products currently on the market. Summarize the advantages and shortcomings of current products, propose strategies for redesigning laptops in mobile office scenarios in response to the shortcomings, and finally practice redesigning in terms of material, size, and color, respectively, so that people have more portable work carriers and make the products sustainable in terms of service mode and form to meet people's more free and diversified office scenarios in the future and adapt to the rapid development of society.

Keywords: post-epidemic era; service design; mobile office; redesign; sustainable development

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Does healthy food consumption structure decrease the ecological footprint? The ecological footprint of nutrition in Hungary: reality vs. recommendations

Zsófia Vetőné Mózner
Corvinus University of Budapest, Budapest, Hungary

Abstract

Food consumption provides nutrients for individuals, fulfils daily biophysical needs, thus it has one of the highest environmental impacts of all areas of consumption. The environmental impacts of nutrition include increasing land use and accounts for one-third of total anthropogenic greenhouse gas emissions (FAO, 2022). International research studies on food consumption patterns in developed countries confirm that healthy and low-impact diets may show many similarities with each other (Clark et al., 2019; Aschemann-Witzel et al., 2021).

The research question of the present analysis is to examine to what extend does a healthier diet could reduce the environmental impact of nutrition. The aim of the research was to quantify the ecological footprint of actual Hungarian food consumption as well as the ecological footprint of a healthy diet, based on the dietary recommendations by the Hungarian Dietetic Association. The ecological footprint is an appropriate indicator for measuring the environmental impact of nutrition as it provides a standardized methodology for measuring land use and carbon dioxide emissions. The ecological footprint is a consumption-based indicator, thereby showing the environmental responsibility of consumers regarding their food consumption. The average quantity of actual food consumption per person and the ecological footprint intensities were used to calculate the ecological footprint of the main food consumption categories.

Results showed that consumption of animal origin dominates the ecological footprint of Hungarian residents (67%). Meat products have large ecological footprint intensity thus the reduction of meat consumption could result in advantages both from environmental and health perspectives. Examining the footprint of income deciles showed that middle income level groups use their relatively high incomes to consume more food. Research results confirmed the assumption that the ecological footprint of the recommended healthy diet would be 19% smaller than the footprint of the actual consumption. This highlights that a food consumption pattern which is favourable both from environmental and health perspective is realizable. It offers a great opportunity for instigating a harmonised and integrated environmental and health policy in the future. Sustainable diets play a crucial role in achieving sustainable nutrition and may also reduce health costs in the long run. Present research confirmed that the ecological footprint as a biophysical indicator can be an appropriate tool for drawing the attention of consumers to the environmental load of their diet.

The research is closely related to SDG Goal 12: Responsible consumption and production, sub-target 12.3 and 12.8, and SDG 3: Good health and well-being. Results are closely linked to the topic of the ISDRS conference, showing that double dividend can be achieved through healthy food consumption, contributing to the health and well-being of People and decreasing environmental impact of the Planet.

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Consumer Rights as Citizens in Sustainable Consumption and Production

Dr. Tze Chin Ong, Dr Nurhidayah Abdullah, Dr Zalina Abdul Halim, Dr. Sridevi Thambapillay
Universiti Malaya, Kuala Lumpur, Malaysia

DR. TZE CHIN ONG

Abstract

Consumers are active participants and contributors in economic activities, particularly in a circular economy. Consumers' behaviour in consumption patterns on the demand side has a direct effect on production from the supply side of the market. Moving towards a more sustainable global market, consumers should be viewed as citizens in the market economies participating and contributing directly to sustainable consumption and production. However, consumer rights are often considered as private rights in the private law sphere rather than in the public law sphere of human rights. The secondary standard of consumer rights in consumer protection law is often being sidelined by developing countries, having little significance in public policies related to sustainable development. Since consumers are the major active participants and contributors to sustainable consumption and production, consumer rights should be given priority in public policies related to sustainable development. This paper employed qualitative content analysis approach in analysing consumer rights as citizen rights in advancing (Sustainable Development Goals 12) SDG Goal 12. Enhancing consumer protection law aligned with sustainable consumption and production would provide a symbolic advancement in achieving SDG Goal 12 balancing economic, social development, and environmental protection of developing countries.

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Consumption of Natural Health Products – Is it safe and sustainable?

Mrs. Nur Syamila Mohd Roziman[1], Dr. Wardah Mustafa Din[2], Dr. Zurina Mahadi[2], Associate Prof. Dr. Farida Hanim Islahudin[3], Dr. Mazlina Mohd Said[3]
[1]Institut Islam Hadhari, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia. [2]Pusat Pengajian Citra Universiti, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia. [3]Faculty of Pharmacy, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

MRS. NUR SYAMILA MOHD ROZIMAN

DR. WARDAH MUSTAFA DIN

DR. ZURINA MAHADI

ASSOCIATE PROF. DR. FARIDA HANIM ISLAHUDIN

DR. MAZLINA MOHD SAID

Abstract

Since the outbreak of Covid-19 in 2020, people are more health-conscious and thus felt responsible for taking care of their own health for long-term well-being. The public is more aware and actively looking for better alternatives as awareness of sustainable lifestyles was promoted. Since then, many manufacturers see this opportunity as a way to produce more health supplements from natural bases. Historically, natural products have been used since ancient times for the treatment of many diseases and illnesses. The term “natural” brings a positive image to the product since most consumers perceive natural as safe even though it does not necessarily mean safer or better. There are many reports on natural health products that are adulterated with harmful substances, and many still do not have data on their efficacy, hence it is pivotal that consumers know the safe-use elements of natural health products. It is important for consumers to have the right awareness regarding the safety of natural health products to prevent any adverse effects in the future. The objective of this study is to identify the safe-use elements perceived by consumers for natural health products. A qualitative approach of Focus-Group Discussion (FGD) is employed to elucidate the safe-use elements, and thematic analysis is being done on the qualitative data to explore the objective. From the results, we found that the most frequently mentioned for safe use of natural health products over all age groups was that natural health products must follow the guidelines from the Ministry of Health of Malaysia. There are other elements listed as safe use such as testimonials from other consumers, the product has a halal certificate, the perceptions of the efficacy, and popular products. Alongside the safe use elements of natural health products from the study, there are also additional on good practices that have been mentioned such as health status monitoring, and consumers must be well informed before taking any natural health products. It is identified that these elements coincide with the guidelines disseminated by the regulators, but the depth of safety elements between these two stakeholders hold a very huge gap in achieving a sustainable ecosystem on the safe use of natural health products. It can be summarized that the safe use of natural health products is very crucial in ensuring healthy lives and promoting well-being for all ages. This list of safe use elements by

consumers is pivotal in developing policies for the safe use of natural health products and ensuring effective initiatives are being taken regarding this issue to bring toward a healthy society and environment.

For the final section, we found that SGD 3+Target 3.8 are related to this research topic. The target mentioned above is to achieve universal health coverage, including financial risk protection, access to quality essential healthcare services and access to safe, effective, quality and affordable essential medicines and vaccines for all. This is important as the safety and quality of natural health products are crucial to actually promoting general health and long-term well-being of society.

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The Impact of Green Marketing on Pro-Environmental Purchasing Behavior: Applying the Theory of Planned Behavior Model (Empirical Study on Organic and Recycled Products Consumers in Semarang City)

Mr Andi Tri Haryono[1,2], Ms Sinta Petri Lestari[3], Mr Zet Ena[4], Mrs. Alya Elita Sjioen[4]
[1]Wahid Hasyim University, Semarang, Indonesia. [2]Heylaw, Jakarta, Indonesia. [3]Pandanaran University, Semarang, Indonesia. [4]Universitas Kristen Artha Wacana, Kupang, Indonesia

MR ANDI TRI HARYONO

MS SINTA PETRI LESTARI

MR ZET ENA

MRS. ALYA ELITA SJIOEN

Abstract

This study aims to analyze the impact of green marketing on pro-environmental behaviour and the theory of planned behaviour. The population of this study is people located in the Semarang City area who have shopped for organic and recycled products, with a total sample of 250 respondents. The sampling method used is random sampling with an online survey method for data collection. The research method used is a descriptive quantitative research design. The data analysis method used Structural Equation Model-Partial Least Square (SEM-PLS). The results show that green marketing dimensions green product (GP), green distribution (GD), and green people (GPO) have not correlated and impacted pro-environmental purchasing behaviour (PEPB) and with the theory of planned behaviour (TPB). However, other green marketing dimensions green price (GPI), green product promotions (GPP), and green physical evidence (GPE) have a positive impact on pro-environmental purchasing behaviour (PEPB)and also have a positive impact on the theory of planned behaviour (TPB). The impact of exogenous variables on the endogenous variables is relatively weak only 33 percent, and 31 percent. The study also provides insights into theoretical and practical perspectives about green marketing strategies and sustainable consumer behaviour.

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ANALYSIS OF CONSUMER PREFERENCES AND ATTITUDES TOWARDS SUSTAINABLE CONSUMPTION OF PLASTIC BEVERAGE PACKAGING IN MALAYSIA

Miss Khalilulnisha Abu Bakar, Prof. Dr. Ahmad Fariz Mohamed
National University of Malaysia (UKM), Selangor, Malaysia

MISS KHALILULNISHA ABU BAKAR

Abstract

Malaysia is one of the highest plastic packaging consumers per capita in Southeast Asia but lacks the capacity and capability to manage its waste in a sustainable manner. One of the challenges towards promoting plastic packaging sustainability in Malaysia is the lack of awareness on plastic consumption among consumers and the absence of Extended Producer Responsibility (EPR) scheme. Consumers are decision-makers when it comes to purchasing products with plastic packaging therefore, play a significant role in sustainable consumption which includes better management of plastic packaging and behavioural change in their way of consuming products with plastic packaging. Using beverage products as an example, an online survey was carried out among 395 Malaysian consumers on their willingness to participate in an EPR system and to pay for a more sustainable packaging options. Some open-ended questions were also applied to implore further on factors that would encourage consumer participation in sustainable plastic packaging management. A majority of the respondents gave positive responses towards their willingness to participate and indicated their willingness to pay for a more environmentally friendly plastic packaging options. The results also showed that the respondents will be more encouraged to participate if it is convenient for them to do so, such as the close proximity of a collection centre with their residences. Their preferences on using plastic packaging with a higher content of recycled material, even though the product will be on a higher price, is encouraging. However, the respondents raised the need for a better waste management system, infrastructure, mindset, awareness and education to be in place. Without mandatory implementation of EPR nationwide or an efficient collection and recycling system, recovery of plastic packaging for recycling will be challenging and will be counter-productive to achieve plastic circularity in Malaysia. The results provide insights on how policy makers and the fast-moving consumer goods (FMCG) sector can communicate, accommodate and engage with consumers for EPR and plastic packaging. The inputs are also valuable and relevant to determine the way forward for solid waste management in general and plastic policy and management in particular.

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Lesson from Malaysian Halal SME firms on Sustainable Food Production

Mrs Asma-Qamaliah Abdul-Hamid[1,2], Dr Mohd Helmi Ali[2], Dr Mazzlida Md Deli[3], Dr Norhidayah Suleiman[4]
[1]Faculty of Economics and Management, Universiti Kebangsaan Malaysia, UKM-Bangi, Malaysia. [2]UKM-Graduate School of Business, Universiti Kebangsaan Malaysia, UKM-Bangi, Malaysia. [3]UKM-Graduate School Business, Universiti Kebangsaan Malaysia, UKM-Bangi, Malaysia. [4]Faculty of Food Science & Technology, Universiti Putra Malaysia, UPM-Serdang, Malaysia

Abstract

The purpose of this study is to investigate and assess the interactions and links that exist between traditional food production procedures and the concepts of sustainable production. Halal food production is a significant sector in Malaysia, where the majority of the population is Muslim, and there is a growing domestic and global demand for halal-certified items. Small and medium-sized firms play an important part in the Malaysian halal food industry, and there is growing acknowledgment of the need to embrace sustainable food production practises. One of the most important takeaways from Malaysian halal SMEs is the significance of sourcing ingredients locally Many SMEs are attempting to build stronger partnerships with local farmers and suppliers in order to assure the quality and sustainability of their ingredients. The implementation of environmentally friendly procedures is another key part of sustainable food production for Malaysian halal SMEs. This involves minimising trash, conserving water, and utilising renewable energy whenever possible. Several SMEs are investing in new technology and innovations to improve their sustainability practises and reduce their environmental impact. Furthermore, there is a rising recognition of the importance of social sustainability in halal food production. This involves ensuring that employees are treated fairly and ethically, encouraging community growth and engagement, and advocating for the welfare of animals used in food production. The findings offer comprehensive insights into sustainable food production strategies. As a result, the finding is expected to (1) understand the synergies between standard production practises and sustainable production principles; (2) clarify whether halal food production captures aspects of sustainable development; and (3) identify opportunities for small and medium-sized enterprises to venture into sustainable initiatives at a low cost. Overall, Malaysian halal SMEs recognise the significance of adopting sustainable food production processes to meet the growing demand for halal products while simultaneously supporting environmental and social sustainability. This trend is projected to continue as worldwide demand for sustainable food production develops and consumers demand greater openness and responsibility from the food business.

Full Papers

PHENOMENON OF THRIFTING FASHION IN INDONESIA: IS IT A SUSTAINABLE FASHION?

Annalisa Yahanan[1], Murzal Zaidan,[1] Zulkifli Moekti,[1] Yose Rizal,[1] AS Clarissa P Aulia[2]

[1]Faculty of Law, Universitas Sriwijaya, Indonesia

Correspondence Author: murzal@fh.unsri.ac.id

[2]Faculty of Public Health, Universitas Sriwijaya, Indonesia

Abstract Clothing is one of the primary needs of human life which serves to protect the body and beautify the appearance of the body or fashion. Changes in fashion occur more quickly than changes in culture as a whole. For this reason, those who always want to keep up with the latest fashion developments, will always change fashions, with one of their strategies is to buy branded imported used clothes. In Indonesia, imported used clothing is prohibited under its positive law. This research aims to prove that such sustainable fashion can damage the environment. In addition, the purpose of this study is to analyze the regulations that prohibit imported used clothes from entering Indonesian territory. Meanwhile, regulations that prohibit imported used clothes from entering Indonesian territory as illegal goods, in fact, seem do not work. Many imported used clothes are found entering Indonesian territory. The reason is partly because there are so many captivating use imported second-hand clothes. In addition, control from the Government regarding illegally imported used clothes is still weak. For this reason, control of the sale of imported used clothes as illegal goods entering Indonesia needs to be increased by imposing strict sanctions to the parties involved.

1. Introduction

Clothing is one of the primary needs of human life which serves to protect the body, also serves to beautify the appearance of the body (fashion). For someone, clothing can be regarded as a medium to show identity and establish social status in society (egotistical drivers) (Steg, *et al,* 2014, pp. 104-105). Fashion is something that is easily available to everyone and tends to be seasonal, so it can experience changes quickly (Ristiani, Raidar & Wibisono*,* 2022).

People who want to always follow the latest fashion developments certainly need clothes that want to always change fashion with famous brands. This desire can be done by thrifting. Thrifting can be interpreted as an activity of buying used goods and this activity is also personal satisfaction when getting quality goods (limited) at affordable or cheap prices. Thrifting can also be said as a sustainable fashion. In fact, one study stated that thrifting is a millennial lifestyle (Ghilmansyah, Nursanti & Utamidewi, 2022). On average, people (consumers) who carry out thrifting fashion activities are caused by wanting to be stylish

with good foreign brands, but at low costs (Janna, 2017). Buying imported used clothes is trendy and looking for pleasure or a hedonic life can be done by thrifting (Steg, *et al,* 2014).

Shopping for used clothes has been around for a long time and in recent years it has become more popular. One of the easiest ways to get involved in sustainable fashion is through thrift, namely buying used clothing where sustainable fashion has emerged as an antidote to the harmful practices of fast fashion. Imported used clothing is prohibited from entering Indonesian Territory, but even so, imported used clothing continues to flow from year to year because interest in used clothing is quite high. Therefore, it is one of the reasons for the emergence of thrift shops with abundant (Fajar, 2022) stocks of used clothes and sellers of used clothes are scattered in big cities in Indonesia (Arifah, 2015) (Chandradewi, Rahadjo & Yitawati, 2018).

In the long term best interests of people and the environment, the practice of thrifting continues to evolve as it is one of the most effective ways to shop for fashion in a sustainable manner. But on the other hand, imported used clothing that enters Indonesian territory is prohibited under regulations even as a sustainable fashion that can counteract fast fashion. This is due to several reasons, among others, to protect the domestic textile industry; environment; as well as health. Not all imported used clothes can be used or utilized by consumers, the remaining 60-70% will actually end up in the trash which can damage the environment because it is difficult to decompose.

Reuse of textiles such as using used clothing refers to various ways of extending the practical useful life of textile products by transferring them to new owners (Fortuna& Diyamandoglu, 2017). Thrifting activity as a fashion sustainability needs to be studied related to the environment or environmentally friendly. It has been proven that 42% of people enjoy thrifting even more during the Covid-19 pandemic and even plan to buy more used clothes on an ongoing basis (ThreadUp, 2021). For this reason, the purpose of this research is to prove whether thrifting can be said to be a sustainable fashion and to examine the impact of imported used clothing entering Indonesia. In addition, it is also to analyze the reasons for the ban on imported used clothing entering Indonesian territory based on the laws and regulations in force in Indonesia.

2. Literature Review

The fashion industry is one of the industries that contribute the largest pollution in the world. The fashion industry produces the most pollution because the production process uses large amounts of water which releases carbon dioxide (CO2), uses hazardous chemicals, requires large amounts of energy, and uses non-renewable materials (Shafie et al., 2021). Fast fashion is a fashion trend that changes and develops quickly and has a more affordable price but has a negative impact on the environment and social welfare. The fast fashion production process produces waste that can pollute the environment, from soil, water, to air. Therefore, there is sustainable fashion as a solution to deal with the negative impacts generated by fast fashion. Sustainable fashion is fashion that really pays attention to the environment. The application of sustainable fashion and ethical fashion has various benefits that have a good impact on the environment (Pramodhawardhani, Endrayana & Retnasari, 2021).

Concept of sustainability which is being developed today has begun in 1960 when people started seeing negative consequences on people's health and environment. Origin of concept emerged in 1987 in a report 'Our Common Future'. In the beginning this concept seemed to cover environment sustainability like saving water, decomposition of garbage and many more. But now over years this concept has become broader, and it also includes social sustainability as well as environmental awareness (International Institute for Sustainable Development, no date).

Sustainable fashion is not only limited to fashion but is a lifestyle development that can affect global warming, ecological balance, minimizing natural disasters, vegetative conservation, wildlife conservation, and all things that are nature-friendly or environmentally friendly (Kaikobad, *et al*, 2015). Sustainability has three aspects consisting of environmental, social and economic (Ganatra & Nayakawadi, 2021). The environment must be very concerned in making sustainable fashion. All processes that have the possibility of damaging the environment or causing scarcity must be minimized. Social is concerned with human welfare and equality. In this case, what is meant is the welfare and equality of those involved in the fashion industry. The third aspect is the economy. Sustainable fashion is expected to increase economic growth without negatively impacting the environment and society. These three aspects are the main aspects

of sustainability but can still be expanded with two additional aspects, namely aesthetics and culture (Kozlowski, Bardecki & Searcy, 2019).

Figure 1. Five Dimenssions of Sustainable Fashion

The aesthetic aspect includes fashion designs that always look attractive, timeless and durable. The point is that sustainable fashion designs will last and look attractive over time and will not look out of date. Furthermore, cultural aspects are related to culture or ethics in treating workforce and resources properly (Pramodhawardhani, Endrayana & Retnasari, 2021).

Sustainable fashion refers to clothing that involved designing, manufacturing, reusing, and disposing of materials consistent with the concept of sustainable development (Iran & Schrader, 2021). Sustainable fashion includes designing, distributing, reusing, recycling, or disposing of fashion that supports the entire system to minimise the negative impact on society and the natural environment (Kozlowski, Searcy & Bardecki, 2018). The benefits contained in sustainable fashion are that it can reduce environmental pollution, save costs, provide convenience for consumers, and improve people's welfare (Shafie, *et al*, 2021). The use of water, soil and chemicals must be minimized as much as possible so as not to cause pollution. In addition, the raw materials for manufacture must also be considered. For example, if the raw materials used are materials that come from nature, producers must pay attention to their availability and avoid scarcity. This could happen because manufacturers are concerned with using natural ingredients but ignoring their

reduced availability due to continuous use. Sustainable fashion can also be applied in the form of recycling owned fashion items into different shapes or models so that they will look new and consumers can save on expenses. Clothing that is produced in a sustainable manner will definitely have good quality so that when it is recycled into a new product, the new product will also have good quality so that it can last a long time (Pramodhawardhani, Endrayana & Retnasari, 2021).

One of the easiest ways of indulging in sustainable fashion is through thrifting, i.e, purchasing second-hand apparel. Thrifting skips multiple checkpoints of sustainability as new material need not be brought in, no additional manufacturing takes place, no labour is required to make the clothes, no carbon is used up in transportation, no money is spent on marketing and so on. Thrifting simply extends the life of a preexisting garment and prevents it from ending up in a landfill. It is an excellent way of keeping the garment in the market at the least possible environmental and social cost and a decent financial profit (Tripathi & Rongali, 2023).

Society's view of thrifting is still taboo and negative, where people still often think that buying or using used goods are those who live in a lower social class and are synonymous with cheap goods and thrift (Cross, 2018). The development of second branded goods is due to the phenomenon thrifting. Rifky Ghilmansyah's research, said that a new lifestyle shift has begun for millennials, where there has been a shift in lifestyle values in the form of shopping patterns in shopping centers shifting to markets, shops, and places selling used clothes (Ghilmansyah, Nursanti & Utamidewi, 2022). The history of the thrift shop began to awaken in the 1760-1840s. The industrial revolution of the 19th century introduced mass-production of clothing which changed the way people see the world of fashion (Mahabarata, 2020).

In its development, thrifting goods are no longer known as obsolete used goods. Over the past few years, the habit of hunting for used goods has become a popular phenomenon among teenagers, adults, housewives and workers (Khurin, 2021). Thrifting culture is carried out as a form of support for the zero waste campaign, namely the reduction and utilization of waste, especially textile waste caused by the fashion industry (Mahabarata, 2020).

Thrifting is a word that comes from the English language "thrift" taken from the word "thrive" which means developing and advancing. While the word “thrifty” can be interpreted as a way to use money and goods properly and efficiently. Thrifting is an activity or method of shopping that aims to save and so that the costs incurred for shopping out are as minimal as possible. (Ristiani, Raidar & Wibisono, 2022). Thrifting is an activity of 'hunting' various thrift items that are being targeted. Thrifting online can be done by paying attention to product photos and details of the condition of the item to the seller. Usually online thrifting is carried out on social networking sites such as Instagram, WhatsApp and Facebook or on used goods buying and selling pages such as Bukalapak, Carousell, Shopee and Tokopedia. You can also choose to thrift offline directly to the market. In contrast to online thrifting, offline thrifting provides a different sensation, starting from the hustle and bustle of the market, scrambling and competing with other buyers, and bargaining with sellers. Unlike shopping at supermarkets or markets in general, thrift markets require careful buying (Putri & Patria, 2022).

Factors that influence the consumption of thrifting fashion are:

a. affordable prices

Consideration of the price of thrifting clothing is used to make savings. This act of frugality can be categorized as an act of instrumental rationality, where saving aims to minimize expenses so that the money that is owned can be used for other purposes and the effort made is to buy thrifting clothes.

b. good quality and branded clothes

Thrifting aims to get clothes with well-known brands besides that clothes with well-known brands are considered to have good quality. Therefore, in doing thrifting, it is clear to get branded and quality clothing, regardless of the main function of clothing is to cover and protect the body.

c. off-the-shelf mode

Fashion or fashion style is made to be accepted and can be followed by the wider community in certain places. The thrifting clothes sold in the market or online have different characteristics in each dress, even in a shop it is not certain that there are clothes that have the same style, the same color or the same shape of the clothes. This is one of the reasons for doing thrifting, namely to get clothes that are different from other people.

d. entertainment (fun activities)

Looking for thrifting clothes is considered fun and exciting for trifting lovers, this is because the process of looking for the clothes you want is in a pile of clothes that are in poor condition, so when the clothes you can find are quite in accordance with what you want, the feeling of the buyer will feel satisfied and happy.

e. mission to protect the environment

> Behind thrifting activities or buying used clothes which are the current trend, there is an environmental mission tucked into it. Awareness of the environment due to clothing waste, people say thrifting is seen as an affordable price and can help reduce clothing waste due to fast-fashion production.

According to the results of the questionnaires distributed, it was found that 83.3% of respondents chose the main reason they liked thrifting was because of the low price. Followed by reasons of good quality materials at 69.8% and also for reasons of uniqueness at 62.5% (Putri & Patria, 2022). The thrifting fashion products that are popular with the public are dresses, blouses, shirts, pants, outerwear, including underwear (Sari, 2022). Fashion thrifting activities can have a negative impact, namely the emergence of a consumptive attitude due to affordable prices, unhygienic clothing, and to get proper clothing you need to choose clothes carefully and in detail so that it takes a lot of time (Ristiani, Raidar & Wibisono, 2022). The thrifting culture is carried out as a form of support for the zero waste campaign, namely the reduction and utilization of waste, especially textile waste caused by the fashion industry (Mahabarata, 2020).

3. Methodology

The method in writing this article uses a qualitative method by means of a literature review. In this study, the views studied are the impact of environmental pollution from the thrifting phenomenon and the Indonesian government's regulation on the ban on the import of used clothes. The data studied use primary and secondary legal materials (Irwansyah, 2021). The primary legal material used is legislation that is relevant to the ban on the import of used clothes. Meanwhile, secondary legal materials are processed and sourced from books and journal articles and supported by news via online media that are relevant to the topic being studied. The study will provide answers according to the research objectives.

4. Results and Discussion

4.1. Thrifting Phenomena Can Damage the Environment

One trend that is currently in vogue, especially by the younger generation and is expected to be a way to achieve sustainable fashion is thrifting. In simple terms, we can identify fashion thrifting as the activity of buying used clothes or fashion products that are still usable. Stocks of used clothing sold in thrift stores usually come from personal used clothing, purchases, or donations (Fajar, 2022). Thrifting is an

activity of buying used goods and buyers have their own satisfaction when they get quality or limited goods at low prices. References show that buying thrift products has become a trend in various countries. Looking for thrift products has become a growing trend because they can be a substitute for someone in fulfilling their needs and desires for fashion products. As the thrift consumer market continues to grow, the thrift shop phenomenon has become increasingly popular. Even this trend has been predicted to continue where in 2029 the total value of global sales of used clothing products will reach $ 80 billion dollars (Gafara, 2019).

Textile reuse refers to various ways of extending the practical useful life of textile products by transferring them to new owners (Fortuna & Diyamandoglu, 2017). It is estimated that 86% of consumers in 2020 are open to buying used clothing, this estimate has increased to 41% from 2016 (ThreadUp, 2021). Used clothing consumption is identified based on economic value, self-expression, hedonism, environment, and social contribution (Hur, 2020).

Buying and reusing used clothes is an effort to uphold the reuse principle in the 3R waste utilization hierarchy. That way, the circulation of clothes will be longer, preventing them from lying uselessly polluting the environment, and reducing the need for manufacturers to produce new clothes. Research conducted by ThreadUp shows that buying used clothes can reduce carbon emissions by 82%, energy consumption by 88%, and water usage by 98% compared to new clothes. It is estimated that this circular economy business model is in line with the aspirations of the Paris Agreement as it is able to reduce 143 million tonnes (~315B lbs) of greenhouse gas emissions by 2030 (Fajar, 2022).

In Indonesia, thrift shopping phenomenon is also growing. This phenomenon has actually appeared for a long time in Indonesia, but it has just become a trend that is currently busy and in great demand by many people, especially among millennials because there are many influencers on social media who carry out this activity. This thrifting activity is starting to be loved in order to save expenses, because it is not uncommon for people to find thrift clothing with well-known brands and are still usable at low prices, the Covid-19 pandemic which has created economic uncertainty has also made more consumers switch to the thrifting trend (Kompasiana, 2021).

Samantha Hall & Anna-Becca Chester's research examines how today's generation uses thrifting versus second-hand clothing that benefits the environment. The research results reveal what is behind this trend-driven consumerism, sustainable shopping habits, and how the idea of reselling used goods will impact sustainability in the future. Used clothes at low prices can encourage people to buy more used clothes beyond their needs (Fajar, 2022). Consumptive lifestyle and always following fashion trends make people always up to date. This consumptive behavior results in accumulation of clothing waste, resulting in pollution. The total greenhouse gas emissions produced by textile production are up to 1.2 million tons per year (Sari, 2022).

Imported used clothes can increase the amount of clothes that are wasted, thus potentially endangering the environment. Most clothes use materials mixed with plastic, which will take longer to degrade in the environment. While Indonesia itself is still having difficulties managing domestic clothing waste, if imported used clothes end up in landfills, it will actually present a new problem, namely the accumulation of waste. In addition, most of the imported used clothes have been curated from market interest. Garments that do not qualify for market interest as textile waste end up in landfills, which are the most difficult wastes to process and decompose. This practice leads to environmental pollution because the clothes are accumulated at the disposal sites. Clothes made from chemical products cannot be fully decomposed, thus leading to environmental pollution (Shafie, *et al*., 2021).

The amount of imported used clothing that cannot be used reaches 60-70% and will likely end up in the trash (Rizky, 2023). Imported used clothes can increase the amount of clothes that are wasted, thus potentially endangering the environment. Most clothes use materials mixed with plastic, which will take longer to degrade in the environment. While Indonesia itself is still having difficulties managing domestic clothing waste, if imported used clothes end up in landfills, it will actually present a new problem, namely the accumulation of waste. The characteristic of fast fashion that seeks to make clothing at low prices makes various brands also use cheap inputs, such as synthetic fibers which take millions of years to decompose (Fajar, 2022). This causes the waste from these clothes to become increasingly harmful to the environment. By 2020, it is estimated that 18.6 million tonnes of clothing will end up in landfills (Young, 2020). In addition,

35% of microplastic waste that pollutes the sea is produced from synthetic fibers contributed by clothing waste (Friot & Boucher, 2017).

Textile reuse refers to various ways to extend the practical life of textile products by transferring them to new owners (Fortuna & Diyamandoglu, 2017). Reuse of textiles generally reduces the environmental impact compared to burning and landfilling, and that reuse is more beneficial than recycling. However for reuse, customer-induced transport can cause environmental impacts that outweigh the benefits from avoided production, unless the use phase is adequately extended. So the general narrow focus on climate change and energy use may not capture the real benefits of many types of textile reuse and recycling, thereby potentially contributing to a shift in the problem, which is that we mitigate climate change by increasing other environmental impacts, such as toxicity and the consequences of land transformation (Sandin and Peters, 2018, pp. 353-365). If not addressed properly, thrifting can actually become a moral trap that encourages us to be more consumptive in buying clothes.

4.2. Prohibition of Imported Used Clothes Entering Indonesian Territory

Sustainability means having a positive impact or reducing negative impacts on the entire production process for three aspects, namely environmental, economic and social (Kumar, *et al,* 2012, 482-489). Sustainability is a major issue that appears in marketing strategies from time to time. Fashion sustainability can also be interpreted as an activity to reduce the negative impact of using fast fashion. For the public and fashion lovers to join the campaign "Thrifting Campaign as a solution to Fashion Waste" (Balqies and Jupriani, 2022, p. 186). Sustainable fashion is a term that has been used since the 1990s. However, it is stated that the development of sustainable fashion has grown very rapidly over the years since the launch of the first sustainability program for fashion companies by Copenhagen Fashion Summit in 2009 (Remy, Speelman, and Swartz, 2016). For Indonesian market consumers, they have become aware of sustainable environmental aspects related to sustainable marketing fashion (Wijaya and Paramita, 2021, pp. 49-57).

Sustainable fashion on the one hand has a positive impact, especially related to the environment. However, on the other hand, it can be detrimental if these goods (used clothes) are imported into Indonesian

territory for reasons such as those studied from various regulations in Indonesia. If a regulation prohibits something, of course there is a reason why it is prohibited, including the ban on imported used clothing from entering Indonesian territory. Regarding imported goods that enter Indonesia, it is required that the goods must be new goods, not used goods, including imported used clothes. For this reason, it is necessary to study the reasons for regulations prohibiting imported used clothing into Indonesian territory and it is necessary to study the health impacts for the community as consumers and the impact on the environment.

There are several regulations that prohibit imported used clothing from entering Indonesian territory, including: Law no. 8 of 1999 concerning Consumer Protection which stipulates that business actors are prohibited from trading used goods. The definition of used goods here includes used goods such as used clothes (Article 8 paragraph 2). If the business actor violates it, he will be subject to imprisonment for a maximum of 5 (five) years and a fine of two billion rupiah (Article 62).

Imported used clothes are also prohibited from entering Indonesian territory based on Law Number 7 of 2014 concerning Trade. This law requires that the imported goods are in new condition. This provision can also be interpreted that imported goods are not used goods, including imported used clothing with the consideration of maintaining the balance and progress of the national economy. The Preamble contains the main ideas which are the background for the enactment of this law, namely:

> "Development in the economic sector is directed and carried out to advance public welfare through the implementation of economic democracy with the principles of sustainability, environmental insight, and by maintaining a balance of progress and national economic unity as mandated by the 1945 Constitution of the Republic of Indonesia. Besides that, the implementation of economic democracy is carried out through trade activities to strengthen the competitiveness of domestic products."

It is for this reason why imported used clothing is prohibited from entering Indonesian territory, and it is expressly stated in the norm "Every importer is obliged to import goods in new condition" (Article 47). This law clearly states that the government prohibits the import of goods in a non-new condition for the national interest on the grounds of protecting national security or public interest, including social, cultural and public morals; to protect intellectual property rights; to protect the health and safety of humans, animals,

fish, plants and the environment (Article 50). The national interest that needs to be protected means protecting domestic products in the sense of the textile industry, including protecting health and the environment. Sanctions for violations by importers who import goods in non-new condition shall be subject to imprisonment for a maximum of 5 (five) years and/or a maximum fine of five billion rupiah (Article 111).

Further regulations specifically, namely Regulation of the Minister of Trade No. 40 of 2022 concerning Amendments to the Regulation of the Minister of Trade Number 18 of 2021 concerning Export Prohibited Goods and Import Prohibited Goods. This regulation explicitly states the prohibited import goods listed in Appendix II, namely types of used bags, used sacks, and used clothing (part IV) with Tariff heading/HS 6309.00.00.

Of the three regulations related to the ban on selling and importing used clothing, it was found that there are several basic reasons why imported used clothing is prohibited from entering Indonesian territory. This reason is partly because imported used clothing has several impacts, such as reducing the competitiveness of domestic products, increasing textile waste, and has the potential to be bad for human health (Sari, 2023). With this ban, at least the Indonesian people are proud to use domestic products and can strengthen the domestic textile industry (Kementerian Perdagangan RI, 2023).

From the several regulations mentioned above it is very clear that what is imported into Indonesian territory must be new goods or not used clothes, especially related to economic factors i.e. it can threaten the local textile industry (local brands also harm local designers and the fashion industry) (Natalia, 2023) health (Arifah, 2015) factors as well as environmental factors that have the potential to add new waste to piles of waste.

5. Conclusion

Thrifting activity as a continuation of fashion on the one hand has a positive impact, especially in counteracting the existence of fast fashion. Indonesia still has difficulties managing domestic clothing waste, so if imported used clothes end up in landfills, it will actually present a new problem, namely the accumulation of waste. Thrifting can damage the environment, where used clothes that cannot be used

become waste that is difficult to decompose. In addition, thrifting fashion transport processes can cause environmental impacts that outweigh the benefits, thereby potentially contributing to a shift in the problem, namely that we mitigate climate change by increasing other environmental impacts, such as toxicity and the consequences of land transformation. However, from an economic point of view, thrifting is prohibited in Indonesia for several reasons due to unprotected local products which can reduce the competitiveness of domestic products where these domestic products need to be protected for national interests. For this reason, maintain a fashion style that is environmentally friendly and reduces pollution as well as strict supervision from the government to prevent imported used clothes from entering Indonesia.

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Consumption of Natural Health Products – Is it safe and sustainable?

Nur Syamila Mohd Roziman[1], Wardah Mustafa Din[2,] Zurina Mahadi[2], Farida Islahudin[3] and Mazlina Md Said[3 4]

[1] Institut Islam Hadhari, Universiti Kebangsaan Malaysia, 43650 UKM Bangi, Selangor, Malaysia.
[2] Pusat Pengajian Citra Universiti, Universiti Kebangsaan Malaysia, 43650 UKM Bangi, Selangor, Malaysia.
[3]Faculty of Pharmacy, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia.

[4] P116490@siswa.ukm.edu.my

Abstract. Since the outbreak of Covid-19 in 2020, people are more health-conscious and thus felt responsible for taking care of their own health for long-term well-being. The public is more aware to seek extra health measures with alternative therapies as awareness of sustainable lifestyles was promoted before the vaccine was introduced. The term "natural" brings a positive attitude towards the product since most consumers perceive natural as safe even though it does not necessarily mean safer or better. There are many reports on natural health products that are adulterated with harmful substances, and many still do not have data on their efficacy, hence it is pivotal that consumers know the safe-use elements of natural health products. It is important for consumers to know and have the right knowledge regarding the safety of natural health products to prevent any adverse effects in the future. The objective of this study is to identify the safe-use elements perceived by consumers for natural health products. A qualitative approach of Focus-Group Discussion (FGD) is employed to elucidate the safe-use elements, and thematic analysis is being done on the qualitative data to explore the objective. There are 11 safe use elements of natural health products mentioned by consumers. However, there is only 1 safe use element that is in line with the current regulation in Malaysia. A complete guideline on the safe use of natural herbal products for consumers is pivotal to maintain their general health and well-being aligned with sustainable development goal number 3.

1. Introduction

Since the outbreak of Covid-19 in 2020, people are more health-conscious and thus felt responsible for taking care of their own health for long-term well-being. The public is more aware to seek extra health measures with alternative therapies as awareness of sustainable lifestyles was promoted before the vaccine was introduced. Since then, a lot of producers have embraced this chance as a method to create more health products using natural ingredients. Such mechanisms of supply and demand in consumers' preferences on natural health products show when there's a high demand for the products by the consumers, the enterprises will deliver and produce more products or services to meet the needs of the consumers, in this matter, the natural health products (Liadis et al., 2019, p. 2). The term of "natural" brings a positive image to the product since most consumers perceive natural as safe even though it does not necessarily mean safer or better. Historically, natural products have been used since ancient times for the treatment of many diseases and illnesses. But today, since these natural herbal products are easily accessible and known as over-the-counter products, people tend to get deceived by the natural term and perceive all natural health products are safe. The increase in the usage of NHPs in Malaysia is due to the accessibility and availability of the product in the market (Farida Islahudin et al., 2019, p. 1830). There are many reports on natural health products that are adulterated with harmful substances, and many still do not have data on their efficacy, hence it is pivotal that consumers know the safe-use elements of natural health products. It is important for consumers to know and have the right knowledge regarding the safety of natural health products to prevent any adverse effects in the future. The objective of this study is to identify the safe-use elements perceived by consumers for natural

health products. A qualitative approach of Focus-Group Discussion (FGD) is employed to elucidate the safe-use elements, and thematic analysis is being done on the qualitative data to explore the objective. For this article, we will be reviewing the safe use element of NHPs agreed upon by consumers. Toward the end of this research, the researchers are designing a model concept for the safe use of NHPs that could be a reference and guide to all stakeholders, especially consumers. The framework is expected to guide consumers in the safe use of NHPs. A complete guideline on the safe use of natural herbal products for consumers is pivotal to maintaining their general health and well-being aligned with sustainable development goal number 3, towards healthy lives and promoting well-being for all at all ages.

2. Literature Reviews

Estimated to be more than 130 million years old, as one of the oldest rainforests in the world, Malaysia is a country rich with biodiversity, especially in the tropics which could be a source of new drugs. Of approximately 15,000 species total of flowering plants, a total of 2,000 medicinal plants have been recognized for their therapeutic and medical values, and a large number of other plants have remained undiscovered for their benefits to humans' health (Ministry of Natural Resources and Environment, 2006; Fazleen Izzany Abu Bakar *et al.*, 2018; Forestry Department Peninsular Malaysia, 2020). This statistic shows Malaysia has big potential in producing more quality natural health products and commercializing them locally and internationally as it can benefit the economy. In 2020, the market value for the herbal industry in Malaysia was expected to achieve a target of RM32 billion with annual growth of eight to 15%, which should increase the income of the country (Bernama, 2019). This target was seen as possible as the Malaysian Government has acknowledged the potential development of the herbal industry as a promising industry in the country. Hence, the government introduced New Key Economic Areas (NKEA) EPP1 under the Economic Transformation Plan (ETP) (National Agricultural Policy 2011-2020), as one of Malaysia's economic transformation journeys in 2011. The main objective of EPP1 is to enhance the quality and efficacy of high-end herbal products through various scientific tests on the raw materials used in the production of herbal products (Farizah Ahmad *et al.*, 2015; Mohd Hafizudin Zakaria, 2016; Rajendran and Nitty Hirawaty Kamarulzaman, 2023).

NHPs in Malaysia are regulated by National Pharmaceutical Regulatory Agency (NPRA) that can be classified into four (4) categories which are i) traditional medicines, ii) finished herbal product, iii) herbal remedy, iv) homeopathic medicine, and v) natural products with therapeutic claim (National Pharmaceutical Regulatory Agency, 2023, p. 1). In this article, the term "NHPs" will be referred to the definition of finished herbal products from the Drug Registration Guidance Document (DRGD) Third Edition, Fourth Revision January 2023 by NPRA. The definition of finished herbal product in the DRGD is defined as "*products consist of herbal preparations made from one or more herbs. If more than one herb is used, the term "mixture herbal product" can also be used. Finished herbal products and mixture of herbal products may contain excipients in addition to the active ingredients. However, finished products or mixture herbal products to which chemically defined active substance have been added, including synthetic compounds and/ isolated constituents from herbal materials, are not considered to be herbal.*" (National Pharmaceutical Regulatory Agency, 2023, p. 4). Generally, the definition of NHPs to consumers is any herbal products that are plant-based, and it is believed that they can prevent or treat diseases and able to maintain their general health (Farida Islahudin et al., 2019, p. 1832).

Based on the NPRA's Annual Report 2022, there were 766 registration applications received for natural products and 670 NHPs registered in 2022 (National Pharmaceutical Regulatory Agency, 2023a, p. 12 & 13). This high number of NHPs registered in Malaysia's market shows the relevancy of alternative medicines and it is widely accepted by society here. In terms of safety for medication, it brings the meaning of no adverse effects or harmless for the consumer to consume any pharmaceuticals from the market. As for NHPs that are sold as over-the-counter products in every premise in Malaysia, the products' quality and safety can be supported with clinical trials or scientific evidence to support the claim of the products (Moreira et al., 2014, p. 249). NHPs are popular among consumers especially when they have a positive perception of herbal substances as the main ingredient of NHPs that are safer to be consumed and free from any adverse effects (Farida Islahudin et al., 2019. p. 1830). This common misconception is worrying as it could cause a serious adverse effect that could be affecting the quality of life for the consumer (Suzi Fadhilah Ismail et al., 2020. p. 192). Studies have found that most raw herbs that are used as the active ingredient in NHPs may contain

toxic compounds resulting from microorganisms or environmental contaminations. Misidentification for part of plants or species, and adulterations may also lead to toxicity of NHPs. Thus, this could affect the general health of consumers associated with the toxic effects which may be life-threatening side effects such as renal failure, liver damage, extreme fatigue, or even death (Ekor, 2014, p. 3; Nur Azra M. Pauzi et al., 2021, p. 2010). Another factor that can cause adverse effects from consuming NHPs is consumers are not obliged to get permission from professional practitioners to consume any NHPs in the market. They can purchase any NHPs from the claims on the packaging of the product following their intended use of NHPs (Yang, 2020, p. 1689). Although the herb used in any NHPs is scientifically proven can treat certain diseases depending on its claim, the finished products in the market are mostly untested and unregistered (Farida Islahudin et al., 2019, p.1836).

Despite the fact that natural products have been used as medicines and treatments since ancient times, their safety, effectiveness, and quality are currently still being addressed, particularly in the context of finished herbal products that are being sold to consumers without any aid or prescription from healthcare professionals. From the National Centre for Adverse Drug Reactions Monitoring Annual Report 2020, the number of adverse drug reactions (ADRs) reported for NHPs was 173 (National Pharmaceutical Regulatory Agency, 2021, p.11). This problem arises from the action of the consumers who mostly will not disclose the usage of NHPs to healthcare practitioners and are self-regulated by the consumer themselves (Ekor, 2014, p. 4; Nor Fadhlina Zakaria et al., 2021, p. 9). ADRs are always associated with herbal medicines as they can cause acute to serious adverse effects to consumers. It is generally a harmful and unpleasant reaction towards the body caused by any pharmaceutical product intake that usually needs proper administration from healthcare professionals to withdraw the ADRs from the body. This reaction can occur due to contraindications or herb-drug interactions that are usually not noticeable by consumers. ADRs contribute to the increase in admission to hospitals, morbidity, and mortality rate in most countries (Patton and Borshoff, 2018, p.77; Zazzara et al., 2021, p. 464). In order to tackle this ADRs issue, many strategic and systematic approaches need to be done since the intake of this type of product cannot be controlled. Educational programs to spread awareness and increase the knowledge for safe use of NHPs to the public are crucial that need to be done especially by the government and healthcare professionals (Suriana Hanim Ariffin et al., 2021, p.134).

Since herbal medicines have been utilized as an alternative and complementary medical therapy in Malaysia and gained much attention from Malaysia's MOH, the conservation and sustainable use of medicinal plants must be planned wisely to preserve them for future use. As for sustainable use, good agricultural and harvesting practices must also be implemented to prevent excessive harvesting of medicinal plants. Besides that, it is also necessary to implement sustainable harvesting of medicinal plants to ensure the continuous supply of these plant species. Furthermore, the quality of medicinal plants used as the raw materials of NHPs should be of high quality and free from microbial contamination and heavy metals (Chen et al., 2016, p.6; Akinyemi et al., 2018, p. 195). In line with the Sustainable Development Goal (SDG) number 3 i.e., good health and well-being, this study aspires to balance the risks and therapeutic benefits of NHPs that are being used widely among consumers for the treatment of illnesses and for the maintenance of general well-being. As the primary source for NHPs, medicinal plants need to be protected to reduce unnecessary harvesting of natural products from the environment and promote sustainable use of natural raw products.

3. Methodology

As exploratory research, the qualitative method approach was adopted to capture the complexity of various perspectives and views of participants for this study. The methodology involves two (2) phases which are structured to answer the Research Objectives. The phases are: 1) Identification of principle elements for safe use of NHPs, and 2) Distinguishing the common elements for the safe use of NHPs between consumers and current regulation in Malaysia.

Phase 1: Identification of principle elements for safe use of NHPs in Malaysia

To answer Research Objective 1, we have conducted content analysis, focus group discussions (FGD), and round table discussion (RTD) to identify the principal elements for safe use of NHPs by consumers. Content analyses were conducted on the relevant documents which include NHPs' registration guideline from the Ministry of Health Malaysia (MOH), DRGD Third Edition, Fourth Revision January 2023, Appendix 7, 33,

& Product Advertisement Approval Guide, safe use framework from other countries, and international bodies to retrieve the elements that have been established elsewhere. The findings from the content analysis were analyzed and incorporated into the protocols for the FGD. A protocol was prepared to steer the FGD, but flexibility was allowed so that participants were able to explore the wider aspects of the topic they considered important. The participants for FGD (n=8) were recruited using a purposeful sampling strategy that focuses on the need to obtain 'information-rich cases' from experienced individuals on the phenomenon of interest, which in this case, the consumers of NHPs in Malaysia (Palinkas et al., 2015, p. 2 & 3). During the FGD, participants involved are those who are willing to talk freely and openly about a particular subject (Cortini et al., 2019, p. 31). The saturation of the data was discussed among the researcher team during the focus group study analysis. Although saturation of the data will be determining the emerging themes from the thematic analysis process, the safe use elements mentioned even once by the consumer will also be included in the final guideline depending on the relevancy and suitability in Malaysian settings. The data from the FGDs was thoroughly examined to acquire the participants' views of the elements. All the FGD data was recorded, and thematic analysis will be carried out using qualitative analysis software, ATLAS.ti version 23.2.0., which involves methodically reading through the verbatim transcripts and segmenting and coding the text into categories that highlight what the participants have discussed (Thompson, 2022). They are then assessed, compared, and interpreted, also any similarities and differences will be noted. The categories will be combined and assigned to major themes that provide the information sought to derive the core elements. The FGD with the consumers was conducted in the Malaysian official language, Malay, and the audio will be transcribed in English language without changing the meaning of the script from consumers.

Phase 2: Distinguishing the common elements for safe use of NHPs between consumers and current regulations in Malaysia.

To answer Research Objective 2, all emerging themes and sub-themes from the FGD pertaining safe use of NHPs by consumers were structured by the research team in a series of discussions and workshops. The safe use elements of NHPs agreed upon by the consumers were compared with the current guidelines from NPRA to see the similarities or differences of the occurring elements. Similar sub-themes will be tabled to ease the process of discussion among the researchers. There were 3 documents from MOH Malaysia that were used as the main references to compare with safe use elements deduced by the consumers and current regulations in Malaysia. The documents include DRGD's third edition, appendix 7 and 33, and Product Advertisement Approval Guideline. Elements that emerged from the thematic analysis will be further strengthened with RTD with the regulators (n=3). Different divisions of regulators were invited ie: NPRA and Selangor State Pharmaceutical Services Divisions to give their viewpoints on the elements that arose during the RTD session. The discussion was mainly to gain in-depth insights into the major themes that emerged and were being compared with current regulations in Malaysia from the focus group study analysis among the researchers. Each element for the safe use of NHPs was discussed and decided to be included in or excluded in the final consumer guideline according to the feasibility and suitability of the elements to Malaysian settings. The draft will be subjected to criticism from different perspectives to ensure the list of safe use elements of NHPs by consumers are able to be understood and subscribed to in a common space among common people and is not confined to an exclusively specific dimension such as medicine or pharmacology.

4. Results and Discussion

From the FGD, the consumers were expected to elucidate the safe use elements of NHPs. There are 11 safe use elements of NHPs deduced by them. The most frequently mentioned safe use elements of NHPs over all age groups of participants was that natural health products must be in compliance with the guidelines from the Ministry of Health Malaysia (MOH). Other elements also were being mentioned and discussed ie: testimonials from other consumers and sellers, halal-certified products, perceptions on the efficacy of the products, popular products, and others. In Table 1 shows the list for safe use elements of NHPs agreed upon by the consumers.

4.1 Safe use elements of NHPs agreed by consumers

Table 1. Safe use elements of NHPs agreed by consumers

11 Safe use elements of NHPs

Testimonials	Natural terms
In compliance with the guidelines from the Ministry of Health Malaysia (MOH)	Established brand manufacturers
Halal certified	Published report on safety, efficacy, and quality
Perception on efficacy	Sunnah diet ingredients
Trusted over-the-counter outlets	Recommended products
Popular products	

4.1.1 Testimonials

Testimonies mentioned by the participants were usually from other consumers, sellers or agents including online sellers, and family members. These wealth of information testimonies about the product give them confidence and feel safer consuming the NHPs. It will validate their perception of the products and proceed to make the purchase of that particular NHP. The testimonies obtained through various online selling platforms and social media based on the reviews from other satisfied consumers of the product, hence, managed to influence the participants to try the product. They were depending on the reviews from other consumers to make the purchasing decision.

> *"First is testimonials, when we look at a product, I like to read testimonials from other consumers. The more testimonies, the higher of chance that I will be purchasing that product, meaning I will feel more confident of the product. Because I like to read testimonials. If it's positive feedback, then I will try it."* (C07)

> *"Then, testimonials from the specialists."* (C02)

> *"Yes (testimonials from other consumers). When I ask them to provide me with information about the product, they will contact me. They will ask me to read and query them about the product. I will tell them about my condition and ask if I can consume this product. They will provide testimonials from other consumers as well…"* (C04)

> *"I will read testimonials. If I am looking for products, I did some research usually on Facebook and I will read the testimonials. Usually in the comment section, people will leave honest feedback. Then I will check if the feedback is negative, and I will direct message the user. If there are any negative side effects, I will ask them. They will tell us and from there I will decide if I want to proceed and purchase the product. If there were a lot of negative comments, I will not buy it. But usually, I will be asking other consumers about the product. Because I want to know their feedback"* (C03)

> *"To me testimonials are important… I will cross-check from one online-selling platform to another to read the reviews on their pages… Another way, I will ask my friends or other consumers if they have experience of consuming the product and will ask them if the product is okay or not"* (C08)

> Based on the uncertainty reduction theory by Berger and Calabrese, 1975, on online shopping context, shoppers will feel uncertain about the product or service offered through online selling platforms before they read the reviews from other shoppers convincing them the product or service is worth buying. Lack of information from the seller or previous consumers might affect the uncertainty of the shopper on the quality of the product or service (Lee and Ma, 2012, p. 112). From this study, more information and positive feedback about the product from previous consumers increases the participants' certainty to buy the NHP from online selling platforms or physical stores.

4.1.2 In compliance with the guidelines from the Ministry of Health Malaysia (MOH)

This safe use element is the most mentioned element by consumers. For this element, there are six other sub-elements discussed by consumers that match with the current regulation: NHPs registration guideline, DRGD

Third Edition, Fourth Revision January 2023, Appendix 7, 33, & Product Advertisement Approval Guide, ie: registration number, hologram, dose, GMP, label & packaging, ingredients.

"Firstly, I will check if the product is registered" (C04)

"I think ingredients are one of the elements for a safe product. If the product fails to list the ingredients on the packaging, how does it get the approval for KKM?" (C04)

"It has a serial number (registration number) from KKM, so… and I will search the serial number on the website checker to see if it's registered or not, and it is registered" (C05)

"To me, I always check the hologram sticker" (C03)

"*Processed from a hygienic place (GMP)*" (C05)

"I want to add on, for me, packaging is also a concern to me to see whether the product is safe or not because for packaging, we know there are laws and regulations that need to be followed. They must have ingredients, manufacturing date, expiry date, origin, and brand. That is also my concern…" (C06)

"To me, usually the dose will be stated, and we need to follow it" (C07)

These sub-elements seen as detailed and added values for the safe use of NHPs by consumers incorporated with the guidelines from NPRA. NPRA is the regulatory body that regulates the registration and conducts post-marketing surveillance for a thorough evaluation of the drug safety of NHPs in the country. These guidelines are important to ensure the quality, safety, and efficacy of NHPs (National Pharmaceutical Regulatory Agency, Appendix 33, 2023, p. 6).

All registered products must display the registration number or MAL number on the packaging of the product followed by 8-digit numbers and ends with the code "T" to indicate the product is under the natural products category. Other than the registration number, a registered product usually has a hologram logo as a security feature that can be easily observed by consumers or pharmacy enforcement officers (Jauze, 2018). Consumers also can check the validity of the registration number of the product on the official NPRA website, Quest3+ checker. As for the Meditag^{TM} hologram security sticker, consumers can download an application on their phone, MediTag Checker, to scan the hologram on the packaging of the product to confirm the authenticity of the product before purchasing it (Munira Muhammad and Nor Izyani Hanafi, 2016). Other additional sub-elements such as dosage information, GMP logo, detailed label & packaging, and list of ingredients of the NHPs also were discussed by consumers during FGD to strengthen the point of safe use elements of NHPs that are in compliance with the current regulation in Malaysia.

4.1.3 Halal certified

Halal certified products are considered as safe by the participants, especially to the Muslim consumers. To confirm the NHP is halal certified, the halal logo is printed on the packaging of the finished product. The consumers agreed on the importance of halal status for NHPs to indicate the product is safe to consume.

"Yes, yes, usually it has a halal logo…" (C01)

"Other than halal…" (C2)

"… after that, I will check the halal symbol first" (C04)

"Then, when we look at the product box, there's halal logo.." (C05)

Halal certification is not mandatory to the manufacturers to apply from Department of Islamic Development Malaysia (JAKIM). Halal pharmaceutical in Malaysia is described as following the Malaysian Standard MS 2424: 2012 Halal Pharmaceuticals-General Guidelines and Shariah compliance (Islamic law)

from the ingredients prospect to the manufacturing process of the products. In terms of following Shariah law for ingredients, the pharmaceutical product must not contain any parts or products from animals that are non-halal and must be slaughtered according to the Shariah law. Additionally, halal pharmaceuticals must not contain any parts of humans or its derivatives. Other than that, the product must not contain any filths, safe for human consumption, and be non-poisonous. The types of equipment used for the preparation, processing, and manufacturing of any pharmaceutical products must be not contaminated with filths, and the process from the early stage until the end stage of producing a pharmaceutical product must be separated from the products that do not meet the requirements as stated before (Johari Ab Latiff and Zalina Zakaria, 2016).

Overall, consuming halal products is one of the Islamic teachings that are stated in the Quran and the hadith of the Prophet Muhammad SAW. All Muslims are obliged to follow Islamic law to consume sanctioned products as an act of worship to Allah SWT. However, halal concepts are not only applicable to Islamic religious practices but also can be a new dimension in understanding halal practices to Non-Muslim consumers in sustainability, product safety, and concern about animal welfare. In terms of maintaining general health and well-being, halal products are confirmed for their safety, cleanliness, and nutrition aspects (Golnaz Rezai, Zainalabidin Mohamed and Mad Nasir Shamsudin, 2012). Other than being particular about the halal requirements in the production of halal NHP, especially on the permissible source and equipment, a halal certified NHP assures the safety, quality, efficacy, and hygienic elements are emphasised. Thus, this can be beneficial to the well-being of Muslim and Non-Muslim consumers (Rahmatina Awaliah Kasri *et al.*, 2023).

4.1.4 Perception on efficacy

Effectiveness is measured as a safety aspect of NHPs by consumers. The NHPs are considered as efficacious when the consumers felt positive changes from the intake of NHPs. Other than the efficacy towards their health, the consumers will find any NHPs from any herbal extracts that are proven of their functions and ability to perform in treating or preventing certain illnesses based on their concern.

> *"I feel the product is helpful… It gives positive effects to my body"* (C07)

> *"One more thing, when I use the product, I feel more energetic, when our body feels lighter, our movement is faster, and my sleep is also good"* (C04)

> *"I will search for the benefits of the plant. When I looked up for the plant, but I don't know its function, so when I read about their benefits and aligned with the description on the product, I feel it's safe to be consumed"* (C05)

An effective NHP is viewed as safe for the participants. Other than that, the period of effectiveness of NHPs also was considered by them to see if they are fit to continue consuming the NHPs. They believed the faster the NHPs could treat their health as long as it will not harm them, the better it is. If it took time to see the result, they will immediately stop consuming the product and find another NHP with the same function in the market with quick effects.

4.1.5 Trusted over-the-counter outlets

There are many physical and online outlets selling NHPs as it is considered an over-the-counter product which allows the consumers to make the purchase without a prescription and aid from practitioners. The input on this safe use element by consumers is they prefer to buy the NHPs from trusted outlets such as the pharmacy or online selling platforms with a high number of purchases history of the NHPs.

> *"Secondly, when I'm buying a product, the place of the product sold will be my concern. If it is from a pharmacy, then it is one of the factors that give confidence to me"* (C07)

> *"Usually if at the pharmacy, we will ask the pharmacist. For example, if we were looking for fish oil product, they will suggest the best product for us."* (C01)

"Yes (recommendation from a pharmacist). If we are looking for a vitamin, we must refer to them." (C04)

Products sold in pharmacies will increase their confidence to consume since there are pharmacists as healthcare professionals to guide them in purchasing decisions on NHPs according to their health status. This may increase the awareness for the consumer to consult with healthcare professionals before deciding to consume any NHPs from the market. The pharmacists could also monitor their health status from time to time to ensure there are no adverse effects caused by the NHPs. Other than ensuring the safety and quality of the NHPs, the health status of the consumers is also guaranteed.

4.1.6 Recommended products

One of the usual factors that influenced the participants to consume NHPs is the products recommended by other users which could be from other consumers, family members, or practitioners. Any recommended products especially by family members are perceived as safe to consume. Other than safe, the product is believed to be effective in treating symptoms of certain illnesses.

"Preferred by other consumers" (C07)

"If there is any of my family members have consumed the product and it's not affecting their general health, then I will consume it too. I feel it is safe because I trust my family members." (C08)

"I will choose based on the prescription by the doctor." (C06)

There are many sources of recommendations for the participant in consuming NHPs from the market. Since there are so many products, they will ask around and trust other people's recommendations on the NHPs before purchasing them.

4.1.7 Popular products

Popular products are considered as safe by the participant since there are many other consumers out there that know and have been using the same product.

"There are many other consumers for this product…Many said that the product is good… Testimonies from many consumers show that this particular product was more preffered than other product" (C07)

Comparison was made between few products before deciding to proceed with purchasing to ensure the chosen product is the best option that they could get from the market. They prefer products that are well-known and popular among other consumers.

4.1.8 The use of the "natural" term

The common use of NHPs among consumers is due to the perception of the use of the "natural" term that is emphasized on each packaging is beneficial to their health. Other than that, the consumers believe that if the NHPs contain natural herbals without any other derivatives are safe to consume and free from any side effects (Farida Islahudin *et al.*, 2019).

"They use natural herbs, not mixtures" (C07)

"Because it's a natural-based product since the ingredients are from fruits. It says after boiling it, the ingredients, these fruits can be consumed. That's why I feel it's safe to consume." (C04)

Findings from the FGD show that consumers' beliefs on the benefits of natural sources could treat their health problems influencing them to consume NHPs. In addition, they feel the natural plants will not cause any serious side effects to them and if they feel negative effects on their body, they will immediately stop consuming the NHPs without feeling the need to consult practitioners, especially medical doctors.

4.1.9 Established brand manufacturers

Since there are many brand manufacturers in Malaysia, consumers prefer NHPs from brand manufacturers that they are familiar with. There are consumers that will do some research to check the background of the manufacturers before proceeding with buying their products. This is to ensure the manufacturers are valid in processing the NHPs to be sold in the market.

> "*And also, when I did my research of the company's name and it stated that the company is located in Penang, and it's a big factory, so I feel it's fine to me to consume the product."* (C05)

> "*... Means that people know the product, when mentioned, we know, we know the producer."* (C07)

Brand manufacturers in Malaysia should not focus on marketing purposes only as they are responsible to produce safe, quality, and effective products for the consumers. It is important for the brand manufacturers to follow the guidelines by MOH to meet the specific standards of safety and quality NHPs and register their products with NPRA. There are many big brand manufacturers in Malaysia that took their own initiatives to conduct tests on their product to prove their product is safe and quality for the consumers.

4.1.10 Published report on safety, efficacy, and quality
Evidence-based safety studies of the NHPs are viewed as one of the safe use elements by the participant. Even though they only touched on this matter generally and not discussed it in depth, they are aware a safe, quality, and effective product must be tested beforehand to ensure it is safe to be consumed by consumers.

> "*So, I will feel more confident to consume since the product has undergone tests rather than just simply spreading words without any evidence"* (C05)

A registered NHP at least is confirmed its safety and quality when the manufacturers must meet certain requirements such as being free from microbial contamination and heavy metals that could cause adverse effects to the consumers.

4.1.11 Sunnah diet ingredients
This element was deduced by Muslim consumers as the Sunnah diet is one of the many teachings of Prophet Muhammad (p.b.u.h) that brings benefits to humans' general health and overall life.

> *"I also look up for sunnah diet"* (C02)
> *"Since I have been consuming habattus sauda and olive, I feel confident that the product is safe since in the Al-Quran is stated it is a sunnah diet"* (C01)

> *"It has raisins and other sunnah diet ingredients..."* (C04)

There is much evidence on following the sunnah diet especially when it is stated in the Al-Quran that prohibited Muslims from consuming foods that could cause harm and affect their general health. Health is something that Islam has taught us to take care of and by consuming sunnah foods is one of the ways in maintaining good health. Consumption of the sunnah diet promotes the well-being to the consumers. It also could reduce the risk of getting chronic diseases such as cardiovascular diseases, hypertension, and diabetes (Mariam Abdul Latif and Suhaimi Ab. Rahman, 2020).

5. Conclusion

From this study, we found that there are 11 elements of safe use mentioned by consumers. Among the elements mentioned, only one element is aligned with the current regulations: NHPs must comply with the guidelines from the MOH. Under this element, there are six sub-elements coexist with the current regulations. They include of a registration number, hologram label, dosage information, GMP logo, complete label & packaging, and list of ingredients. These sub-elements for the safe use of NHPs are important for the consumers and are seen as added values for them to perceive a NHP is safe to consume. In this study, the safe use elements mentioned by consumers are mostly brought up more than once. But other elements that were mentioned once are also included in the safe use elements of NHPs. For future studies on this research

topic, a quantitative study is suitable to be conducted to measure the relevancy of each safe use element emerged from this research findings.

Alongside the safe use elements of natural health products from the study, there are also additional on good practices that have been mentioned such as health status monitoring and must be well-informed before taking any natural health products. It is identified that these elements coincide with the guidelines disseminated by the regulators, but the depth of safety elements between these two stakeholders hold a very huge gap in achieving a sustainable ecosystem in the safe use of NHPs. It can be summarized that the safe use of NHPs is very crucial in ensuring healthy lives and promoting well-being for all ages also could prevent any worrisome consequences. This list of safe-use elements by consumers is pivotal in developing policies for the safe use of NHPs and ensuring effective initiatives are being taken to bring a healthy society and sustainable environment toward producing a safe, effective, and quality NHP in the future.

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TRACK 5
Production, consumption and innovation

5f. Food system transformation

Abstracts

5

POLICIES OF GENETICALLY MODIFIED ORGANISMS IN AFRICA

Mr Moses Mukui[1], Dr Grace Alawa[2]
[1]Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya. [2]Rivers State University, Port harcourt, Nigeria

MR MOSES MUKUI

DR GRACE ALAWA

Abstract

Genetically Modified Organisms (GMO) are those organisms (crops, microbes and livestock) that have been engineered in the lab to produce the most desirable traits. Their genomes are altered using engineering methods such as Recombinant DNA technology and gene cloning. In Kenya, GMO was adopted recently due to the prevailing drought that hit the country in 2022. According to Kenyan authorities, over 4.35 million Kenyans faced food insecurity and thus prompted the government to adapt GMOs as a solution. GM foods can help fight food insecurity but might have unforeseen consequences and thus proper policies and research should be put in place before adaptation. A lot of debate is currently ongoing about the environmental safety, transfer of DNA material to non-target organisms and loss of biodiversity. There are many people who are against GMO for various and valid reasons. This paper aims to identify whether GMOs can help a country curb food insecurity and identify the policies that govern GMO production, commercialization and consumption across Africa. According to UN about 1 in 10 people worldwide are suffering from hunger and nearly 1 in 3 people lack regular access to adequate food (2020). GMO might be the solution to the droughts and food insecurity experienced by many countries across Africa. Therefore educating the general public and empowering them on facts about GM foods is vital. Implementation of good GMO policies is key in maintaining a sustainable food system in Africa to ensure a more informed decision around GM foods.

According to SDG 2 “End hunger, achieve food security and improved nutrition and promote sustainable agriculture.” GM foods may be the solution we need in Africa to promote food security and curb post-harvest losses. We should strive to implement good GMO policies to ensure food sustainability across Africa

Keywords: Genetically Modified Organisms, Recombinant DNA technology, Gene cloning, SDG (Sustainable Development Goals).

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REVIEW OF MANAGEMENT METHODS OF TYPE II DIABETES MELLITUS

Mr Finagnon Toyi Kevin Fassinou[1], Dr Marius Affonfere[2]
[1]Faculty of Agriculture and Environment/Gulu University, Gulu, Uganda. [2]Laboratoire de Sciences et Technologie des Aliments et Bioressources et de Nutrition Humaine, Ecole des Sciences et Techniques de Conservation et de Transformation des Produits Agricoles, Centre Universitaire de Sakété, Université Nationale d'Agriculture (UNA), Sakete, Benin

MR FINAGNON TOYI KEVIN FASSINOU

DR MARIUS AFFONFERE

Abstract

Non-communicable diseases (NCDs) are a major contributor to the global burden of disease around the world and according to WHO, NCDs count for over 70% of all deaths globally. The majority of these deaths occur in low and middle-income countries (80%) and the major illnesses associated are cardiovascular diseases and diabetes. Diabetes prevalence is increasing and emerging as a global health problem that may reach pandemic levels by 2030 and the most prevalent form is type II diabetes mellitus (T2DM approximately 90%). The International Diabetes Federation estimates that 19.8 million people have T2DM in Africa where approximately 75% remain undiagnosed. Africa is projected to bear the brunt of a 142.9% increase in T2DM compared with 51.2% globally and it has the highest proportion of deaths attributable to T2DM (73.1%). Sub-Saharan African countries especially are more impacted with 15.5% in 2017 and by 2045, this number is expected to increase by 162.5%. Obesity, sedentary lifestyle and genetic components are the most underlined causes of T2DM and are highly connected to physical inactivity and high calorie-food consumption. However, despite many strategies exist such as physical activity, antiobesity drugs, oral hypoglycemic agents, glucose monitoring and calorie restriction, and much research on calorie restriction; the prevalence of T2DM in Africa is still increasing. The present study intends to investigate T2DM management methods and their effectiveness. This study could be useful for researchers and policymakers to design and implement sustainable T2DM management methods in Africa. It will be particularly helpful for food designers to design appropriate diets for diabetics people using local food resources in Africa. A literature review on management methods of T2DM are ongoing. Databases such as Google Scholar, Springer, and ScienceDirect are consulting from November 2022 to now. Data on T2DM prevalence and causes and management methods, and calorie restriction methods for T2DM management are collected. (i) The sustainable strategies that could be used for T2DM management in Africa are collected.

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Experiences of Fulani women in Dairy Business and the implication for Dairy development Efforts in Ibarapa and Iseyin Area of Oyo State

Ms Victoria Olujimi[1], Dr Omobolaji Obisesan[2]
[1]University of Ibadan, Ibadan, Nigeria. [2]Interconnections for Making Africa Great Empowered and Sustainable (IMAGES) Initiatives, Ibadan, Nigeria

MS VICTORIA OLUJIMI

DR OMOBOLAJI OBISESAN

Abstract

Nigeria, with more than 180 million inhabitants has an annual demand for milk and other dairy products estimated at around 1.3 billion tons, which represents a sizable market for locally produced milk. Unfortunately, imports account for 60% of the nation's dairy consumption. The contribution of nomadic and semi-nomadic Fulani women (FW) to the pastoral economy of the nation is pertinent to the livelihood as well as sustainability of the dairy sector. The Fulani's main source of subsistence is raising livestock and the women are responsible for marketing and processing of milk as well as other dairy products. However, the procedure and economic activities still remains local that a dairy firm could not expect to receive products from them. Much effort has not been initiated to make the process modern and technologically-drive in such a way that it will advance wealth. Thus, this study was therefore designed to examine the resources available to FW, to determine the problems encountered and the coping strategies and assess the infrastructure put in place to develop small scale dairy sector. The study will be anchored on the Rational Choice Theory and Social Action Theory. 16 In-depth interviews would be used to elicit narratives from FW in hamlets in Ibarapa and Iseyin Area of Oyo State. Secondary data would be from books, journals and articles. The expectations are that there will be establishment of centres to collect fresh milk from the FW and to supply urban dairy plants. The women would also benefit from more efficient and hygienic methods of small-scale dairying, improved roads and transport services. By so doing, they could do the processing themselves and sell in more lucrative markets which will in turn improve the economy. The study is targeted at SDG 1, No poverty, targets 1a and 1b, SDG 8, decent work and economic growth, targets 8.3, SDG 9, industry, innovation and infrastructure, targets 9.3, 9.a and SDG 12, responsible consumption and production, target 12.3. The result will not only drive the government to provide resources for the FW but it will also generate wealth for the people and the society at large thereby incorporating the 5Ps of the SDGs.

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RETHINKING DISRUPTIVE AGRICULTURAL TECHNOLOGIES FOR IMPROVED PRODUCTIVITY AND PROFITABILITY AMONG SMALLHOLDER FARMERS

Mrs Tabitha Avoga
Egerton university, Nakuru, Kenya

MRS TABITHA AVOGA

Abstract

Rising population, pressure on food systems, food and nutrition insecurity, urbanization, poor value addition, low participation in the global value chains, gender inequity and threats of climate change are megatrends demanding the need for advancement in and adoption of disruptive agricultural technologies. Digitalizing and disrupting agricultural productivity, profitability and sustainability of food systems can help build resilience, be an enabler to economic growth and the overall economic performance across African countries. Disruptive agricultural technologies have the potential to reduce the cost of production, link farmers to buyers, reduce the inequalities of accessing production and market information/technologies to boost farmers' decision making processes. In spite of the benefits, the uptake and utilization of these disruptive technologies is still low, especially among smallholder rural farmers in Africa. The study will assess the role of social cultural barriers, including gender relations and traditional agricultural practices facilitating or constraining the adoption of disruptive agricultural technologies; and understand the challenges, successes and opportunities facing African countries in scaling up disruptive agricultural technologies. Disrupting the existing agricultural production and profitability situation can enable players in the agricultural sector to leapfrog current methods to increase productivity, profitability efficiency and competitiveness.

A meta-analysis of published literature will be conducted to understand the key issues affecting full adoption of disruptive agricultural technologies among smallholder rural farmers in Africa. In the policy area, the study would provide information on possible entry points that would enhance broader adoption of disruptive technologies for improved African food systems.

Keywords:

Disruptive agricultural technologies, digitalizing policies, use and adoption of the technologies.

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Urban agriculture provides multiple benefits besides food

Dr. Prajal Pradhan
Potsdam Institute for Climate Impact Research, Potsdam, Germany. Bauhaus Earth, Berlin, Germany

Abstract

Urban agriculture, including peri-urban farming, can nourish around one billion city dwellers and provide multiple social, economic, and environmental benefits. However, these benefits depend on various factors and are debated. Therefore, we use machine learning to semi-automate a systematic review of the existing literature on urban agriculture, starting from around 76,000 records for initial screening, based on a broad keyword search strategy. We apply the topic modeling approach to systematically understand various aspects related to urban agriculture based on the full text of around 1450 relevant publications. Urban agriculture literature covers 14 topics, clustered into 11 themes, which are related to urban agriculture forms, their multi-functionalities, and their underlying challenges. Promoting urban agriculture requires accounting for its multi-functionalities, besides food provisioning, and encouraging efficient and sustainable practices.

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Urban agriculture in China supply >20% of its vegetable needs and emit less GHG than traditional agriculture

Dr Yuanchao Hu[1], Dr Prajal Pradhan[2]
[1]Wuhan University, Wuhan, China. [2]Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany

Abstract

Urban agriculture (UA) is multi-functional and thus an essential contributor to net-zero-emission cities and food systems. Previous studies mainly investigate UA practices of limited cases in developed countries. However, the production potential and the comparative carbon emissions relative to traditional agriculture in developing countries remain underexplored. To address this knowledge gap, we construct a new dataset of multi-form planting area in rooftops, community road verge, urban greenspace and residential balcony for 124 mega Chinese cities with dense population larger than 1 million.

The total potential planting area or all the above-mentioned UA forms amounted to 3043.5 km2, where rooftop takes a share of 69%. To determine the potential rooftop harvesting area, we identified 13 million buildings with a total rooftop area of 6944 km2 using either visual interpretation or existing database. The productive roofs are further limited by four conditions, namely the buildings with flat roofs, less than 30 years-old, less than 40-meters height, non-occupied and buffer zone from the edge, to select areas that are suitable for rooftop planting. As the results, the potential rooftop area takes 36% (ranged from 12-48%) of the total rooftops. For the average level of 124 cities, urban agriculture could provide 20% (4-61%) of the daily vegetable needs of urban residents (i.e., self-sufficiency), given different levels of yield, space usage and vegetable requirement. Under the medium scenario of urban vegetable cultivation, the median GHG emission intensity of all cities is around 0.51 kgCO2e/kg, which is much larger than 0.29 kgCO2e/kg, the average life-cycle emission of traditional vegetable cultivation in China. However, the major three system-wide benefits (reduced building energy use, food miles and food loss) will cut 41% of the GHG emission intensity of urban agriculture. Thus, the actual emission intensity of urban vegetable production is about 0.3 kgCO2e/kg, which is comparable to traditional vegetable production.

Our results show that urban agriculture have a substantial potential to provide fresh vegetables for urban residents, but highly varied across cities due to the different building density. The GHG emission intensity of urban agriculture could be lower than that of traditional agriculture, with accounting other potential benefits.

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HIGH PRESSURE PROCESSING OF AFRICAN INDIGENOUS VEGETABLES FOR FOOD SECURITY

Miss Jennifer Kago[1], Prof Fatunbi Oluwole[2]
[1]Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya. [2]University of Forth Hare, Alice, South Africa

MISS JENNIFER KAGO

PROF FATUNBI OLUWOLE

Abstract

For the longest time, African Indigenous Vegetables have always been considered as food for the underprivileged. Some examples of such vegetables include amaranth (Amaranthus species), cowpeas (Vigna unguiculata), African night shade (Solanum species), spider plant (Cleome gynandra), okro (Abelmoschus esculentus), sweet potato (Ipomoea batatas) and Ethiopian kale (Brassica carinata). People have become much aware of their nutritional value. Not to mention its availability and accessibility. Many underutilized crops have been found to hold benefits for sustainable agriculture. These indigenous vegetables are low input, drought and disease resistant.

Climate change is intensifying food insecurity across Africa. According to World Food Program 2022, as many as 828 million people go to bed hungry every night, the number of those facing acute food insecurity has soared from 135 million to 345 million since 2019. A total of 50 million people in 45 countries are on the edge of famine. With the changing climate change, it is likely that the summers will be hotter and the winters colder. African Indigenous vegetables production is the way to go. There is need for a paradigm shift in the food production and consumption of these vegetables. High Pressure Processing (HPP) is an emerging processing treatment that makes food safer and extends its shelf life, while allowing it to retain many of its original qualities and healthy attributes. HPP also tackles specific product quality and productivity issues without the use of flavor-altering additives or methods. It will meet consumer demand for freshness without the negativity often associated with other methods such as irradiation. It is an interesting alternative to traditional food processing and preservation methods due to its limited effects on covalent bonds resulting in minimal modifications in nutritional and sensory quality.

Keywords: African Indigenous Vegetables, High Pressure Processing, Food security, Ethiopia

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MILK QUALITY SUPPLY CHAIN ANALYSIS AMONG SMALLHOLDER DAIRY ACTORS IN GULU DISTRICT, NORTHERN UGANDA

Mr Ahmed Abi Abdi Warsame
Gulu university, Gulu, Uganda

M R A H M E D A B I A B D I W A R S A M E

Abstract

Abstract

Milk production in Uganda is as low as 2.81 billion liters annually compared to 124.16 billion liters produced by India, which is the world leading milk-producing country. The causes of low milk production in Uganda are currently not well understood. Currently, it is unclear why milk output is so low in Uganda. Technologies that increase milk production, factors affecting milk production and quality should be understood at different levels of the value chain. Objectives of the study are to: determine the factors affecting the milk quality produced by domestic dairy farmers in Gulu city, northern Uganda; and indicate that farmers in the different locations will produce milk that could potentially experience significant nutrient in the nutrition status of children 6-59 months in developing countries. The study's aim will be to inform academic institutions and interested public sectors on the variables influencing milk production and milk quality marketing among smallholder dairy producers in Gulu city. Milk samples will be collected from different locations; Pece, Bar dege. Laroo and Layibi. Additional samples will be collected along the value chain supply; farmers, milk sellers, and off-takers. Select milk quality parameters; fat, lactose, SNF, density, ts, salt, protein, and added water will be measured using lacto scan device to analyze the milk's somatic cell count. It will discover where significantly higher amounts of milk parameters and how much the Somatic cells compared to the rest. The findings from this study will indicate that farmers in the different locations will produce milk that could potentially experience significant nutrient in the nutrition status of children 6-59 months in developing countries.

Keywords: Dairy Actors, Lactoscan, Milk quality, Milk parameters, Milk supply chain

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Drivers of Consortium Agribusiness Model Performance among Young potato smallholder farmers in Tanzania

Dr. Semeni Ngozi[1,2], Prof Souleimane Adekambi[3]
[1]University of Dar es Salaam, Dar es Salaam, Tanzania, United Republic of. [2]Michigan State University, East Lansing, USA. [3]University Institute of Technology, University of Parakou,, Parakou-Borgou, Benin

DR. SEMENI NGOZI

PROF SOULEIMANE ADEKAMBI

Abstract

The consortium business model is an innovative model that enables businesses to work together to achieve common goals. Consortiums provide a variety of benefits to businesses, including increased efficiency, cost-savings, and collaboration. The consortium business model is based on the concept of shared resources and shared goals. For example, a consortium can increase efficiency by sharing resources such as marketing resources, collective procurement of inputs and expertise. This can save costs such as transport, prices of inputs among others. Agribusinesses work together to achieve a common goal, such as increasing sales, or expanding into new markets. The consortium approach in agribusinesses on the other hand, refers to a collaborative and holistic approach built on a win-win partnership that focuses on closing the gaps of low agricultural productivity and income of smallholder farmers. The approach catalyzes private sector investment, ensuring that smallholder farmers are integrated into value chains in a manner that ensures their capacity is built on good agricultural practices, improved access to inputs, finance, and market. The partners are smallholder, input suppliers, off takers and service providers. Kilimo Trust adopts the consortium approach to value chain development in implementing the Calories and Household Income from Potato Smallholder farmers in Tanzania project. However, little is known about the drivers of performance of the consortium agribusiness model. Understanding the drivers of consortium agribusiness model performance is important as it help stakeholders such as government to develop the supported-policy environment that will facilitate the establishment and strengthening the performance of the model thereby to sustainably engaging and retaining young people in agriculture. Thus, a study was design to therefore, determine the drivers of consortium agribusiness model performance among young potato smallholder farmers. The study employed a multistage sampling technique to select villages for data collection. Then a random sampling technique was employed to collect data from 124 participants and 120 non-participants of the consortium agribusiness model using a semi-structured questionnaire. Additionally, key informant interviews were employed to collect qualitative data from the project focal people. The data collected were analyzed using descriptive statistics, multiple regression model and thematic content approach. The findings reveal that the participation of small holder farmers in consortium agribusiness model is associated with increase in potato yield. A comparison analysis indicates that potato young smallholder farmers who participated in a collaborative procurement of inputs, marketing of potatoes, and attended trainings performed better than non-participants. The results further show that amount of potato sold, potato price and total number of livestock owned improved the performance of consortium agribusiness model while collection center used to market potatoes and total cost incurred negatively influenced the performance of the model. These findings prove that a well- designed consortium training programs on the functioning of the consortium agribusiness model can be used as an important instrument, and can be used to enlighten young smallholder farmers on the importance and concrete benefits of the model and increase their participation in agriculture.

Keywords: Consortium-Agribusiness Model, Collaborative-Procurement of inputs, Collaborative-marketing of outputs.

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Assessing the environmental impact of soilless systems: a literature review.

Mr Antonio Licastro, Prof. Roberta Salomone, Dr. Giovanni Mondello, Prof. Grazia Calabrò
Department of Economics, University of Messina, Messina, Italy

Abstract

Agriculture is one of the major contributors to climate change and other environmental impacts. Many solutions have been proposed to hamper emissions from agricultural production: one is given by soilless systems. Soilless systems allow the cultivation of crops without the soil, leading to optimized water and fertilizers consumption and higher yields, as well as lesser space. But impacts from soilless systems can vary depending on the season, crop variety, technology employed and whether the context is urban or rural. Given these considerations, it appears wise to assess the environmental sustainability of these systems from a holistic perspective. However, to the best of our knowledge, there is no review focused on the assessment of the environmental impacts of soilless systems. For this reason, a systematic and bibliometric review has been carried out. First, a review of reviews has been conducted to understand which is the most used method to assess environmental sustainability and Life Cycle Assessment (LCA) turned out to be the most prominent one. Then, the search effort has been focused in analyzing LCA application on soilless systems and 46 articles were finally selected and included in the sample, following the PRISMA protocol and the snowballing method. From the bibliometric analysis, it emerges that the leading research teams are all located in Spain and that the most prominent soilless technique is drip irrigation. The system analyzed in the sample include urban rooftop greenhouses, ground-based greenhouses, and indoor farms. Main purposes of these farms are either commercial or focused on research. Results also point out that there is an increasing interest in soilless systems, and this is mostly due to the increasing attention in urban agriculture, because of their intrinsic applicability to urban environments. Most frequent evaluated crops are tomato and lettuce, as they are the easiest crop to grow in soilless environment and because they are particularly prominent in Mediterranean diets. Future research will deeply investigate the methodological issues emerging when applying LCA for the environmental assessment of soilless systems.

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"Assessing the Relationship between Farm Production Diversity and Women's Dietary Diversity in Rural Bihar and Odisha, India"

Balram Kumar
Indira Gandhi Institute of Development Research, Mumbai, India

B A L R A M K U M A R

Abstract

Nutrient adequacy and positive health outcomes are linked to increased dietary diversity. Farm production can influence the household diet if they consume what they produce, after controlling for income and relative food prices. The study aims at understating the association between farm production diversity and dietary diversity in the Women of the Reproductive Age (WRA) group (15-49 years) and the role of the market. A cross-sectional survey on agriculture and food consumption patterns of a representative sample of 4100 households was conducted in rural Bihar and Odisha, in 2014-15. It uses three measures of production diversity: Farm Production Diversity, Crop Species Count and Animal Species Count. The dietary diversity was assessed by using quantitative 24 hours recall and the Minimum dietary diversity for women (MDD-W) was calculated using 10 food groups (FAO, 2021). Logistic regressions were applied to study the association between variables. The dietary diversity varied across different agroclimatic zones and socioeconomic groups. Purchased foods were found to have a greater impact on dietary diversity than home produced. The median Dietary Diversity (DD) score was 5, with a mean score of 4.75. Only 58% of women achieved minimum dietary diversity and are more likely to have adequate micronutrient intakes. The farm production diversity was associated with higher dietary diversity and higher odds of achieving MDD-W (OR: 1.16). After adjusting for sociodemographic and seasonality, the association becomes weak. Further cereals production did not increase the odds of attaining MDD-W whereas milk production did (OR: 1.44). Access to common property resources positively affected DD only among poor households. The findings suggest that while crop species count and milk was associated positively with dietary diversity, animal species count was negatively associated. Access to the market played a positive role. Factors like the education level of households, wealth index and land are positively associated with DD. There exist significant differences across different social groups as well. The proposed abstract broadly relates to SDGs 2 and 3. Since mothers' health is a necessary precondition for a healthy child therefore this study can relate to SDG 3.2: By 2030, end preventable deaths of new borns and children under 5 years of age. The proposed contribution is relevant to the conference theme of "Assessing the 5Ps of SDGs" as it specifically addresses the "people" aspect of the SDGs by promoting healthy and sustainable food choices by assessing the role of agriculture and purchased food in improving dietary diversity. Additionally, the study also touches upon the "prosperity" aspect of the SDGs by examining the impact of market orientation on the relationship between farming practices and household welfare, the study sheds light on how sustainable agriculture can promote economic prosperity.

Full Papers

Assessing the environmental impact of soilless systems: a literature review

Antonio Licastro*[1], Roberta Salomone[1], Giovanni Mondello[1], Grazia Calabrò[1]

[1] *Università degli studi di Messina, Dipartimento di Economia, Piazza Pugliatti, 1 - 98122 Messina, Italy*

*antonio.licastro@studenti.unime.it

Abstract. Agriculture contributes significantly to climate change and environmental impacts. Soilless systems may offer a potential solution by enabling crop cultivation without soil, leading to optimized water and fertilizer usage, higher yields, and space efficiency. However, there is a lack of comprehensive reviews on the environmental impacts of soilless systems. To address this gap, a systematic and bibliometric review focused on Life Cycle Assessment (LCA) was conducted. 46 articles were selected, revealing Spain as a prominent hub for soilless system research, with drip irrigation being the favoured technique. Analysed systems included urban rooftop and ground-based greenhouses, and indoor farms, primarily targeting tomatoes and lettuce. The review identified a growing interest in soilless systems, mainly for their adaptability to urban environment. Future research will address methodological challenges in applying LCA to assess the environmental impact of soilless systems.

1. Introduction

The agricultural sector remains fundamental to human development as it still provides the means for growth (like food and fuel) (Payen *et al.*, 2022). Yet as the world population is projected to increase to 8.5 billion in the next decade, concerns are rising about the never-ending demand for agricultural food, potentially leading to insufficient access to food and an increase in cases of malnutrition and starvation (FAO, 2021). The pursuit of higher yield can prompt higher competition for land use, leading to the expansion of arable land, causing deforestation and other environmental disasters (Tan *et al.*, 2005; Muscat *et al.*, 2020; Payen *et al.*, 2022). Given this pressure, farmers are forced to over-exploit land resources for the sake of higher productivity, employing chemicals and soil and water management practices that are not always environmentally friendly. Chemical substances used in agricultural practices contribute significantly to aquatic and terrestrial eutrophication and acidification while inadequate soil and water management, along with inefficient agricultural waste management, further contribute to pollution, loss of fertility, and groundwater poisoning and depletion (Popp *et al.*, 2014; Clark and Tilman, 2017).

In the face of these challenges, potential solutions can be found in urban agriculture (UA) practices. Orsini *et al.* (2013) define UA as the cultivation of vegetables and fruits (but also specialized plants), as well as small animals' husbandry with setting in urban or peri-urban areas, including consumers' very home. UA offers reduced environmental impact, social and economic improvements in urban areas, and the preservation of biodiversity (Specht *et al.*, 2014; Thomaier *et al.*, 2015; Artmann and Sartison, 2018). UA can be classified according to several distinctive aspects, as it has been proposed by Payen *et al.* (2022). They can be based on production location (indoor, outdoor, rooftops, on-building or ground-based greenhouses), directional expansion (vertical or horizontal), growing medium (soilless or soil-based), and crop conditions (open-air or controlled-environment with natural or artificial light).

However, certain challenges have been identified in open-air, ground-based, and horizontal urban farming systems (Fussy and Papenbrock, 2022). These systems are particularly vulnerable to contamination from heavy metals released by industrial and urban sources (Mok *et al.*, 2014), as well as soil-borne pathogens, viruses, and fungi that can pose risks to human health (Salomon *et al.*, 2022). To address these issues, the implementation of controlled environments becomes crucial, as they can help mitigate the risk of soil contamination (Armanda *et al.*, 2019) and the occurrence of soil-borne diseases (Gumisiriza *et al.*, 2022).

Within the context of controlled environment agriculture, soilless systems appear to be the most used, but there is still a need of comprehensive assessment of the environmental impacts of these specific systems (see section 2). Therefore, the objective of this preliminary study is to conduct a systematic literature

review and bibliometric analysis of Life Cycle Assessment (LCA) studies applied to soilless systems. By identifying key areas for improvement and discussing the implications of these findings, this research aims to enhance the accuracy and holistic understanding of the environmental impacts and benefits of soilless farming methods. First, a brief summary of the main evidence emerging from the literature used to outline the boundaries and motivations of this research is presented (section 2). Then the methodology for selection of relevant articles is introduced in the section 3, including a review of reviews on the various methods to assess the environmental impacts of systems to confirm the primacy of LCA among the many methods of assessment. The final sections provide for the preliminary results followed by a conclusion.

2. Literature Reviews

Recently academic research has focused the attention to soilless systems (Sambo *et al.*, 2019; Gautam *et al.*, 2021; Joshi *et al.*, 2022). This interest is largely driven by the compatibility of soilless systems with urban settings (Arcas-Pilz *et al.*, 2022). Soilless systems enable cultivation without natural soil, instead relying on alternative growing media (substrates) such as gravel, glass wool, rockwool, perlite, or nutrient-rich liquid solutions (Butler and Oebker, 1962; Di Lorenzo *et al.*, 2013). These systems optimize resource use, minimize water consumption and fertilizer usage, and eliminate the need for pesticides, resulting in lower environmental impacts (Manos and Xydis, 2019). Innovative technologies, including machine learning, automatized irrigation systems, remote controls, and sensors, have further enhanced the performance of soilless systems (Armanda *et al.*, 2019; Massa *et al.*, 2020; Gonnella and Renna, 2021). These advancements allow for precise manipulation of climate and plant parameters, leading to improved environmental outcomes.

However, it is important to consider that these sophisticated systems can also entail higher operating costs and potential environmental impacts compared to conventional land planting. Indeed, in certain areas, the climatic conditions may lead to increased energy consumption for heating, with negative environmental consequences (Goldstein *et al.*, 2016). Moreover, the environmental impact of soilless systems varies depending on the crop species, each having its own specific requirements and potential impacts (Armanda *et al.*, 2019). Additionally, the production or extraction of certain substrates used in soilless systems can present environmental issues, as well as social ones (Vinci and Rapa, 2019; Toboso-Chavero *et al.*, 2021). Therefore, a comprehensive assessment of soilless systems is necessary to understand their environmental sustainability fully.

While previous literature reviews have shed light on the environmental impacts of specific aspects of soilless systems (Barrett *et al.*, 2016; Gruda *et al.*, 2019; Gruda, 2019), there remains a need for comprehensive and holistic analyses that encompass the multiple facets of these systems (Armanda *et al.*, 2019).

Among the various methods available for assessing environmental sustainability, such as Material Flow Analysis (MFA) (Brunner and Rechberger, 2016), Environmental Impact Assessment (EIA) (Ott *et al.*, 2012) or Environmentally Extended Input-Output Analysis (EEIOA) (Kitzes, 2013), Life Cycle Assessment (LCA) is widely recognized as the most comprehensive approach as it considers all stages of a product or system's life cycle, including raw material extraction, manufacturing, transportation, use, and end-of-life disposal (ISO 2006a, ISO 2006b). LCA can provide a holistic view of the environmental sustainability of soilless systems, enabling the identification of potential hotspots, trade-offs, and areas for improvement. According to some authors it is one of the most used methods to assess environmental impacts in agriculture and other sectors (Maaoui *et al.*, 2021; Costa *et al.*, 2023). In the context of soilless systems, LCA can provide valuable insights into the environmental performance of these systems and assist stakeholders in making informed decisions regarding their implementation and optimization.

3. Methodology

This section provides the steps followed in this analysis. First an overview of the various soilless techniques has been conducted in order to identify the nomenclature of each one and shed light on the varied and often unclear terminology used in the sector. Then, a review of review has been carried out to identify the most used and appropriate method to assess the environmental performance of a system on which to focus on. The results from these two preliminary steps have been merged to create the search query for the main review. A summary of the research methods steps is available in Figure 1.

Figure 32 Overall Research Method

3.1 Literature Overview of Soilless techniques

A visual summary of the various soilless techniques is available in Figure 2.

"Soilless" is a generic term used to describe plants growing without being anchored to soil, nor receiving from it the necessary nutrients. This term tends to be used interchangeably with the term "hydroponics" by some authors (Savvas and Gruda, 2018; Fussy and Papenbrock, 2022) but for others the term hydroponics is strictly related to plants growing using a liquid medium, generally water (Gericke, 1937; Adams, 2002).

In this article, the preferred term is "soilless", as in fact, these systems can be distinguished into those which uses a liquid medium and those which use a solid medium. Solid medium (or substrates) encompasses all materials that can be inert or organic. Inert substrates include expanded clay, sand, but more frequently rockwool and perlite, while organic substrates imply the use of coconut fiber, peat moss or even compost. This difference is important as inert substrates do not possess the natural elements needed for the plant to flourish, which in turn requires additional nutrients from the nutrient solution, thus leading to environmental problems (Arcas-Pilz *et al.*, 2021). On the contrary organic substrates allow for a reduced amount of nutrients as they naturally possess some components useful to the plants, yet nutrient solution remains the main driver of growth (Raviv and Leith, 2008).

Furthermore, the management of fertilizer and water, commonly referred to as fertigation management, plays a crucial role in soilless systems. Depending on this management approach, these systems can be categorized as closed-loop, semi-closed, or open-loop (Sardare and Admane, 2013). The choice and adaptation of a specific fertigation management practice largely depend on the location and climate characteristics of the system (Pardossi *et al.*, 2006). Closed or semi-closed loop methods involve the recirculation of the nutrient solution within the system, while open-loop methods, or non-recirculating approaches, entail disposing to the environment or replacing the nutrient solution when its concentration decreases (Fussy and Papenbrock, 2022).

The soilless techniques associated to a liquid medium are:

- Drip Irrigation: nutrient solution is dripped directly on plant roots (Çetin and Kara, 2019).
- Deep-water culture: roots are immerged either partially or totally in nutrient-diluted water (Holmes *et al.*, 2019)
- Nutrient Film Technique: roots are traversed by a nutrient-filled flow of water (Alipio *et al.*, 2019).
- Ebb and Flow (or ebb and flow) systems: roots are temporarily immersed in nutrient-filled water, this water, successively is collected and reused again (Sharma *et al.*, 2018).
- Run-to-Waste: the water flows through the medium and passes out of the system to never return (McIntyre and McRae, 2005).

- Kratky Method: also known as passive sub-irrigation, the nutrient solution reaches the root system thanks to the capillary action through inert porous material (Kratky *et al.*, 2007).
- Rotary Garden: plants grow in a cylindrical structure, revolving around UV lamps, while roots are immersed in a nutrient-filled solution (Sadov *et al.*, 2021).
- Aeroponics/Fogponics: nutrient solution is vaporized in small particles to be deposited in roots while hanging in air. The difference between aeroponics and fogponics, lies in the dimension of the particles nebulized (in fogponics the particles are smaller) (Eldridge *et al.*, 2020; Rakib Uddin and Suliaman, 2021).

Solid-medium based techniques revolve on how the substrate position is configured. For instance, if the substrate is covered in a bag and hanged on greenhouse structure, the technique takes the name of "Verti-grow" or "hanged bag technique" (Hasan et al., 2018), while if it is posed in rows it takes just the name of "Grow bag technique" (Miranda et al., 2014). "Trench technique" implies the excavation in soil of trenches which are covered in plastic sheets and then filled with substrate (Maya Waiba et al., 2020). Finally the substrate can be simply be put in pots, "Pot Technique" (Goswami and Yadav, 2022). It should be noted that for these techniques, fertigation can be delivered through drippers or via capillary action. Finally, a different setup consisting of the combination of liquid-medium soilless system and aquaculture is given by the so called "aquaponics". In aquaponics plants and fishes develop in a symbiotic environment where fish wastes are converted into nutrients for the plants, while the plants purify the water for the fishes (Goddek et al., 2015). Given the different setups, inputs/outputs and technologies employed in aquaponic, comparing this technique with plant-oriented soilless systems is challenging, therefore aquaponics will not be part of this study.

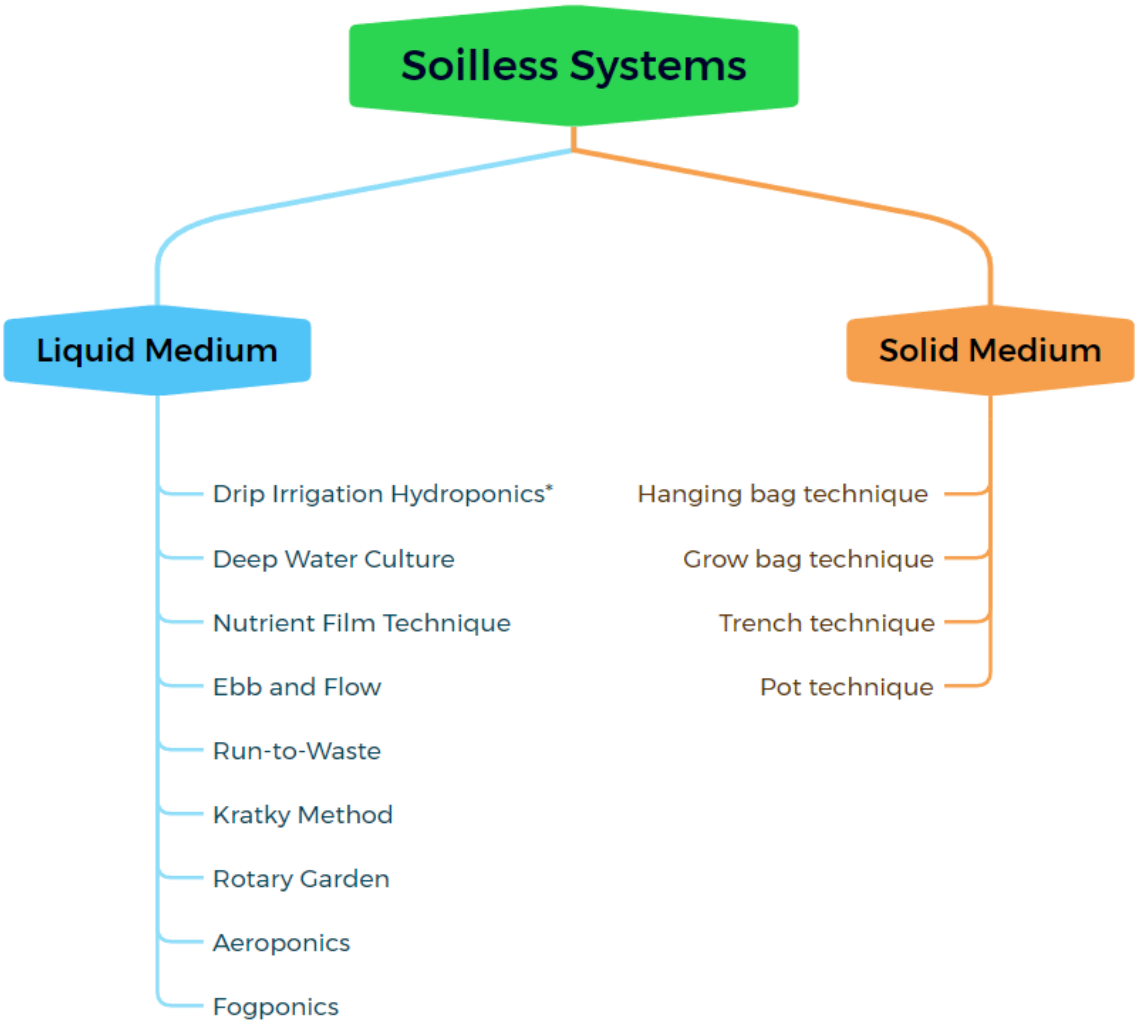

Figure 33 Soilless techniques divided by type of medium.

NOTE: hydroponic drip irrigation can be employed also in solid medium culture*

3.2 Review of Reviews

The vast amount of methods used for environmental assessment available in literature (Angelakoglou and Gaidajis, 2015) brings the need to narrow down to one for the sake of consistency and comparability. In order to effectively evaluate and compare the environmental impacts of different systems or processes, it is important to use a standardized and widely accepted method of assessment. A review of reviews of environmental assessment methods can help identify the most appropriate method for a given context. Reviews in fact are useful works which condensate the available knowledge granting precision and completeness. A comprehensive collection of reviews was conducted from Scopus and Web of Sciences (WoS), specifically focusing on English studies that evaluated various environmental impact assessment methods. Initially, a sample of 38 reviews (21 from Scopus and 17 from WoS) was obtained. Following the removal of duplicates (13 articles), non-available articles (1 articles), finally a full-text reading led to exclude 4 articles for being out of topic. Finally, a set of 20 reviews was identified for analysis. The results of this analysis can be seen in Table 1. Among the different methods discussed in these reviews, Life Cycle Assessment emerged as the most frequently mentioned, accounting for approximately 95% of the cases. Consequently, LCA was selected as the primary method to be focused on in the subsequent review stage.

Table 15 Identified environmental assessment methods among the analysed reviews

Method of environmental assessment	Frequencies	% Frequencies
Life Cycle Assessment	19	95%
Substance Flow Analysis	3	15%
Carbon Footprint	3	15%
Exergy Analysis	3	15%
Absolute environmental Sustainability Assessment (AESA)	2	10%
Emergy Analysis	2	10%
Ecological footprint	2	10%
System dynamics	2	10%
Economic input-output life-cycle assessment	2	10%
Material Flow Analysis (MFA)	2	10%
environmentally extended input–output analysis (IOA)	2	10%
Water Footprint	1	5%
Material and Energy Flow Analysis (MEFA)	1	5%
MET-Matrix (Materials, Energy, Toxic emissions)	1	5%
Environmentally Responsible Product/Process Assessment Matrix (ERP)	1	5%
Materials, Energy, Chemicals, and Others (MECO)	1	5%
Environmental Network Analysis (ENA)	1	5%
Physical Input-Output	1	5%
Material Inputs per Service (MIPS)	1	5%
Ecological Rucksack	1	5%
Sustainable Process Index	1	5%
Cumulative Energy Demand	1	5%
Exergy Demand	1	5%
Embodied Energy	1	5%
Bridges to Sustainability Framework	1	5%
Ecosystem Damage Potential	1	5%
Life Cycle Sustainability Dashboard	1	5%
USES-LCA	1	5%
Techno-Economic Sustainability Analysis (TESA)	1	5%
Exergoenvironmental analysis	1	5%
CASBEE-UD	1	5%

3.3Steps for the construction of the final Sample

The final search query was a combination of the various names of soilless technique and "LCA OR Life Cycle Assessment". Chosen databases were, once again, Scopus and Web of Science. Articles were selected according to inclusion/exclusion criteria, such as "English" language and solely articles were LCA has been applied to one of the many soilless systems. It should be noted that a soilless system can be easily recognized by the presence of substrates, even when authors do not clearly state how the nutrient solution is delivered. Collection process and screening started in January 2023 under inspiration of the PRISMA protocols (Page *et al.*, 2021). Initially, the search queries yielded 70 articles in Scopus and 69 in WoS: a total of 139 articles. After removal of duplicates, articles that survived the initial screening (31) were thoroughly read in full to be screened further. To increase the sample size, a snowball method was employed (Wohlin, 2014), leading to discover 15 new articles to be added in the sample. The final sample counted 46 articles and an excel spreadsheet was prepared, subsequently, for data extraction. Preliminary bibliometric and technical data are presented in the following section.

4. Results and Discussion

From a preliminary analysis of bibliometric data, it appears that soilless systems and their environmental sustainability are catching the interest of the academia. From Figure 3 it can be seen, in fact the increasing academic production, which is expected to grow as traditional culture systems began their conversion to a more sustainable production. Indeed, soilless systems can become also predominant cities thanks to their frequent implementation into urban agriculture (Dorr *et al.*, 2021).

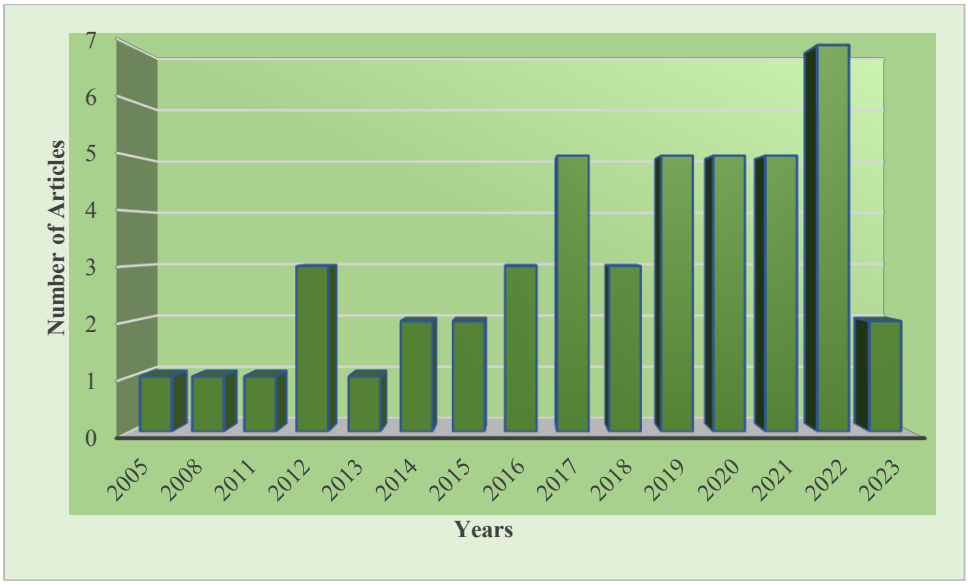

Figure 34 Number of articles counted per year

Figure 4 presents where the greenhouses, object of the assessments in analysis, are located in percentage. Most case studies have been conducted in greenhouses located in Spain. Greenhouses set in Italy are 9% of the cases. The Mediterranean area has always had a vocation for agricultural production, and it comes as no surprise since the agricultural sector in this area plays a vital role in both the local economy and culture. The production of crops such as olives, grapes, tomato, lettuce and other vegetables are integral to the Mediterranean diet (Spada *et al.*, 2022) and contribute significantly to the region's economy (Harmanny and Malek, 2019). As such, it is natural that many studies on agriculture would focus on this area. Indeed, Europe is theatre of this kind of research, however, as it has been noted in Figure 4, Africa, Middle East and Asia receive little attention. The fact that there are very few articles set in Africa and Asia on the life cycle assessment of soilless systems could be due to a variety of reasons. Researchers might find data collection challenging, as the process of creating life cycle inventories can be difficult and time-consuming. Collecting accurate and comprehensive data on all the inputs and outputs of a system over its entire life cycle can require significant effort and resources. This can be particularly challenging when working in underdeveloped areas. Despite the potential benefits of soilless systems in water-scarce areas, such as their ability to save water, there are very few LCA studies on soilless systems in Africa, only one in Tunisia (Maaoui *et al.*, 2021). This gap in the literature highlights the need for more research to be conducted in Africa and Asia on the life cycle assessment of soilless systems to better understand their potential benefits and drawbacks in these regions.

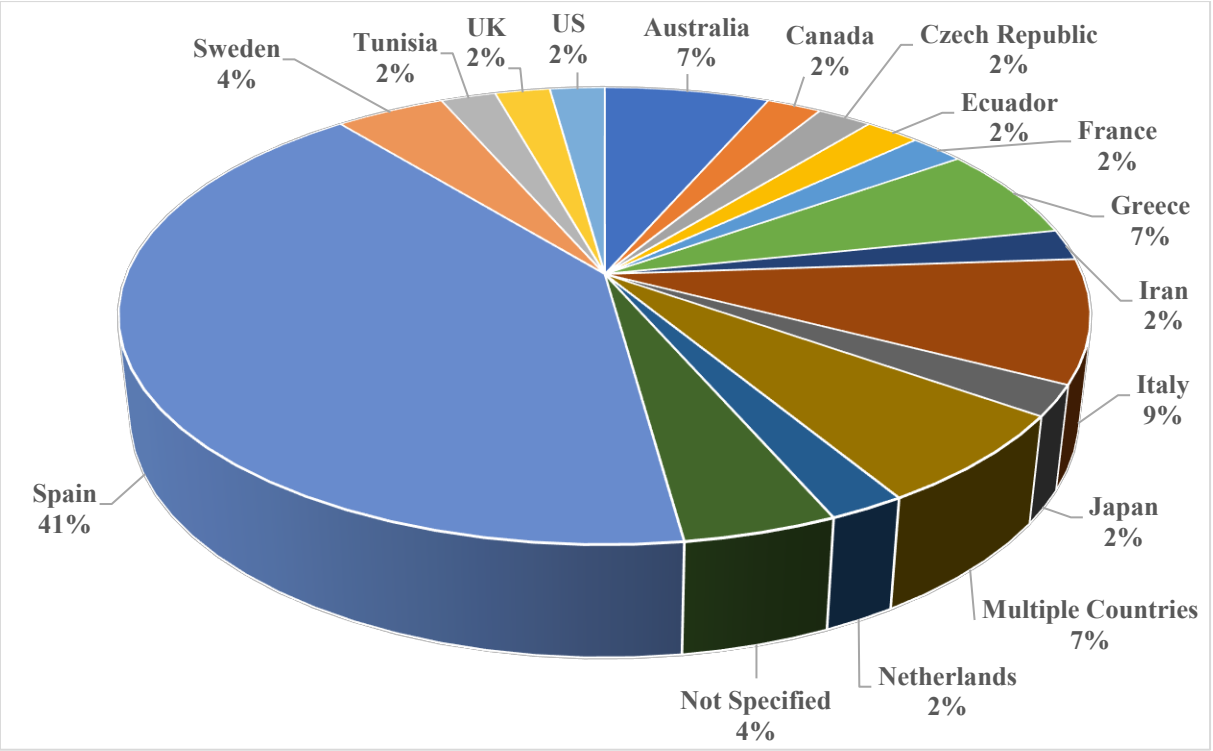

Figure 35 Geographical boundaries of the case studies analysed

From Figure 5 emerges that the most analysed soilless technique is drip irrigation, prevalently in combination with grow bag technique. It should be noted that in several articles the object of analysis was to compare more than one soilless system with each other or in comparison with conventional in-soil cultures. Drip irrigation predominance is due to its simple and cheaper configuration, which is popular in Mediterranean areas (van Os *et al.*, 2019). Nutrient Film Technique (NFT) and its modified version have been found in 5 articles. 3 articles assessed passive sub-irrigation systems. None of the most innovative soilless technologies, such as rotary garden, fogponics or atmoponics, have been assessed yet, except for aeroponics (3 articles).

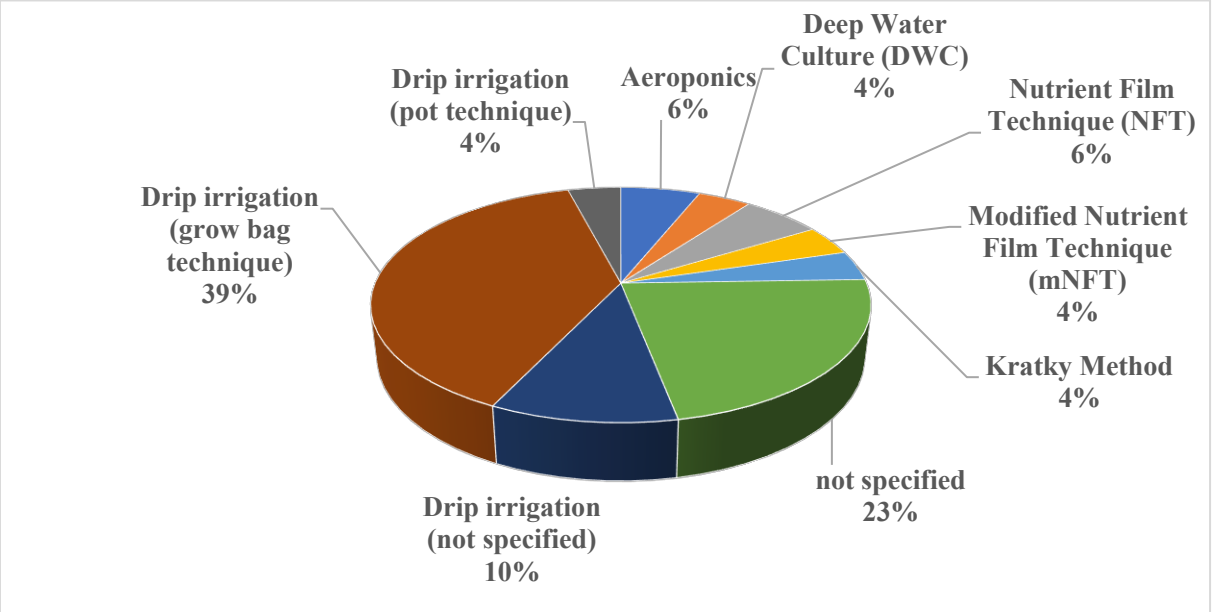

Figure 36 Number of Soilless techniques found in the collected Sample

Tomato and lettuce appear to be the most evaluated crops in the collected sample. Tomato and lettuce are indeed popular crops to be grown in controlled environments (Acuña *et al.*, 2013). This finding is

in line with the geographical distribution of the articles, since as it has been stated before the Mediterranean basin is the target area of these studies. Another reason for the predominance of tomato and lettuces lies in the fact that tomato is considered an high-input crop, while lettuce is very sensitive to changes of environmental conditions, thus they both strive in a controlled environment (Wootton-Beard, 2019).

In the sample of articles analysed, a variety of settings were identified for soilless systems. Nearly half of the systems were in urban environments, taking the form of either indoor farms or green roofs. However, traditional ground-based greenhouses in rural environments were also common, being the second most popular form of setting. This demonstrates the versatility of soilless systems, which can be adapted to both urban and rural environments. While soilless systems are often associated with urban settings due to their ability to maximize space and resources, they can also be effectively used in rural areas to increase crop yields and reduce water usage.

In the sample of articles analysed, the purpose of the soilless systems was classified as either commercial, non-commercial, or research (experimental). Systems located in a campus, laboratory, or research centre were assumed to be for experimental purposes, while those used for commercial purposes made up half of the systems analysed. Most of these commercial systems were ground-based greenhouses located outside urban areas. The remaining systems were primarily located in university campuses or laboratories, with the majority being in Spain. These systems were used for research and experimentation, allowing scientists to study and develop new settings and configurations in the field of soilless agriculture. The versatility of soilless systems allows them to be adapted for a wide range of purposes and settings, from commercial production to academic research.

5. Conclusion

In conclusion, agriculture is a significant contributor to anthropogenic climate change and other environmental impacts. One proposed solution to mitigate emissions from agricultural production is the implementation of soilless systems. These systems facilitate the cultivation of crops without soil, resulting in optimized water and fertilizer consumption, increased yields, and reduced space requirements.

However, the environmental impact of soilless systems is contingent upon various factors such as seasonality, crop variety, employed technology, and whether the context is urban or rural. Thus, it is prudent to assess the environmental sustainability of these systems from a holistic perspective. To address this need, a systematic and bibliometric review was conducted. Life Cycle Assessment (LCA) revealed to be the most prominent method for assessing environmental sustainability. This review focused on analysing the application of LCA to soilless systems and found that most case studies took place in Spain and that drip irrigation is the most prominent soilless technique. The systems analysed in the sample include urban rooftop greenhouses, ground-based greenhouses, and indoor farms with commercial or research purposes. It was also found that there is an increasing interest in soilless systems, particularly in urban agriculture due to their applicability to urban environments. The most frequently evaluated crops are tomato and lettuce as they are facile to cultivate in soilless environments and prominent in Mediterranean diets.

These findings have brought to light a substantial research gap concerning innovative soilless systems such as aeroponics and rotary gardens. The dearth of comprehensive LCA studies examining these innovative cultivation methods signifies an unexplored frontier within the literature. Moreover, while a wide spectrum of crops can thrive in soilless systems, it is evident that the LCA-focused studies on these crops that are not tomato or lettuce remain scarce. This implies a call for increased attention to broaden the scope of LCA research to encompass a wider array of cultivated species. The adaptability of soilless systems across both urban and rural settings emerges as a significant implication, which extends further to the experimental realm, where they shine as invaluable tools for research endeavours. The relative ease of manipulating variables and controlling conditions in these systems offers researchers a unique platform to explore innovative techniques, refine methodologies, and probe the intricate environmental dynamics of agricultural practices.

Nonetheless, the outcomes of this analysis are contingent on the specifics of the reviewed studies, their geographic locations, and their contextual variables. Consequently, the applicability of these findings to disparate regions or crop types must be approached with caution, considering the variations in production practices, climatic nuances, and resource availability that characterize different areas. The generalizability of the results to other crop types grown in soilless systems may be limited, as tomato and lettuce may be more extensively represented in the review compared to other crops. Furthermore, while focus has been given to the solely environmental aspects of soilless systems, it is essential to acknowledge that the broader

sustainability spectrum encompasses economic and social dimensions as well. It is important to recognize that the complete sustainability portrait of soilless systems may require an integration of economic assessments and social impacts. Future research will focus on addressing methodological issues when applying LCA to soilless systems.

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MILK QUALITY SUPPLY CHAIN ANALYSIS AMONG SMALLHOLDER DAIRY ACTORS IN GULU DISTRICT,NORTHERN UGANDA

Ahmed Abi Abdi Warsame[1], Aliro, T[1], Odongo, W[2] , Omara, P[3]

Omobolaji Obisesan[4] [1]Department of Animal Production and Marketing, Faculty of Agriculture and Environment [2]Department of Rural Development and Agribusiness, Faculty of Agriculture and Environment,

[3]Department of agronomy, Faculty of Agriculture and Environment, Gulu University, P. O. Box 166 Gulu,Uganda.

[4]Interconnections for Making Africa Great Empowered and Sustainable (IMAGES) Initiative, IMAGES Initiative,Ibadan, Oyo State, Nigeria

[1]**Corresponding author's email address: aaydid3@gmail.com**

Abstract.

Milk production in Uganda is as low as 2.81 billion liters annually compared to 124.16 billion liters produced by India, whic h is the world leading milk-producing country. The causes of low milk production in Uganda are currently not well understood. This study sought to assess milk quality variation along with milk supply chain actors in Gulu city. To address this, the study embraced an experimental design approach to assess the milk quality along the smallholder value chain in Gulu, northern Uganda. Milk samples (N=146) were collected at the different levels of milk supply chain. The Lactoscan MCC, Milkotronic Ltd Bulgaria were used as an ultrasonic analyzer to measure the milk samples collected from milk supply chain in the study area. Three percent of added water were found to be in the milk produced in Laroo division compared to other locations and was significantly higher ($p<0.05$) while six percent of added water were found in the retailer's level and was significantly higher ($p<0.05$) compared to other value chain actors. These indicate that milk quality was highly compromised in Laroo Division and among the retailers. The study recommends that government should prioritize enforcing measures to control water addition to milk through the establishment of certified milk collection centers for milk quality assessment and by forming market oriented dairy producer led-cooperative. Future research should prioritize in-depth analysis of drug residues in milk, total bacterial counts, and milk marketing channels extension.

Keywords: Dairy Actors, Lactoscan, Milk quality, Milk parameters, Milk supply chain

1. Introduction

Livestock husbandry plays a substantial role in the economy of nearly all regions in Africa. Milk production in Africa was recorded at 45.7 million tonnes in 2017 (FAO, 2021). East African countries havemilk production levels ranging from one to five liters per cow per day, and it contributes to 68% of milk produced in Africa (Global Agriculture and Food Security Program, 2016; ECDPM, 2015). Available statistics reveal that Uganda's annual milk production stands at 2.04 million tons(UBOS, 2020), obtained from an estimated 4.14 million heads of milked cows. Each cow was estimated to produce 492.8 liters of milk per lactation .

Central and South Western Uganda milk sheds together contribute 50% of the total national production. Among the socio-economic factors associated with dairy cow husbandry, it was found that Kampala farmers' compliance withbetter keeping of farm records and in- frastructural establishmentsto ease cow husbandry compared with thefarmers in Gulu can be due to the two organizations in Gulu is not reflected in higher productivity and reproductive efficiency. Likely, the farming skills among Gulu farmers have not yet reached that of the Kampala farmers(Owiny et al., 2015). Uganda account for 1,800.00 Million Litres of milk produced in east Africa (Mkwizu et al., 2020). The country imports about 35% of the total milk consumed in the country annually (Dairy Development Authorityof Uganda, 2021). Most (87%) of the existing processing units which are found mainly urban and peri-urban areas operate under capacity and less than 30% of the total installed capacity is utilized.
Most research done on milk quality in Uganda has emphasized SCC, milking routines, drug residues, total bacterial count, and several other sanitary factors. Efforts to improve milk quality are therefore paramount to the Ugandan economy as they lead to increases in demand and sale (supply) of agricultural (livestock) products. There is a crucial need to understand the dairy supply chain in the country and analyze different factors affecting milk quality along the chain. The main objective of this study was to assess the existing dairy supply chain and evaluate milk quality parameters in the Gulu district in the north of Uganda

2. Literature Reviews

2.1 The market size of the milk supply in Uganda

Ugandan milk production is largely dominated by small-scale farmers who own over 90 percent of the national cattle population (MAAIF, 2020). In Uganda, 85% of the milk is produced from indigenous cows mainly Ankole, whose average lactation is about six months and when under good management produce about 800 litres of milk. The exotic breeds and their crosses which constitute approximately 10% of the total national herd, produce about 3,000 litres of milk per lactation of 10 months. However, Kabwanga Ismail Tijjan etal, (2019) noted that higher productivity per cow is hindered by low adoption of improved technologies. Out of the total milk produced, 80.2%is marketed with an estimated US$835.9 million as of 2019, and the remaining 19.8% is consumed at farms and household levels. Of the marketed milk, 34% is processed into a wide range of products such as powdered milk, butter, UHT milk, yogurt, cream, ice cream, and cheese, while the remaining 66% is sold in raw form (Dairy Development Authority (Government of Uganda), 2021)

Milk marketing in Uganda involves different actors throughout the supply chain from the point of production to the ultimate consumers (Figure 1). In uganda, milk quality is influenced by several factors along the milk-market supply chain that falls into two major categories: on-farm factors and post-milking or post-farm gate factors (Nyokabi et al., 2021). The number of milk-quality factors associated with poor milking routines on farms: Not using milking gloves, no washing of hands before milking; not covering milk pails/buckets or tying cows' tails during milking; lack of potable water for washing milking utensils; and not practicing pre- and post-milking dipping of udders to reduce bacterial contamination. Some of the factors influencing milk quality in the post-milking environment are lack of cooling facilities on farms and during transportation to milk collection centers (Ndambi et al., 2018) . Some farmers who sell milk add water to increase quantity (Majalija et al., 2020).Door to door milk suppliers have a habit of adding water to milk, especially during dry season when feeds are sca rce to meet the demand of their clients. Poor milk quality and food safety risks are a major challenge in the dairy sector in LMICs with weak food safety management systems and low compliance with food safety standards (Amenu et al., 2019) There is a need

for an integrated approach to milk quality and safety that guarantees its integrity from 'farm to glass'.

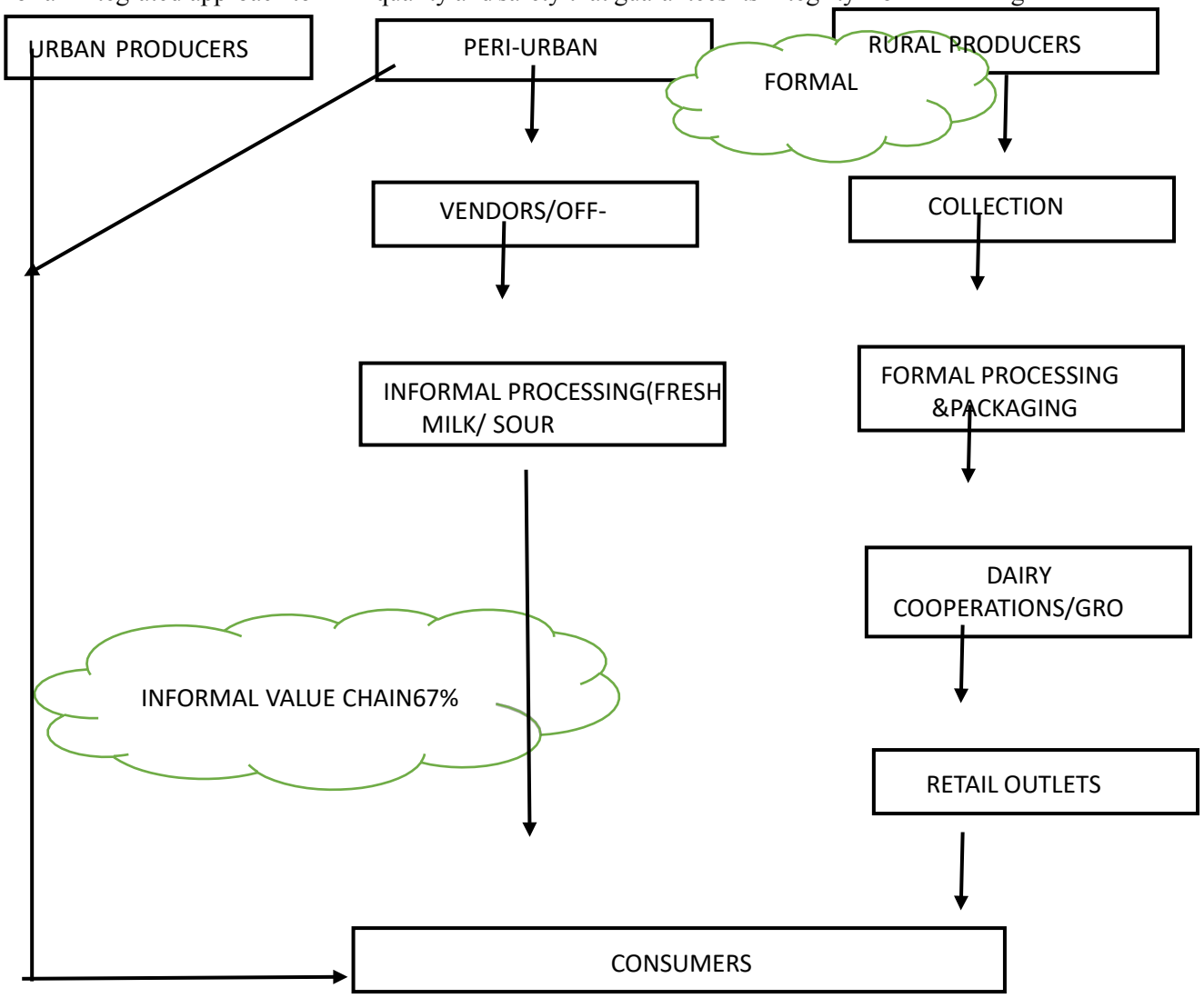

Figure 1. Milk marketing channels in Uganda (DDA source)

3. Methodology (11pt Times New Roman)

The study was done Gulu city, located in the Northern Region of Uganda. It is the commercial and administrative Centre for the Acholi Sub-region of Gulu District. The farmers or farmers groups from the Gulu divisions; the Eastdivision (Pece & Laroo) and West division (Bar-dege & Layibi) were a good representative sample of the Gulu district. These divisions have many dairy farmers composed of dairy corporations and smallholder dairy farmers and its suitability for dairy business in the region and experience of working with smallholder dairy farmers in the study area

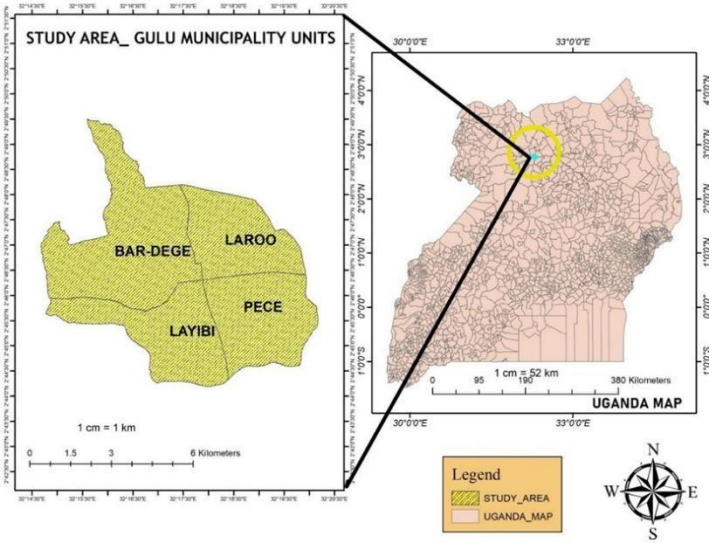

Figure 2. Map of Uganda with the study districts magnified Source: ArcGIS

The research design was a survey that included a collection of milk samples from the Gulu East-West divisions. Atotal of 109 milk samples were collected from 109 farmers that were sampled systematically from total number 150 of DDA list of farmers. Twenty four milk samples were collected from the Off - takers (hotels, restaurants, Main market) that were purposively sampled, and 14 milk samples collected from the milk Bulking collection centres were purposively sampled until saturated number. In total 147 milk samples, each measuring 500 ml were sampled from farmers, of-takers, and bulking centers in Laroo,Pece, Bardege, Layibi Sub-counties using plastic cups. The milk samples were packed in plastic containers and stored in cool boxes at -18oC for 4 hours during period (24th May-27th June 2022) of sample collection and the milk samples were transported to a laboratory at DDA.
The milk analysis used an ultrasonic analyzer (Lactoscan MCC, Milkotronic Ltd Bulgaria) to measure the milk nutrient components. The measurements were conducted in Dairy Development Authority Lab (DDA) figure (3).

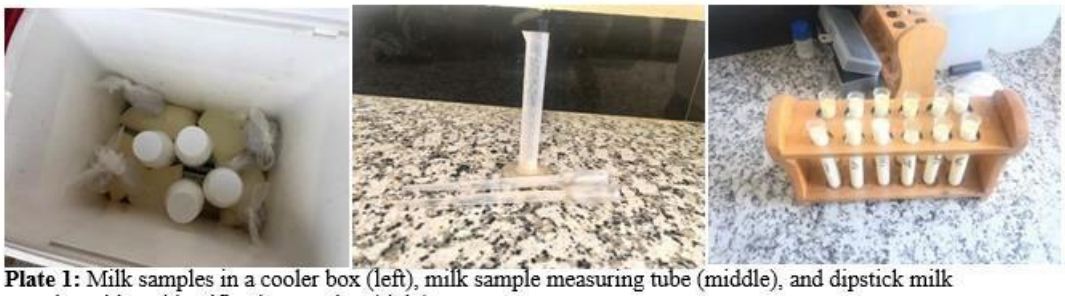

Plate 1: Milk samples in a cooler box (left), milk sample measuring tube (middle), and dipstick milk samples with an identification number (right).

Plate 2: Arranging milk samples (left), preparing milk samples into the calibrated cup (middle), and analyzing milk samples into lacto-scan analyzer (right).

Figure 3. Samples Analysis in DDA LAB

It is used for the determination of fat (FAT), solids non-fat (SNF), protein, lactose, salts, water content, temperature(°C), freezing point, pH, conductivity, and density in a single sample directly after milking,

The reports (raw data) of milk nutrients analysis from every milk sample were transferred to excel sheet to creat master data base which captured information for all the 147 milk samples. Data were analyzed using R software for windows. The raw data was entered in excel and imported into R. Descriptive statistics was performed on the data. The data were further checked for normality and equality of variances using the Levene test, Q-Q plots, and boxplots. Variables that met the assumptions of normal distribution and equality of variances were subjected to ANOVA. Otherwise, the Kruskal Wallis test was performed. Posthoc analysis was performed using Tukey HonestSignificant Difference (HSD) and Wilcoxon rank sum test.

4. Results

4.1 Milk quality parameters

The results (Table *1*) shows that three percent of water were added to the milk produced in Laroo division compared to other locations and showed significantly higher ($p < 0.05$). However, it is evident that no water was added to the milk inLayibi division. There was no significant difference in the mean values for all the milk quality parameters; fat content, solid not fat, density, lactose, protein, and total solids across locations except for salt content and added water. Average mean value of 0.76 % salt content was significantly higher ($p < 0.05$) in Bar-dege division compared to other divisions.On the other hand, average mean values of 0.72% of salt content was not significantly different between Pece and Layibi.

Table 1: Milk quality parameters along different locations.

Place	FC%	Snf %	Mass	LC %	PC%	Salt %	TS %	AW%
Laroo	4.42^{a}	8.27^{a}	28.81^{a}	4.25^{a}	3.32a	0.69^{b}	12.69^{a}	**2.95^{ab}**
Pece	4.22^{a}	8.42^{a}	30.08^{a}	4.24^{a}	3.44^{a}	**0.72^{ab}**	12.63^{a}	1.50^{b}
Bardege	4.42^{a}	8.41^{a}	30.02^{a}	4.25^{a}	3.14^{a}	**0.76^{a}**	12.65^{a}	1.58^{b}
Layibi	4.71^{a}	8.23^{a}	28.81^{a}	4.12^{a}	3.39^{a}	**0.72^{ab}**	12.94^{a}	**0.00^{a}**
P-value	*0.249*	*0.77*	*0.1827*	*0.5777*	*0.5592*	*0.0001617*	*0.7262*	*4.256e-5*

***Note**: % = percentage, FC = fat content, SNF = solid not fat, LC =lactose content, PC= protein content, TS= total solid and AW = added water. Means values followed by the same letters are not significantlydifferent.ab=significantlydifferent.*

4.2 Milk quality parameters along the different value chain supply

The results of (Table 8) shows that the milk produce contained six percent of added water in the retailer's level ($P < 0.05$). Whereas the added water in the farmers level (2%) and milk sellers' level (1%) were not significantly different. Therewere no significant in the mean values of the fat content, density, salt, protein, and total solid content along the different levels of the supply chain. There were significantly higher ($p < 0.05$) amounts of average mean value of (SNF) and lactose at the milk seller level compared to the other levels in the supply chain. Solid not fat content was not significantly different between farmers and retailers.

Table 2: Milk quality parameters along the different value chain supply

Levels	FC %	SNF %	Mass	LC %	Salt %	PC %	TS %	AW %
Farmers	4.44^{a}	8.27^{a}	29.52^{a}	4.21^{b}	0.73^{a}	3.31^{a}	12.74^{a}	1.52^{b}
Milk- seller	4.41^{a}	**8.78^{b}**	30.80^{a}	4.78^{a}	0.76^{a}	3.21^{a}	12.95^{a}	1.23^{b}
Retailer	4.53^{a}	8.40^{a}	28.82^{a}	4.53^{ab}	0.73^{a}	3.14^{a}	12.94^{a}	**5.59^{a}**
P-value	*0.6139*	*0.02044*	*0.204*	*0.0009114*	*0.1408*	*0.4956*	*0.4029*	*4.72e-11*

***Note:** % = percentage, FC = fat content, SNF = solid not fat, LC =lactose content, PC= protein content, TS= total solid and AW = added water. Means values followed by the same letters are not significantly different*

5. DISCUSSION

Water added to milk produced were significantly higher in the Laroo division across the other divisions (Bardege, Pece divisions) this indicates a considerably low proportion of dairy farmers in the area and high demand of milk consumption and this may compromise the quality of milk produced under such condition. However, there is regional variations in milk production which is highly concentrated in the south-western region, and contributes 60 to 70% of Uganda's milk trade (World bank, 2018). Followingthe extent of added water in milk at retailer level, this has been identified as high difference compared to other milk supply chain in Gulu. This highlights low profitability of selling pure milk due to market competition. This is in agreement with other research that revealed that adulteration is more prevalent in areas with weaker milk quality regulations and that retailers are more likely to adulterate milk during periods of low milk supply (Gonzaga, 2019).

6. Conclusion

The findings from this study indicate that farmers in Laroo and the Off takers where the addition of water was prevalent, could potentially experience significant deterioration in milk quality. Milk low inquality is known to affect the nutrition status of children 6-59 months in developing countries.

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TRACK 6
Cities and regions

6a. Urban and regional transformations

Abstracts

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Sustainability and circularity in regions – an approach from a regional study in Poland

Prof. Joanna Kulczycka[1], Grzegorz Maliszewski[2]
[1]MEERI PAS, AGH Poland, Cracow, Poland. [2]BANK MILLENNIUM, Warszawa, Poland

PROF. JOANNA KULCZYCKA

Abstract

The monitoring of a country's performance towards achieving UN SDGs or the progress towards a circular economy (CE) is gaining in popularity, thanks to more detailed policies and databases. In EU Member States there are eco-innovation and CE action plans with a number of existing indicators that can help measure performance in several areas that directly, or indirectly contribute to a sustainable development. However, there is not a widely acceptable single measurement index for the CE. Nowadays, many papers and reports are devoted to the assessment and ranking environmental, circular and eco-innovation performance on the country level, i.e.:

- Environmental Performance Index– an international ranking system that measures the environmental health and sustainability of countries, ranks 180 countries on 40 performance indicators across 11 issue categories covering climate change, environmental health and ecosystem vitality.
- Ecopreneur ranking – based on EU Circular Economy Monitoring Framework of the European Commission presented 28 country profiles using a combination of available quantitative data and qualitative information to highlight specific indicators covering various aspects of the CE.
- The Circularity Gap Reporting Initiative – with the individual country reports and including the Circularity Gap Metric for countries provides a deeper understanding of the resource reality of specific countries, in terms of extraction, processing, production, consumption and end-of-use management.
- The EU Eco-innovation Scoreboard gathers data on eco-innovation performance across the EU and beyond, thus helping to monitor and evaluate progress made since 2010. The Eco-Innovation Index measures the environmental innovation performance of EU Member States, on the basis of the 12 indicators included in the measurement framework.[5]

In European Union, most of the Member States have already adopted and implemented CE strategies and launched CE plans. In Poland, the transition towards a CE and implementation of sustainable development goals and eco-innovative activities are in most of the policies and strategies on the central and regional levels. Poland's circularity (10,2%) is higher than the world's average (8,6%), thanks to relatively strong in municipal waste management, but significantly below the EU average in the case of eco-innovation, which is an important enabling factor for the CE. The Polish economy is still among the least resource- and energy-efficient in the EU. To identify the changes and potential in Polish regions the Millennium Eco-index was developed for the first time in 2022. The aim of analysing the potential of eco-innovation should not be to rank regions, but to analyse the process over years and to evaluate the strengths and weaknesses of regions in eco-innovations. It is also aimed at the tightening of cooperation towards eco-innovation. It was shown that regions with large industrial and academic centres are leaders in both innovation and eco-innovation, but there are noticeable differences in the distribution of accents towards eco-innovation. In the paper, the potential for further transition of regions towards CE using Millennium Eco-index, assessment of regional policy strategy and environmental claims of selected the largest companies in the regions (based on information from EMAS and ESG reports) will be presented.

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Transformation labs for a regenerative built environment: Reflections on design, cross-regional learning, and the role of experimentation

Franziska Schreiber
Bauhaus Earth, Berlin, Germany. University of Stuttgart, Stuttgart, Germany

FRANZISKA SCHREIBER

Abstract

Research on sustainability transitions suggests that addressing grand societal challenges such as climate change or inequality requires system innovation, i.e. a deep transformative changes of socio-technical configurations that shape sectors (Geels, 2002). One of the sectors that is key to achieving sustainable (if not regenerative) development is the built environment (Organschi et al., 2022), which contributes to about 39% of global CO2 emissions (Hertwich, 2021), while failing to meet the basic needs of billions of urban dwellers who continue to lack dignified and safe dwelling spaces (Schreiber et al., 2022). Given that an additional 2.5 billion people are expected to live in cities by 2050 (UN DESA, 2019) - especially in Asia and sub-Saharan Africa - which will create a huge demand for new housing and infrastructure, the current environmentally devastating and socially inequitable building practices and dynamics must change to rescue the 2030 Agenda for Sustainable Development and the Paris Agreement from failing (Pradhan, 2023). How to initiate and enable systemic change in the built environment is a subject of growing concern. One promising approach that has received growing attention to foster sustainability transitions is experimentation in the form of labs such as urban living labs (von Wirth et al., 2019) real-world labs (Schäpke et al., 2018) or city labs (Scholl & Kemp, 2016). However, compared to other sectors, the built environment remains underrepresented in lab initiatives and knowledge on their impact on system change is limited (Kern & Haupt, 2021). Most labs to date have been conducted in the global North, particularly in European cities and regions, and a better understanding is needed of their potential role and applicability in contexts of the global South (Pareira et al., 2020), where the majority of future construction activities will take place, sustainability challenges already converge, and innovative solutions are being developed. In addition, the strong focus on single case studies has so far made comparisons and generalizations between transition trajectories in different spatial and sectoral contexts (e.g., built environment) difficult (Heilberg et al., 2022), and too little attention has been paid to cross-regional learning related to system innovation. The ReBuilt project seeks to address these gaps by exploring transformation pathways towards a regenerative, circular, and inclusive built environment through Transformation Labs (T-Labs) in four different city-regions in Bhutan, Indonesia, South Africa and Germany. The aim of the T-Labs is to initiate and facilitate multi-actor innovation processes that bring change agents together for a deep engagement about systemic change in the built environment through knowledge co-production, visioning, experimentation, and mutual learning. The paper will share reflections on the cross-regional learning approach and the design of the T-Lab 2.0 format that has been developed based on the lessons learned from the first wave of T-Labs (The Pathways Network, 2018) and insights from other lab approaches that specifically address the built environment. The transformation of the built environment especially relates to 11.1, 11.3, 13.2, 15.1, 15.2, 17.9, 17.16.

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An Assessment Framework for Mainstreaming Nature-based Solutions: The Case of Taipei City

Yung-Chen Cheng[1], Prof. Sue-Ching Jou[2], Jing-Chein Lu[3], Chia-Chi Lee[4]
[1]Department of Landscape Architecture, Catholic Fu Jen University, New Taipei City, Taiwan. [2]Department of Geography, National Taiwan University, Taipei, Taiwan. [3]Graduate School of Disaster Management, Central Police University, Taoyuan, Taiwan. [4]Research Center for Environmental Change, Academia Sinica, Taipei, Taiwan

Abstract

In recent years, nature-based solutions (NBS) have been widely promoted as an effective and innovative way to address the challenges of climate change and to accelerate positive urban transformations. While small-scale and community-driven NBS experiments have been tested and demonstrated in many places, there remain knowledge gaps concerning the integration of NBS strategies into mainstream urban policies and practices, and the role of city authorities in upscaling NBS in different local and regional contexts. For this purpose, researchers have called for the evaluation and monitoring of NBS performances to inform evidence-based approaches and actions, and the examination of local governance structure that facilitates NBS adoption and institutionalization. This paper responds to the two-fold research priorities by developing a place-based NBS assessment framework according to the four-stage policy cycle of NBS implementation, and by utilizing this assessment framework to gain a deeper understanding of how different NBS benefits are weighted and/or prioritized in Taipei City. In Taipei, the Department of Public Works is responsible for road construction, flood control, drainage system, and green space management, and now it becomes the leading administration that executes green and blue infrastructure for urban resilience and sustainable transformations. Based on literature review and in-depth qualitative interviews with key actors, our assessment framework is designed to explore how government employees perceived the social, ecological, institutional, and governance dimensions in the different phases of NBS projects. Our research finding shows that engineering safety is a top priority in the phase of policy creation, which must be taken into consideration along with climate change adaptation and ecological restoration. In the phase of planning and design, close partnerships with urban planners and landscape architects, who act as intermediaries between city government and citizen groups, is a key factor. Volunteers and community members, who are willing to participate in monitoring and environmental education, are crucial to the third stage of maintenance and management. Lastly, positive feedback and supports from civil society may strengthen NBS mainstreaming, but the lack of actionable guidelines and regulations may be an obstacle. Our research confirms that there are nuanced differences among government departments and their pathways of mainstreaming NBS, which may help to inform actionable policy recommendations.

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Mapping urban sustainability politics in the global city-region: Tensions between social and environmental sustainability and economic development in the Beijing-Tianjin-Hebei region, China

Dr Yi Li[1], Prof. Andrew Jonas[2]
[1]Hohai University, Nanjing, China. [2]University of Hull, Hull, United Kingdom

Abstract

It is widely understood that the emergence of global city-regions represents a formidable challenge to those nation-states interested in fostering governance and planning for urban and regional sustainability (Scott, 2001; Vogel et al. 2010). If the literature on city-regionalism often triumphs the functional and administrative coherence of such city-regions (Glaeser, 2012), this is achieved principally from the standpoint of the ability of urban and regional governments to balance economic competitiveness with environmental sustainability (While et al. 2004). In comparison, less attention has been paid to a corresponding urban politics of social sustainability around the management of distributional inequalities (e.g. housing and income disparities) often found within such city-regions (Jonas, 2012).

Focusing on Beijing-Tianjin-Hebei (BTH) global city-region in China, this paper investigates how uneven geographies of territorial distribution within the BTH maps onto an urban politics of sustainability that exposes the predicament of small towns and cities within the BTH. Drawing on an analysis of policy documents and newspaper articles, the paper examines the recent efforts towards constructing an economically integrated and environmentally sustainable BTH global city-region. It shows how the Chinese national state has encouraged greater regional collaboration around integrated city-regional integrated development and regional environmental sustainability as part of its wider economic internationalisation agenda (Li and Jonas, 2023). In doing so, however, the competitiveness and environmental benefits of sustainable city-regionalism have largely been internalised by the larger (global) cities (in this case, Beijing and Tianjin) at the expense of the surrounding smaller cities and towns. At the same time, smaller cities and towns must accommodate negative spillover effects in terms of population, housing, income and employment disparities generated by the growth of their larger city-regional neighbours.

The paper argues that future research and policy informing sustainable city-regions should pay closer attention to the urban politics of operating within, and often in tension with, the geopolitical orchestration of global city-regions by nation states. The interests of small towns and cities are frequently marginalised in global city-region sustainability policy and discourse; yet such places often bear the costs of the uneven social and territorial distributional effects of city-regional development. In the case of BTH, the under-provision of housing combined with a shortage of land supply has raised the costs of housing and made living in Beijing unaffordable for many, especially recent migrants.

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Construction Material Consumption for Housing and Regional Population Dynamics – Prospective Case Studies

Andreas Blum
Leibniz Institute of Ecological Urben and Regional Development, Dreasden, Germany

Abstract

Housing and construction have a significant impact on the consumption of resources of any society. At the same time, on all policy levels strategy documents towards sustainability highlight the importance of improvements in resource efficiency. For the built environment this is most prominently represented by the SDGs 12 (Responsible Consumption and Production) and 11 (Sustainable Cities and Communities). Against this background, this contribution presents results of research on the impact of population dynamics and changing user preferences on the use of resources within the housing sector with a focus on construction materials. The material intensity of different types of housing (in particular detached homes vs. apartment buildings) are quantified for different housing scenarios. For comparative purposes two medium sized German case study municipalities were selected to represent different contexts of stable vs. declining population dynamics. Among other, the results indicate that the stock of construction materials incorporated within the housing sector will under trend conditions further increase despite a stable or even falling population. With respect to alternative housing scenarios, our results show, that in the case of a stable or slightly growing population a sufficiency oriented shift of housing supply from single-family (detached) homes towards a higher share of multi-unit residential buildings can contribute to a more efficient use of materials (stock of construction materials per capita). However, depending on the context, such a shift towards more sufficient individual housing models might nevertheless result in an overall increase of material intensity on the level of the municipality. This is due to potentially increasing vacancy rates in the single family home segment with the respective embodied materials being wasted. An interesting scenario under the context of a declining population is the conversion of a potentially growing number of vacant single-family homes into smaller multi-unit/multi-purpose residential buildings. Such a conversion can help to avoid vacancy and keep otherwise wasted resources in use. This scenario could gain even more practical relevance if future detached housing designs would intrinsically consider the option of a later division into smaller residential units – apartments – e.g. once the children moved out or elderly households wish to downsize their living space and likewise maintenance burden. At the same time and although policy-makers start to question the appropriateness of the resource intensive detached housing model under sustainability considerations, most recently the demand for suburban detached homes is high in many places despite of high prices, among other due to the Covid Pandemic and supported by low real estate mortgage interest rates. Against this background and the presented results all involved actors are well advised to set the course with foresight as increasingly difficult vacancy situations can be expected on the longer term at least in less dynamic regions eventually resulting in a huge amount of resources being wasted. A development, which impacts equally on the planet (depletion of resources), people (compromising living environments) and prosperity (devaluation of real estate property) dimensions.

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Initial discussion of vacant industrial space valid reuse's key factors --- Take Ten Drum cultural and creative park as an example

Student Yu-Ping Hsu, Assistant Professor Jen-Hao Cheng
Harbin Institute of Technology, Harbin, China

STUDENT YU-PING HSU

Abstract

In the context of global industrial transformation, urban areas have shifted from expansion to shrinkage. Industrial areas in and around cities have started to lose their effectiveness and become vacant, which leads to environmental pollution and safety issues. However, traditional urban planning theory was created in response to urban population growth and industrial expansion, and it is worth exploring whether it can cope with the dilemma of contemporary urban shrinkage. Through field investigation and analysis in Taiwan, there are still many industrial vacant spaces that are still ineffectively reused, not only failing to attract people, but also causing the spaces become idle again. Finally, through the analysis and semi-structured interviews with key figures in the development of Ten Drum, that traditional planning theories are no longer able to cope with the rapidly changing social environment. But in Huashan and Ten Drum case study, vacant spaces are gradually being revitalized through the temporary urbanism approach. This paper compares the development experiences of Huashan and Ten Drum. Through semi-structured interviews Experts also clearly pointed out that temporary use can effectively activate industrial idle spaces before officially used, temporary use is one of the most important tools in many urban regeneration strategies.

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Developing Climate Change Adaptation Plans under Planning Deficit: The Case of Guandu, Taipei

Associate Professor Liling Huang[1], Professor Shang-Hsien Hsieh[2], Ph.D. Student Wei-Jung Ho[2], Ph.D. Candidate Yun-Tsui Chang[2], Ph.D. Student Po-Jung Shih[1], MS Student Jiun-An Chien[1], MS Student Ying-Peng Chu[1]
[1]Graduate Institute of Building and Planning, National Taiwan University, Taipei, Taiwan. [2]Department of Civil Engineering, National Taiwan University, Taipei, Taiwan

Abstract

Urban planning is a process that intervenes in the allocation of spatial resources. However, as wicked problems occur, it often leads to the absence or suspension of planning, which creates the situation of planning deficit. Under such circumstances, how can climate change adaptation plans be carried out? How can they shape strategies for action in the cleavage of political power, and break the deadlock brought about by government inaction? Furthermore, how can the process be theorized through the related concepts of climate governance? This study takes Guandu Plain in Taipei City as a case study, investigating the process of intervention and reshaping of local vision plans through climate adaptation project by the collaboration of university and the NGOs. Guandu Plain is the biggest remaining agricultural area in Taipei. Many development-oriented landowners have put pressure on city government agencies, demanding the conversion of farmland into construction land. Small-scaled farmers with passion for agriculture, on the other hand, are often limited by the production mode and marginalized political voice, being unable to effectively lead in local development. The city government has environmentalist ideals but lacks planning strategies and financial mechanisms to carry out innovative urban agricultural development plan. In the second half of 2022, through collaboration between the National Taiwan University team and Beitou Community College, local communities and farmers were connected, and a community adaptation plan began to take shape.This research examines the process which net-zero city framework was used to guide multiple stakeholders in collaborative planning. It analyzes the characteristics of the process, particularly the role of communicative technologies based on carbon footprint. It aims to evaluate the potential of net-zero policy framework on reshaping the wicked problem and fill the planning deficit. This study is related to “SDG11-Make cities and human settlements inclusive, safe, resilient and sustainable (11.3, 11.4,11.7 & 11.a)”, “SDG13-Take urgent action to combat climate change and its impacts (13.2)”, “SDG15-Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss (15.2, 15.a & 15.b)”, “SDG16-Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels (16.6 & 16.7)”, and “SDG17-Strengthen the means of implementation and revitalize the global partnership for sustainable development (17.14 &17.18)”. Moreover, this study will contribute ISDRS 2023 through its local practice experience in reshaping the net-zero policy framework on the low-carbon city transformation planning deficit.

Keywords: Net-zero city, climate adaptation plan, citizen science, planning deficit, climate governance, urban transformation

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Breaking down barriers: A decision-support platform for facilitating community-based climate change adaptation.

Subhashree Nath
Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany. Dresden Leibniz Graduate School, Dresden, Germany. TU Dresden, Dresden, Germany

S U B H A S H R E E N A T H

Abstract

In the absence of sufficient government support, a transformative community-based adaptation approach that fosters empowerment and agency through the reframing of decision context and decision-making processes offers a pathway for under-resourced communities to adapt to the uncertainties of climate change. For such an approach to be successful, it is crucial to overcome structural barriers related to power relations and societal norms that restrict inclusive and representative participation in adaptation decision-making. Therefore, an online decision-support platform (DSP) is proposed that can break down these barriers by intervening at two deep leverage points. First, by changing the structure of information flow, the DSP acts as a repository of information relevant to the local context of climate adaptation, translated into actionable knowledge through scenario development and simulation of the effects of adaptation measures on their immediate surroundings. Second, it provides a platform for self-organization, interaction with other actors and stakeholders, and reflection on the information provided, thereby providing the power to change the system structure. Third, it takes the decision-making process online, accessible via smartphones and computers. It is argued that a mobile application will increase participation, especially from women, allowing them to participate from their own homes and reducing inhibitions created by socio-cultural norms and consequent power relations. To mobilize these, a list of features for an enabling DSP is derived based on inputs from key informants from five stakeholder groups: community members, researchers and practitioners of community-based adaptation, NGOs working with communities, government officials, and private investors. Based on these, the architecture of the DSP is proposed. Finally, a proof-of-concept is illustrated through the design of the DSP for facilitating community-based adaptation to heat and drought in an informal settlement in Delhi, India. Embedded in the socio-technical context of the community, the proposed DSP facilitates decision-making through a matrix of adaptation measures assessed on criteria like increase in thermal comfort, reduction in surface runoff, cost-benefit analysis, and municipal departments and/or external agencies to be contacted for funding and implementation. Each community member can vote on relevant measures from a portfolio, based on their relevance for short to long-term adaptation, therefore enabling and facilitating participatory, transparent, and accountable climate adaptation decision-making.

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Urban Innovation Spaces for Co-creating Sustainability Solutions: The transformation of Shanzhuku Landfill from Wastescape to Eco Energy Park

Prof. Sue-ching Jou[1], Prof. Marc Wolfram[2], Prof. Liling Huang[3]
[1]Departmnet of Geography, National Taiwan University, Taipei, Taiwan. [2]Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany. [3]Graduate Institute of Building and Planning, National Taiwan University, Taipei, Taiwan

Abstract

This study analyzes the changes in Taipei City's Nangang Shanzhuku landfill over the past thirty years from the perspective of sociotechnical and social-ecological systems. We examine the characteristics of the landfill's change over time, explore the factors that influence its transition, and discuss its significance for urban transformation.

Currently, Taipei City has three landfills: Neihu, Fudekeng, and Shanzhuku, with Shanzhuku being the latest established. The landfill was inaugurated in June 1994 and covers an area of 65 hectares. Following Taipei City's zero landfill policy implemented in 2010, part of the site has been used as a waste dismantling and recycling operation, and the other part has changed into the "Shanshuilui (which means mountain water green) Ecological Park", containing multifunctional open spaces such as wetlands, an environmental education area, and a children's playground. In the early days, the landfill site generated methane power, and in recent years, a large number of solar panels have been installed, and experiments on small-scale hydropower generation have been conducted to transform it into a green energy park.

In the mid-1980s, when the Taipei City government announced the plan to turn the Shanzhuku area into a landfill, it faced opposition from community residents and scholars from the nearby Academia Sinica (the highest science research institute in Taiwan), who questioned its potential ecological impact to the area. However, over the past thirty years, through the collaboration and negotiation among multi-stakeholders, the area has successfully established mechanisms for environmental supervision, local feedback, and policy innovation. Therefore, the functions and meanings of the place have been changed accordingly. The transformation process of the landfill site demonstrates the characteristics of incremental and collaborative planning, which is unique in the construction of this type of infrastructure in Asian cities. Therefore, it provides a new perspective for grassroots innovation in sustainability research.

This article mainly responds to the following SDGs:

SDG 9 - 'Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation'; SDG 11 - 'Make cities and human settlements inclusive, safe, resilient and sustainable'.

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Transformation Pathways Toward a Regenerative Built Environment (ReBuilt)

Franziska Schreiber[1], Dr. Prajal Pradhan[2,1]

[1]Bauhaus Earth, Berlin, Germany. [2]Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany

Abstract

Transformation Pathways Toward a Regenerative Built Environment (ReBuilt)

The transformation toward a regenerative built environment is essential for limiting global warming well below 2 degrees. It is because energy-related emissions from the use and operational phase of buildings account for 37% of all greenhouse gas emissions globally. If traditional material use is maintained, "trapped" or embodied emissions in building materials will continue to increase due to rising demand, although operational emissions could decrease due to stricter regulations. Thus, this transformation can only happen by replacing carbon-intensive building materials (e.g., cement) with bio-based materials (e.g., wood). Doing so can not only reduce greenhouse gas emissions but also sequester carbon dioxide (CO2) removed from the atmosphere. For making this transformation happen, the following five interdependent themes are critical:

A. provide and use biogenic materials for buildings and infrastructure from sustainable management practices to maximize climate impact through carbon sequestration, storage, and substitution;

B. circular building practices to promote regional closed-loop systems that replace linear, extractive, and wasteful practices to the greatest extent possible;

C. polycentric, healthy, and green urban systems to optimally connect hinterlands and cities to maximize ecosystem potential and minimize ecological consequential costs, including biodiversity protection;

D. integrating social and environmental needs in the built environment to promote a human and nature-centered transition to equitable, healthy, and liveable conditions;

E. creating enabling environments for systemic urban change, including effective regulatory and financial guidance and policy initiatives.

Our ReBuilt project will address these five themes based on systemic and inter- and transdisciplinary approaches with the following overarching objectives: i) assessing the supply and demand of biogenic materials for future building needs, ii) capturing the complexity and specificity of local transformation challenges, and translating research findings into policy initiatives. We plan to meet these objectives starting from understanding the state of the art in research and practice to capacity-building for making the transformation happen. Our poster will present these key elements of our ReBuilt project, which has just started. Our results will be valuable for ongoing policy initiatives and platforms at the national and European level - such as the New European Bauhaus (NEB) and the newly established National Contact Point NEB as a central coordination and networking platform in Germany - as well as into global agenda processes related to the Paris Climate Agreement, the Biodiversity Convention, and the Sustainable Development Goals (SDGs).

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Opportunities and Challenges in Transforming into a Locally-oriented Industry-based Tourist Village: A Case Study of Sering Village, Pelalawan, Riau Province, Indonesia

Opportunities and Challenges in Transforming into a Locally-oriented Industry-based Tourist Village: A Case Study of Sering Village, Pelalawan, Riau Province, Indonesia Muhammad Syafi'i, Dina Syaflita, M. Jaya Adi Putra
University of Riau, Pekanbaru, Indonesia

OPPORTUNITIES AND CHALLENGES IN TRANSFORMING INTO A LOCALLY-ORIENTED INDUSTRY-BASED TOURIST VILLAGE: A CASE STUDY OF SERING VILLAGE, PELALAWAN, RIAU PROVINCE, INDONESIA MUHAMMAD SYAFI'I

DINA SYAFLITA

Abstract

The effort to accelerate a region to become a tourist destination has implications for various aspects in the area such as economics, social, culture, education, and so on. If the developed tourist area carries the concept of local wisdom-oriented industry, it can also have an impact on the preservation of nature. The purpose of this study is to identify opportunities and challenges for Sering Village in Pelalawan Regency to transform into a local wisdom-oriented industrial tourism village. This research is a qualitative study with a descriptive design. The data collection methods used were direct observation, interviews, and documentation. Data analysis was carried out through data collection, data reduction, data display, and conclusion stages. The results of this study indicate that Sering Village is located between the Pangkalan Kerinci Bridge, Instana Sayap (Pelalawan Kingdom Heritage), and the industrial center. The location of this village can be accessed by land and river routes. The village still holds strong to the local wisdom of its people. This information presents an opportunity for Sering Village to transform into a local wisdom-oriented industrial tourism village. The challenges in realizing this effort are the low human resources of the community, the lack of awareness among outsiders about the potential of this village, and sanitation. These opportunities and challenges can be used by the government in developing the Sering Village area into a local wisdom-oriented industrial tourism region

Full Papers

Initial discussion of vacant industrial space valid reuse's key factors --- Take Ten Drum cultural and creative park as an example

Yu-Ping, Hsu [1], Jen-Hao Cheng [2]

[1] Harbin Institute of Technology, 92 Xidazhi Street, Nangang District, Harbin City, Heilojiang

[2] Harbin Institute of Technology, 92 Xidazhi Street, Nangang District, Harbin City, Heilojiang

[4] j0950007@gmail.com

Abstract. In the context of global industrial transformation, urban areas have shifted from expansion to shrinkage. Industrial areas in and around cities have started to lose their effectiveness and become vacant, which leads to environmental pollution and safety issues. However, traditional urban planning theory was created in response to urban population growth and industrial expansion, and it is worth exploring whether it can cope with the dilemma of contemporary urban shrinkage. Through field investigation and analysis in Taiwan, there are still many industrial vacant spaces that are still ineffectively reused, not only failing to attract people, but also causing the spaces become idle again. Finally, through the analysis and semi-structured interviews with key figures in the development of Ten Drum, that traditional planning theories are no longer able to cope with the rapidly changing social environment. But in Huashan and Ten Drum case study, vacant spaces are gradually being revitalized through the temporary urbanism approach. This paper compares the development experiences of Huashan and Ten Drum. Through semi-structured interviews Experts also clearly pointed out that temporary use can effectively activate industrial idle spaces before officially used, temporary use is one of the most important tools in many urban regeneration strategies.

1. Interpretation of Urban Strategic Planning

The process of urbanization began with the Great Industrial Revolution in 1800. The first industrial revolution, the invention of the steam engine in England in the eighteenth century, which led to a substantial innovation in industry and the gradual elimination of time-consuming and labor-intensive human production. The second industrial revolution, which began in the early nineteenth century with the use of oil as the main source of power, the development of electricity supply and electrification, and the elevation of industry to the next level of heavy industrial development; the third industrial revolution, in the mid-twentieth century, reached the milestone of industrial control automation through computers, and more focused on a broader scale of detection and observation research. In the fourth industrial revolution, industrial development continues to move toward to a more macro and micro world of exploration and development and automation, laying the foundation for future urban development and industry. Through the era of motorization, the ecological revolution, the era of information technology, until the era of globalization in the year 2000, the division of labor in globalized industries and innovative technologies are changing rapidly, and the era has led to the elimination and renewal of industrial plants.

1.1 Urban problems caused by industrial development

Industrial idle spaces in various stages around the world have a particular form in the context of that era. The city is an organism that takes on different forms depending on the way it is inhabited and used. In the early stages of urban development, people built as much as they could, and in the process created various urban diseases that have become familiar until recent times (Huang, 2022). ◦ Cities are formed by the gathering of people, and planning is a normative guideline developed by people under the law of urban development. In the past few years, in addition to regional urban diseases, the "big city diseases" in big cities have been

introduced, including population expansion, traffic problems, housing problems, urban environment and other symptoms. In the past, urban diseases were often diagnosed as an incurable disease, but in the current era of advanced technology and rapid change, many of the "foci" can be debugged and solved (Huang, 2022). Take Singapore as an example, the country has very limited land resources, so it needs to plan precisely the use of each type of land, but the country pays much attention to the convenience and environmental comfort of the area, and not only the use of area allocation, but also needs to use different means to plan the horizontal and vertical space properly and pay attention to each time cost, in order to solve the traffic demand and congestion environment in the city (Tsai, 2023). Urban planning and urban design have a certain influence on cities and must be thought through before implementation. Yang proposed in early 2023 that urban development is different from rural, "The consequences of planting the wrong kind of land are serious, but they can be adjusted after a certain period of time, while the wrong kind of building will affect one or two generations (Yang Kaixin, 2023). This shows the influence of town planning layout on the overall environment, so no decision can be neglected. Industrial heritage is an important carrier of urban development civilization, which inherits the memory and nationality of urban space in the industrial era (Gao Yingjin, Xiao Mingshan, 2021)

1.2 Unknown development status of cities

Industrial heritage buildings have been studied in foreign countries since the 1970s, and the combination of social, value, historical and cultural aspects of space has been studied to extend the life cycle of industrial structures that have not yet reached the end of their useful life in a sustainable way and reduce the consumption of social resources in the contemporary environment of rapid technological development (Gao Yingjin, Xiao Mingshan, 2021). In the context of this development, major cities around the world are experiencing population contraction and urban transformation in the process of industrial development. The issue of old and new space use within cities and towns has gradually emerged, and previously unnoticed urban diseases have become a major challenge for urban development (Feng, Xiaolu, and Qiu, 2021). In the past, experts and scholars arranged and used urban space based on the urban planning concept that the city, i.e., the population, would continue to expand, and the old urban space became saturated over time, so in recent years cities have gradually expanded outward or established satellite cities such as new urban areas in the suburbs (Xu Jiahui, Yu Taofang, 2021). Is this really the trend needed in today's social environment? In recent years, regional urbanization has led to the emergence of previously hidden urban problems or urban diseases due to various factors such as population loss and urban industrial transformation. Urban development now faces the dilemma of de-industrialization, which is generally attributed in the existing literature to the rapid growth of manufacturing productivity, the shift of manufacturing from developed to developing countries, and changes in consumer consumption patterns (Kollmeyer C., 2009). Studies in recent years have shown that urban development around the world has seen urban contraction and that many houses and land in urban centers have become vacant. In the face of the urban vacancy phenomenon, old low-utility land in cities is often accompanied by vacant space, mainly often in the form of vacant property, vacant land, vacant space in the city, if not used for a long time, will be accompanied by social hazards and other social negative externalities (Yi, Xiao-Xiang, Zhang, Hao-Ping, Xia, Lei, 2022). On the contrary, under the concept of ecology and environmental protection, the planning and development should be concerned with the inventory in the city and the large scale spatial structure of the unused industrial buildings, providing different functional types and flexible reuse development conditions. A large number of heritages built in the early stage of urban development should not only exist in museums, but should be experienced through the actual space to understand the industrial development process. It is not only to preserve these industrial relics, but also to find new possibilities for them and to breathe new life and vitality into them, which has become a common concern in all regions of the contemporary world. Industrial heritage is a very important part of China's industrial structure, and since the de-industrialization of China's urban areas, the development of inventory and the restricted development of incremental areas at all levels have led to an increase in the cost of space use. Furthermore, the dilemma that makes industrial space find insufficient value for industrial transformation (Song Ziyang,Wang Lin,2022).

1.3 Insights from experts on the current stage of urban development

This paper uses semi-structured interviews with the people involved in the successful development of the Ten Drum Cultural and Creative Park in Tainan City up to now. The interviewees include the founder of the Ten Drum Cultural and Creative Park, Mr. Xie Shih, the architect of the Ten Drum Cultural and Creative

Park, Mr. Ye Shizong, and the head of the Ancient Residence Operation and Cultural Affairs Bureau, Tainan City Government, Mrs. Guo Qian-yin, and other key participants. Semi-structured interviews are a type of data collection between structured and unstructured interviews. The outline is used as a guideline and an aid for the interview according to the purpose of the study and the interview outline. During the interview process, the sequence and the upper questions can be flexibly adjusted according to the whole process of the interview, and then in-depth questions can be discussed through the content of the interview. In this paper, we used a semi-structured interview outline as a blueprint to conduct a preliminary one-on-one discussion with experts and scholars from different fields on the current situation of the reuse environment of unused industrial space, and to understand the views and suggestions of different fields on unused industrial space during the semi-structured interviews (Lin, Y., 2017). The interviewed experts all provided key insights into their areas of expertise regarding the transformation of industrial idle spaces in the current stage of Taiwan's rapidly changing overall social environment (Chen, P.-C., 2021).

2. Temporary use of industrial idle space in response to a rapidly changing social environment

The rapid development of the city, space with people's habits of use ,and technological progress have a substantial growth. In the early stages of urban development, a lot of effort was invested in building industrial spaces. However, in the context of this rapid development, the issue of old and new space use within the town has gradually surfaced and the previously unnoticed urban diseases have become a major challenge for urban development (Feng, Xiaolu, Qiu, Jun, 2021). With the development of cities, experts and scholars in the past arranged and used urban space based on the urban planning concept that cities' populations, would continue to expand, and the old urban space gradually became saturated with time, so in recent years cities have gradually expanded outward or established satellite cities such as new urban areas in the suburbs (Xu Jiahui, Yu Taofang, 2021). Facing technological growth and industrial transformation, new production machines have shrunk in size and no longer require large factory space, resulting in a significant restructuring of traditional industrial space and leaving a large amount of vacant space in the city (Qianru Liu, 2021). It has become a highly debatable issue in today's urban industrial transformation in the rapidly changing social environment. Industrial heritage is a very important part of China's industrial structure, and since the phenomenon of de-industrialization in China's urban areas, the development of inventory and the restricted development of incremental areas at all levels have led to an increase in the cost of space use. Furthermore, this has led to the dilemma of industrial space finding insufficient value for industrial transformation (Song, Ziyang, and Wang, Lin, 2022). Today's society can no longer afford the high cost of demolition and construction that characterized the early stages of urban development. Studies in recent years have shown that urban development across the country has been experiencing urban contraction and that many houses and land in urban centers have been left vacant. Urban sprawl has ceased to be a trend in recent years, and the issue of urban shrinkage has attracted much attention, with the relocation of industrial areas to peri-urban areas and the transformation of industries within cities, resulting in frequent population movements in urban and suburban areas (饗庭伸, 2015). The rapidly changing social environment, declining population and industrial transformation are forcing us to break out of the bubble of continuous urban expansion. The world is changing so fast that long-term forecasting is impossible, and when cities need to continue to evolve in a complementary way to the times, traditional blueprint planning is not effective in achieving forward-looking forecasting. On the contrary, the visionary plan regulates the operation of cities with short-term and highly inclusive dynamics, thus complementing the shortcomings of the blueprint-based plan in terms of macroscopic guidance. In 2014Bennett and Lemoine proposed that in the face of the current social environment full of Volatility, Uncertainty, Complexity, Ambiguity which is also abbreviated as VUCA (Bennett and Lemoine, 2014). Currently, vacant industrial space in cities is not only restricted by urban development regulations but in some areas is subject to rigid procedural processes. With urban plans no longer able to effectively control the use of urban space, the loosening of formal plans and the flexibility to adjust planning and governance are no longer a long-term solution. However, the temporary use of informal use has been researched and proven to be effective in reducing crime, preventing environmental degradation, and increasing the value of surrounding land through the introduction of temporary use functions in unused space. (Spelman, 1993; Stucky and Ottensmann, 2009; Accordino and Johnson, 2000)。Looking at the reuse of vacant space from the perspective of traditional blueprint planning, it is still felt that the temporary use has too much unknowns and that the longevity sought by traditional planning is contradictory. Visionary planning allows cities to function effectively and sustainably in the short term, but the informal use of temporary planning has not yet been able to be practically integrated with formal planning in many places.

The temporary use of urban space in the industrial city originates from the unsatisfied use of urban space by the masses. In the contemporary rapidly changing society, urban space and planning system cannot effectively respond to the needs of the masses, so there are occupations, lobbying and rallies initiated by the masses. In the time gap between the end of the previous use and the beginning of the next use, the temporarily undefined space is used to solve the current spatial problem (Wu, 2002). Tactical urbanism has been used in different regions to produce many similar but different models and names, such as Urban Catalyst, City Rebelling, City Remaking, Pop-up, do it yourself urbanism, Guerrilla Urbanism. Tactical Urbanism, Spontaneous Interventions, Occupy, Insurgent Public Space, urban acupuncture, etc. are some of the common models (Hou, 2010)。Temporal urbanism is mainly about making the environment more inclusive through the power of mass social practices, so that rigid social relations gradually become more flexible and soften the deadlock through the use of wartime. (Németh and Langhorst, 2014 ; Bowman and Pagano, 2000 ; Schilling and Mallach, 2012)。Urban space and social environment are the two main elements of urban life that are intertwined, temporary use as a short term usage pattern, can lead urban regeneration through temporary excesses to establish a functional exploration opportunity linking the past and the future (T.T. Wan, M.Y. Lee, 2023).

The steady growth of industrial development and economy, through the regional development of the tourism model to link the industrial heritage in the urban space, forming the basis of industrial heritage tourism, can help the revitalization of heritage space and the effective continuation of spatial value, including the Ruhr industrial area in Germany and through such a model to link and stimulate the economic revitalization of the region to the heritage space (Zhao Zhiqing, An Qinglong, Wang Qingren, 2020). In the current contemporary social environment where industrial space is almost successfully transformed, the renewal of industrial heritage has become an issue of great concern. The conditions of the living environment are also gradually shifting from industrial mass production and economy to a human-centered direction (Sheng Chaoxun, 2020). In Western countries, visionary or blue-print planning is used to respond to the nature and needs of different countries. In The temporary city, published in 2012, Peter Bishop and Lesley Williams, among others, suggest that the notion of permanent urban structure has become a fatal problem over time and also find that traditional land use planning has become a major impediment to the transformation of the city. In a major impediment to transformation, it is more boldly assumed that economic change is the driver of temporary use, resulting in vacant space and space owners being more receptive to temporary use as a means of access.

2.1 Limitations of traditional blue-print planning tools for current urban space reuse

In recent years, the world has begun to reflect on the fact that the traditional planning model, which is accustomed to the comprehensive construction of large demolitions of urban spaces, has not had much capital to cope with the high-risk construction model in the face of the current fast-changing social environment. However, urban development is made up of many elements, of which the people who use it are the most important ones. The history of urban development in different periods has been characterized by different planning objectives and means of use in response to the needs of the population. Moreover, the city expands with the movement of people, and planning is born as a result of urban development. Many of the current established traditional planning processes are shaped by urban sprawl. Urban planning has tended to use established regulations to meet the needs of the population and to standardize the process as much as possible to minimize problems. In the past, blueprint planning could easily lead to a dilemma of urban development where there are no new areas to develop, but the inventory of existing space can be reused in conditions that do not meet the economic costs and are not protected by reasonable regulations. The time shift leads to industrial transformation, which leads to a decrease in urban population mobility and regional population density, an increase in the vacancy rate, and the phenomenon of porosity in many parts of the city (饗庭伸, 2015). These phenomena will not only increase the negative externalities of the city, but will also easily force the surrounding residents to move to other areas, thus contributing to the possibility of Broken windows theory. The traditional sprawling urban planning model facing the shrinking vacant space in the city is an important issue that needs to be discussed together nowadays.

2.2 The importance of visionary planning and temporary use for idle space

In 2012, Mike Lydon et al. proposed the use of strategic urbanism as a means to achieve the following four things compared to traditional planning practices: (1) Small-scale, low-cost, experimental short-term activities are carried out in the urban area by means of rapid changes, and the status of the activities is

observed and adjusted in time, thus reducing the risk of large-scale construction; (2) By gathering the power of the masses in small-scale and small areas, public awareness can be easily raised for temporary environmental improvement actions, and the masses can directly communicate the needs and express the public's desire for space use, reflecting the small but urgent local issues.；(3) Strategic urbanism is applicable to a variety of people, and through temporary activities can improve and develop trusting relationships between stakeholders and the public more quickly through personal involvement, and may gain more public and city responses and develop into long-term functions of the field; (4) Strategic urbanism's short-term actions can be effective in creating long-term changes (Lydonetal.,2012). In 2003, Hentil et al. after three years of research proposed case studies of industrial vacant spaces in Amsterdam, Berlin, Helsinki, Naples and Vienna. Through interviews with key local actors, including temporary users, property owners, planners and other authorities, politicians, and other groups, it was concluded that temporary uses successfully promote and enrich the vitality of the area and attract heterogeneous groups to the site. Large-scale field space of industrial vacant space becomes a platform for common learning among different groups, and temporary use activates the vacant space of the city to improve social sustainability and competitiveness (Hentil, Helka-Liisa & Lindborg, Timo. 2003)。The phase zero design concept of tactical urbanism is presented in a 2015 report by Mike Lydon and Anthony Garcia in a report called Tactical Urbanism: Short-Term Action for Long-Term Change. The article mentions tactical urbanism as a bottom-up approach to low-cost, low-tech, flexible use through small (XS) or ultra-small (XXS) interventions that can be copied. The phase zero design can be use as an early implementation tool to test some of the development elements of a project before a long-term investment is made and before the project becomes operational (Lydon, Garcia, 2015). In the German planning system, the temporary use has been interacting with the traditional planning model in a mutually supportive way. The government's proactive planning and the private citizens' reactive planning are successfully practiced in the Spree Riverfront in Berlin (Deng, Tang, 2023). It can be concluded that the investment risk of traditional blueprint planning can be effectively avoided, if short-term zero-phase use is available before long-term planning is undertaken.

3.Cultural and Creative Park Revitalization Experience

Taiwan's industrialization process began during the period of Japanese rule, and a large number of carpentry factories, tobacco and alcohol factories, and sugar and salt manufacturing factories were established during this period for colonial policies. The development of textiles and petroleum-powered light and heavy industries continued only after Taiwan's restoration (Shih-Hui Huang and Yi-Fen Chang, 2016). In recent years, Taiwan has been affected by globalization, and the traditional light and heavy industries have been transformed. Until 2002, under the Planning and Implementation of the Challenge 2008 National Development Plan, the unused industrial space was reused by the creative and cultural industries to extend the life cycle of the space and its value. Looking back at the five cultural and creative parks that have been developed in the past 10 years. In addition to the monotony of the development model and functions, there are often no tourist arrivals (Wang, 2019). This study will discuss the impact of the reuse of vacant industrial space of Huashan and Ten- Drum Cultural and Creative Park on the later operation.

3.1 Huashan 1914 Creative Park

Huashan Cultural and Creative Park is one of the few industrial idle spaces reused in Taiwan that still attract people of all ages to it. The Huashan Cultural and Creative Park was abandoned as a vacant space in the turbulent post-colonial era of Taiwan. After the Huashan Liquor Factory was left idle in 1987, its location in the center of Taipei attracted the attention of many groups at the time, it was granted temporary access and after 10 years of active campaigning by artists (Chen Chang,Zhou Wei, 2014). The short 10-year period from 1997 to 2007 began with one exhibition after another, breaking through the original idle state, many artists formed a wonderful relationship with the vacant space of Huashan Liquor Factory, creating an uncertain atmosphere of identity and experimental creative thinking in the space. Influenced by foreign art culture, the artist decided to use the Huashan Liquor Factory as an Art factory, then transformed the art factory into a broader art and cultural zone, which combining all kinds of art. With the experience of developing art and culture in many countries, revitalization requires more than a one-way effort. It needs a platform for young artists and creators. Zhang mentioned that " Huashan Arts and Culture Special Zone is a temporary, short-term mission, and in every country or region, artists often play the role of pioneers, then the government and developers will make further use of the area after it has become vibrant." and "The most remarkable thing in the social context was that there was very little government involvement and

intervention, so it was the best time for the arts and culture when the government didn't even know what we were doing."
Throughout this 10-year process, the Huashan Arts and Culture Special Zone has brought domestic and international art activities into the space in a self-sustaining way (Huashan Parlor, 2020). What is most valuable about the Huashan experience is not the final operator, but the domain continues to nurture new artists and continues the value of the use of the space. In 2002, under the The Planning and Implementation of the Challenge 2008 National Development Plan, the space of Huashan Liquor Factory was transformed into a cultural and creative park for commercial purposes. (Zhang Jiang,2020). Then operate-transfer to private enterprises for operation (Ren, Huimin, and Li, Yi-Ni, 2019). The Huashan style created by the artist is a balance between the economic value and the artistic and literary value of the Huashan liquor factory and the needs of the social environment (Li Junru, Chen Pinz, 2005).

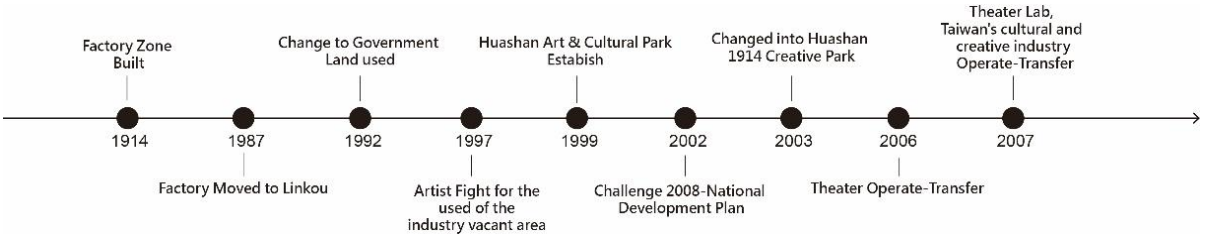

Figure 1. Huashan Cultural and Creative Park development time line

3.2 Ten Drum culture and creative park

The predecessor of the Tainan Ten Drum Cultural and Creative Park in Taiwan was Rendezvous Sugar Factory, built by Japan as a result of colonial policies, which carried the important process of the rise and fall of Taiwan's sugar industry and industrial development, and was closed in 2003. In 2005, Ten Drum Percussion rented part of the space for use (Can Luo, Hongfei Liang, 2017). Knowing that the Rendezvous Sugar Factory was located in the suburbs of Tainan and was currently idle, the Ten Drum Percussion Group rented part of the Rendezvous Sugar Factory space with Taiwan Sugar Corporation as a base for the group's practice. At the beginning of the lease, the Ten Drum Percussion Group did not have a long-term reconstruction plan for the initial use of the space, but used the area for small-scale environmental improvements and the advantages of the existing space, such as a temporary practice stage and a practice area for the group members. In 2007, the Ten Drum Cultural and Creative Park was established (Chen Chang, Zhou Wei, 2014). The planning method of the Ten Drum Cultural and Creative Park is clearly different from other cultural and creative parks. Traditional blueprint planning does not have the "critical period of revitalization" used in the visionary planning strategy. During the critical period of revitalization, temporary use in vacant spaces is commonly used as a catalyst for the site, and short-term testing is used to develop a suitable function for each space in the future. Before the establishment of the Ten Drum Cultural and Creative Park, Ten Drum Percussion only rented part of the vacant space from the Taiwan Sugar Corporation on a short-term five-year contract as a practice space. Over the next five years, Xie X, the head of the group, led the team to build a space for the drum group's performance in the park using the features of the site itself (Wang Qiaoyan, Sir Lin, Chen Zhikun, and Lin Mengwei, 2013). One of the most characteristic things is the performance space combined with the old equipment of the sugar factory, and various extreme facilities in the park, all of which make the visitors very enjoyable. Also with the expertise and spatial practice of Shih Tsung Yeh architect, the environment of the Ten Drum Cultural and Creative Park was elevated to the next level. Through sensitive observation of Director Xie, he often communicates with artists-in-residence and visitors to the park to find new needs and room for improvement (Yuan Yonglin, Wen Yabin, Tu Yihong, 2020). Until last year, Ten Drum Cultural and Creative Park has rented the entire Rende Sugar Factory by itself and has a vision for the whole area already. In addition, because this is an industrial land use, its specification is negatively listed and is permitted insofar as it does not involve functions that are prohibited. Through rolling revisions and temporary use over the past 18 years, Ten Drum has succeeded in turning the Ten Drum Cultural and Creative Park into the first cultural space and tourist venue in Taiwan operated and run independently by a single performing arts group (Chen Chi-kun, 2013).

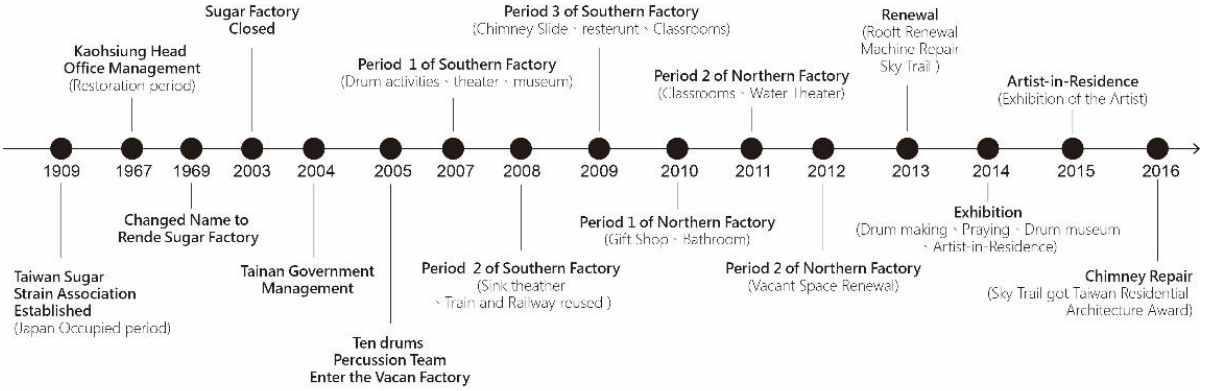

Figure 2. Ten Drum Cultural and Creative Park development time line

3.3 Temporary use continues the value of idle industrial space

Planning and use in cities have been faced with development from scratch since the beginning of urban development. In the current social environment and rapid development of the economic system, there is only a small amount of incremental space left in the city. Traditional urban spatial planning is nothing more than the urban renewal of large areas in the mode of major demolition and construction, but society has no longer such a large capital load, and the traditional one-size-fits-all planning model can no longer respond to urban needs. The above are two examples of the successful revitalization of cultural parks in Taiwan. Through the analysis of Huashan Cultural and Creative Park and Ten Drum Cultural and Creative Park, both of them have different location conditions and current management methods, but both of them have similar planning processes and usage methods in the reuse of idle industrial space. As shown in the figure below, it is common for cultural and creative parks to define the area at the early stage of industrial idle space reuse, and then make commercial investments at the later stage of construction to make enterprises move in. This approach can easily cause the same area to be divided into several small units, and the units are unrelated to each other. In contrast, before the formal use of space in the Huashan and Ten Drum Cultural and Creative Parks was planned, the space was transformed into an art exhibition space through temporary use by artists with limited financial resources, using low-cost and small-scale space adjustment and decoration. The development of the two cultural and creative parks is different from the above blueprinted plan, which makes the space appear fragmented. Temporary use is the derivation of functions and spatial partitions in the space according to the needs of the users. Comparing blueprint planning and temporary use, we can clearly see the limitations of blueprint planning in the development of space utilization. Temporary use revitalizes the space locally, and then installs the required functions and improves the facilities, and then collects information on the surrounding usage needs for the subsequent long-term use of the space through the rolling adjustment of facilities and function positioning. In addition, the blueprint plan has too specific subdivisions at each stage, making it more difficult to manage and integrate later on. However, all functions and spaces under temporary use coexist with each other, the development and use of the whole area is carried out by the same organization. This makes later management simpler and clearer. In the early stages of development, Huashan Cultural and Creative Park and Ten Drum Cultural and Creative Park were both used by artists. The park is considered as a whole and the spaces are linked to each other, so that the existing industrial space can be effectively revitalized.

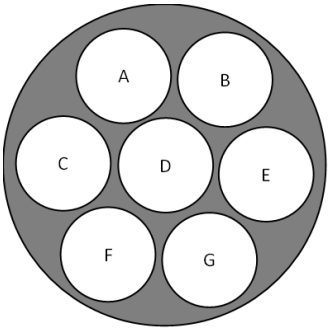

Figure 3. Blueprint Planning

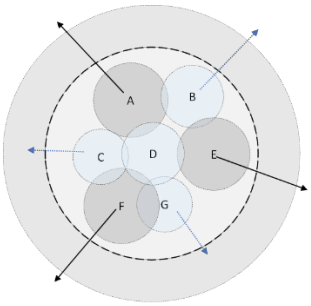

Figure 4. Temporary used

4.Results and Discussion

Facing the conservation and reuse of industrial heritage, all sectors need to bring it closer to the texture of urban development and fully develop it and utilize its characteristics efficiently to attract more people to come and play with the new using the old space (Wang Runsheng, Wang Dawei, Liu Min et al., 2023). Temporary use of vacant spaces in the city is more of a bottom-up spatial creation tool started by the people, without involving property rights and prohibited activities. Temporary use retains a high degree of flexibility and variability to make the use of space more relevant to people's lives without involving property rights and prohibited activities (Liu Qianru, Bonnie Huang & Xia Bing, 2022). Traditional planning as a means of urban regeneration can be effective in seeing immediate results in a short period of time. However, it is extremely difficult to promote and predict future use patterns due to the complicated process in the early stage of urban renewal, which makes it impossible to effectively solve the vacant space problem in the rapidly changing social environment (Mengevenlei, Hu Yaning, 2022). In the context of The Planning and Implementation of the Challenge 2008 National Development plan and the UK's creative industry experience, the Huashan and Ten Drum Cultural and Creative Parks were transformed from declining industrial heritage spaces to popular cultural and creative spaces. The space value of the vacant space was successfully continued, and in the context of the time, the artistic use of the pre-planning period was continued, so that the creative culture of art and other arts was put into the new economic function (Gao Ziwang, 2020).During the semi-structured interview with the founder of Ten Drum Cultural and Creative Park, Mr. Xie Shih, Architect of Ten Drum Cultural and Creative Park, Mr. Ye Shizong, and Mrs. Guo Qian-yin, Cultural Affairs Bureau of Tainan City Government. Mr. Xie Shih, Architect Ye Shizong, and Mrs. Guo Qian-yin gave their preliminary views on the usage of vacant space in former Taiwanese industries and the representative achievements of Ten Drum Cultural and Creative Park in this field.

The head of Ten Drum Cultural and Creative Park Xie Shih defines industrial vacant space as*" The difference between the Ten Drum and other industrial heritage is that Ten Drum achieves an old innovation, as there are a lot of industrial heritages that are simply preserved as industrial heritages. But I hope that the industrial heritage will be maintained with an innovative meaning and connected to the times."*

Shih-Chung Yeh, the architect of Ten Drum Cultural and Creative Park, on the current industrial control space reuse in Taiwan*" Taiwan's concept of these monuments or industrial heritages and other related projects are too conservative, that they are afraid to destroy them... This is why the Ten Drum is such a successful project, because a lot of things are not clearly described."*

Mrs. Guo Qian-yin, Cultural Affairs Bureau of Tainan City Government also propose Tainan's current approach to old vacant spaces and historic buildings*" We don't ask for special requirements, as long as they revitalize the space and maintain it. .... Do not deviate too much from the monument's character, at least there should be some introduction of the monument, not too commercialized. Let the public enter the space, in addition to these cultural and creative products, but also preserve the original history of the monument….*

But the sugar factory is not a historical monument, ... Ten Drum is very respectful of the revitalization and maintenance of the equipment."

According to the above analysis, blueprint planning focuses on the establishment of a framework for space through zoning plans so that new types of businesses can be placed in the space from scratch. Temporary use is different from blueprint planning, which is a spatial development tool during spatial transformation. Through guidance, the space can be expanded from an unknown idle state to the reuse of the whole area through a temporary target concept. However, the regulation and way of dealing with the process is still a major challenge in the utilization of industrial space. Taiwan's rigidly solidified administrative system contains even more administrative laziness and many things are not clearly and effectively enforced, leading to loopholes. Such a situation is not pleasant to see, but the unspecified norms and relatively loose management attitude have instead become an important breakthrough for Taiwan's industrial vacant space as well as one of the key factors in becoming a temporary use.

5. Conclusion

In this paper, we can find out that the economic development model of Taiwan's cultural and creative parks has long been deeply rooted in the lives of the Taiwanese people, and under the changing social environment, people are no longer satisfied with the consumption of basic living, but are more concerned with experiential consumption, which makes it necessary for industries to transform to meet new consumer demands. In recent years, major cities around the world have gradually begun to focus on temporary urbanism to revitalize vacant spaces through temporary use, and it has become one of the most important tools in many urban regeneration strategies. This study will continue to explore the views of experts and scholars on the reuse of industrial vacant spaces in different fields and investigate the importance of temporary urbanism for the development of industrial vacant spaces in cities under rapid social changes.

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Sustainability and circularity in regions – an approach from a regional study in Poland

Joanna Kulczycka[1], Grzegorz Maliszewski[2]

[1] Mineral and Energy Economy Research Institute Polish Academy of Sciences, 31-261 Krakow, Wybickiego 7a, kulczycka@meeri.pl
[2] Bank Millennium, ul. Stanisława Żaryna 2A, 02-593 Warszawa

Abstract. The monitoring of a country's performance towards achieving UN SDGs or the progress towards a circular economy is gaining in popularity, thanks to more detailed policies and databases. In the EU Member States, there are eco-innovation and circular economy action plans with a number of existing indicators that can help measure performance in several areas that directly, or indirectly contribute to sustainable development on the Member States level (NUTS-1). Nowadays, many programs and projects are designated to the regional level (i.e. EU Just Transition, Regional Funds). It is more important to identify and measure the progress towards transformation on this level, especially in eco-innovation. Therefore the Millennium Bank started efforts to create the methodology and invited AGH Kraków and SGH Universities to cooperate on the new proposal. As a result, the new Eko-index Millennium was developed for the first time in 2022. In the paper, the potential for the transition of 16 regions in Poland towards a circular economy and its possible impact on the assessment of regional policy strategies using the proposed eco-index will be presented.

1. Introduction

The monitoring of a country's performance towards achieving UN SDGs or the progress towards a circular economy (CE) is gaining in popularity, thanks to more detailed policies and databases. In EU Member States there are eco-innovation and CE action plans with a number of existing indicators that can help measure performance in several areas that directly, or indirectly contribute to sustainable development. However, there is not a widely acceptable single measurement index for the CE on the regional level. Nowadays, many papers and reports are devoted to the assessment and ranking of environmental, circular and eco-innovation performance on the country level, i.e.:

- Environmental Performance Index – an international ranking system that measures the environmental health and sustainability of countries, ranks 180 countries on 40 performance indicators across 11 issue categories covering climate change, environmental health, and ecosystem vitality (Wolf et al, 2022).
- The EU Eco-innovation Scoreboard gathers data on eco-innovation performance across the EU and beyond, thus helping to monitor and evaluate progress made since 2010. The Eco-Innovation Index measures the environmental innovation performance of EU Member States, on the basis of the 12 indicators included in the measurement framework (Green Business, EC, 2023).
- Ecopreneur ranking – based on EU Circular Economy Monitoring Framework of the European Commission presented 28 country profiles using a combination of available quantitative data and qualitative information to highlight specific indicators covering various aspects of the CE (Circular Economy Update, Ecopreneur 2019).
- The Circularity Gap Reporting Initiative – with the individual country reports and including the Circularity Gap Metric for countries provides a deeper understanding of the resource reality of specific countries, in terms of extraction, processing, production, consumption, and end-of-use management (Circularity Gap Report Poland, 2022).

In the European Union, most of the Member States have already adopted and implemented CE strategies and launched CE plans. In Poland, the transition towards a CE and implementation of sustainable development goals and eco-innovative activities are in most of the policies and strategies on the central and regional levels. Poland's circularity (10,2%) is higher than the world average (8,6%), thanks to relatively strong municipal waste management, but significantly below the EU average in the case of eco-innovation, which is an important enabling factor for the CE. The Polish economy is still among the least resource- and energy-efficient in the EU. To identify the changes and eco-innovation performance in the Polish regions the Eko-index Millennium was developed for the first time in 2022 (Maliszewski, 2022). The aim of analyzing

the potential of eco-innovation should not be to rank regions, but to analyze the process over the years and to evaluate the strengths and weaknesses of regions. It was shown that regions with big businesses and academic centres remain leaders in both innovation and eco-innovation, but there are noticeable differences in the distribution of focus. In the paper the potential for further the transition of regions towards CE using the Eko-index Millennium, assessment of regional policy strategies, and environmental claims of selected the largest companies in the regions (based on information from EMAS and ESG reports) are presented.

2. Literature Reviews

There is not a widely acceptable single measurement index for the CE, however, the CE indices are increasingly recognized as a useful tool to support the development of policies in providing information, and reducing environmental pressures and impacts through a circular recycling process (A. De Pascale, et al 2021). Even, CE developments take place at various spatial levels such as micro, meso, and macro, i.e. the macro-level efforts refer to policy changes on national and regional levels, which will be discussed in this article. Meso-level includes industrial networks and symbiosis between companies while micro-level focuses on the companies and citizens as consumers (Vanhamaki, et al 2019).

Nowadays, many papers and reports are devoted to the assessment and ranking of environmental, circular, and eco-innovation performance on the country level. Environmental Performance Index measures the environmental health and sustainability of countries and ranks 180 countries on 40 performance indicators across 11 issue categories covering climate change, environmental health, and ecosystem vitality. Based on the EU Circular Economy Monitoring Framework of the European Commission, Ecopreneur ranking presents 28 country profiles using a combination of available quantitative data and qualitative information to highlight specific indicators covering various aspects of the CE. The Circularity Gap Reporting Initiative – with the individual country reports and including the Circularity Gap Metric for countries provides a deeper understanding of the resource reality of specific countries, in terms of extraction, processing, production, consumption, and end-of-use management.

As in the literature, there are some proposals for CE indicators, which are based on eco-innovation factors (Smol, Kulczycka, Avdiushchenko, 2017) the eco-innovation indicators are also analyzed. The most important is the EU Eco-innovation Scoreboard gathers data on eco-innovation performance across the EU and beyond, thus helping to monitor and evaluate progress made since 2010. The Eco-Innovation Index measures the environmental innovation performance of EU Member States, on the basis of the 12 indicators included in the measurement framework.

3. Methodology

To identify potential and its changes in Polish regions the Millennium Eco-index was developed for the first time in 2022. It consists of 17 variables that have been grouped into 4 subcategories:

- Eco-innovation inputs: expenditures on fixed assets for environmental protection and water management (PLN per 1 inhabitant), internal expenditures on R&D (natural sciences, agricultural, veterinary, technical and engineering; % GDP), personnel in R&D (% of the total working population), university graduates in the areas belonging to the subgroups of biology, environmental sciences, engineering and technical, production and processing, agricultural, forestry, fisheries, veterinary (% of total).
- Eco-innovation outputs: energy generation from renewable sources (% of total energy consumption), treated wastewater with increased nutrient removal (municipal and industrial, % of total water waste), vehicles running on fuel other than petrol, diesel and LPG (% of total registered vehicles), eco-innovation patents granted (% of total patents granted), gross value added in green industries (low and medium environmental risk industries according to UNEP FI standards, per employed person).
- Social and economic activities in the area of eco-innovations: waste recycled without municipal waste (% of waste generated), persons working in green industries (employment in industries with low and medium ecological risk according to UNEP FI standards, % of total employees in the enterprise sector), enterprises that have invested in innovation activities (industry and services, % of total), bikeways density (per 100 km^2), passenger transport (per 1 inhabitant).
- Resource efficiency: carbon dioxide emission index (CO_2 emissions in particularly arduous plants / GDP), electricity consumption efficiency (GDP / total electricity consumption), water efficiency (GDP / water consumption for the needs of the national economy).

The set of variables included in the index was a result of discussion with the partners and additionally t the availability of the data on a regional level has been considered. In this context, it is worth mentioning that some variables crucial for eco-innovation monitoring, like material productivity, are not available in Poland on a regional level. Among the variables used, 16 are eco-innovation stimulants and 1 (carbon emissions relative to GDP) is a destimulant. The Millennium Eco-Index was calculated on the basis of data provided by the Polish Statistical Office - Local Data Bank and the Polish Patent Office. Data on employment and gross value added in green industries were prepared by the Polish Central Statistical Office at the special request of Bank Millennium. The definition of green industries is based on the recommendations of the United Nations Environment Programme Finance Initiative (UNEP FI) and includes industries with low and medium environmental risk. Data on patents for eco-innovations have been prepared by the Polish Patent Office. They cover patents granted to domestic entities in the years 2015-2021 for inventions in the area of so-called "green technologies". The identification of these solutions was made on the basis of the International Patent Classification, taking into account the symbols proposed in the "IPC Green Inventory". This is a methodology used by WIPO and developed by the IPC Committee of Experts to facilitate the search for patent information related to environmentally sound technologies (EST), listed in the United Nations Framework Convention on Climate Change (UNFCCC). The symbols indicated under the "IPC Green Inventory" concern many areas of technology from alternative energy sources, through transport, agriculture, and waste management to transport and technologies related to nuclear energy. The scope of statistical data covers the years between 2016 and 2020. Currently, the update with the data for 2021 is in progress. No major changes in the results should be expected.

A wide range of indicators included in the Eco-index Millennium enables it to reflect different aspects of eco-innovation on the regional level. The discussion on eco-innovation should not be focused only on energy transformation and energy efficiency, this topic is currently being widely discussed after Russian invasion on Ukraine, but on the overall material productivity, CE, and holistic approach to eco-innovation. The Millennium Eco-index addresses not only the energy crisis, but also the ecological, and climate crisis, as well as inflation and economic crisis (high energy prices).

Some variables, like a share of energy production from renewable sources in total energy consumption, favour less industrialized regions and regions with more favourable natural conditions, but the analysis of trends in this area is particularly important in the context of the escalating energy crisis in Europe. On the other side, some variables like patents for eco-innovations were constructed in a way to underline accents on eco-innovation in the region regardless of whether it is a large or small business and academic centre. This is why eco-innovation patents were presented in the form of a share in total patents granted in the region in a particular year not a relation of eco-innovation patents to the population in the region. The sub-index of socio-economic activities includes variables that reflect environmental awareness in the regions (density of cycle paths, passenger public transport). Environmental awareness is in the authors' opinion an important element of building a culture for eco-innovation. This topic will be more deeply elaborated in conclusions.

For the purposes of the study, all variables have been standardized, as a result, each of them in individual years covered by the analysis ranges from 0 (voivodship with the lowest reading of a given variable in a given year) to 100 (leader in a given variable in a given year). For each data group, a sub-index has been calculated, which is the arithmetic mean of the standardized variables that are part of a given category (each of them has the same weight in the subindex). The general ranking of the Eko-index Millennium is the arithmetic mean of all seventeen variables included in the index while maintaining their equal weights. The Eko-Index Millennium takes into account data from 2016. The presentation of a longer perspective allows for a more comprehensive analysis of the eco-innovation process and assessment of medium and long-term trends.

When using the Millennium Eco-Index, especially for the purposes of rankings, one should bear in mind the methodological limitations, mainly in the form of imperfections of regional databases. The index also does not take into consideration the intra-regional diversity of Voivodships, which is particularly important when assessing regions with high developmental contrasts. This applies especially to the Mazowieckie Voivodship where the capital city of Warsaw drives the result of the whole Voivodeship the most. Therefore, other aspects of eco-innovation should be taken into consideration – qualitative and quantitative in order to properly assess the eco-innovation performance.

4. Results and Discussion

Eko-index Millennium helps to transfer discussion about eco-innovation from the national to the regional level. Such a discussion is becoming more and more valuable as eco-innovation is currently an important factor affecting the sustainable development of regions and their investment attractiveness. Currently, investors are increasingly looking for regions where the pursuit of sustainable development through eco-innovation is visible. This might result from the fact that eco-innovation, energy effectiveness, low material print and low carbon dioxide emissions might be perceived as possible sources of competitive advantages. In this context, it is worth noting that Fich Rating agency suggested that the delay in implementation of the zero-emission strategy in Poland might have a negative impact on the sovereign rating of Poland as slow transformation to a zero/ low emission economy will undermine country's competitiveness. The Eko-Index Millennium can be a tool to help identify regions where investing in eco-innovation is done in an effective way, which is accompanied by high socio-economic activity in the area of eco-innovations, as well as high efficiency of resource utilization. Meanwhile, according to the data from the national statistical office, only ca. 4-7% of innovations implemented in Polish companies from industry had a substantial impact on the environment in the form of reduced material or water use, or reduced soil, noise, water or air pollution, or reduced energy use or CO2 'footprint' (i.e. reduced total CO2 emission), or recycled waste, water, or materials for own use or sale or replaced a share of fossil energy with renewable energy sources. According to the same source, ca. 85% of companies did not introduce environmentally beneficial solutions.

The Eco-index Millennium revealed that regions with large industrial and academic centers are leaders in both innovation and eco-innovation. The strong economy in the region which provides high financial resources as well as big academic centers which provide human resources is conducive to increased eco-innovation activity. However, there are noticeable differences in the distribution of accents towards eco-innovation. The group of leading eco-innovative regions has been relatively stable over the last five years in the general ranking – these are Pomorskie, Małopolskie and Mazowieckie Voivodships. Pomorskie Voivodeship is however the undisputed leader of eco-innovation in Poland. In the case of 15 out of 17 variables it is above the national level and in case of 13 variables it is in top 5. What is very important, Pomorskie also holds a high position in variables reflecting the ecological awareness of citizens (density of bicycle paths and passenger public transport), which is conducive to the development of eco-innovation and implementation of strategies of sustainable development. The value of Eco-index above the national levels was also recorded in Dolnoslaskie and Podkarpackie voivodeships.

Eco-innovation should be viewed as a process that reveals effects in a medium or long-term perspective and from this point of view it is worth noting that the index has increased in almost all regions over the last 5 years, and a significant number of voivodships have shortened the distance to the leader. It is most visible in Łódzkie and Warmińsko-Mazurskie iovodeships, which in this time horizon shortened the distance to the leader the most.

The top of the eco-innovation inputs sub-index constitutes of voivodships with big industrial and academic centres – Małopolskie, Mazowieckie and Dolnośląskie. However, Podkarpackie and Pomorskie voivodships are also above the value of the index for Poland. Over the last five years, almost all voivodships have shortened the distance to the leader. In this respect, the most distinguished are the provinces of Dolnośląskie, Łódzkie, Podkarpackie, Pomorskie and Świętokrzyskie, which came closest to the leader. This indicates that smaller Polish regions are actively working to shorten the gap to the leader. It is worth noting that in the sub-index of eco-innovation inputs Podkarpackie Voivodeship has a relatively high position which may suggest a great value of cooperation in the eco-innovation process. In this region, the percentage of industrial companies that cooperated in the field of innovation is among the highest in the country.

The clear leader of the eco-innovation effects sub-index is Pomorskie Voivodeship, which is at the forefront of all variables forming this category. At the top of the ranking, however with a significant loss to the leader, were also Małopolskie and Łódzkie voivodships. In recent years, Podkarpackie and Wielkopolskie voivodships have systematically shortened the distance to the leader. The situation of other regions is more volatile, which results from the multidimensionality of eco-innovation effects and the inclusion of some variables that aim to reflect the orientation of regions towards eco-innovation regardless of their size and economic potential (tab.1).

Table 1. Companies from industry that cooperated in the field of innovations (% of total companies)

	2018	2019	2020	2021
DOLNOŚLĄSKIE	6.0	5.2	9.2	6.3

KUJAWSKO-POMORSKIE	5.6	4.2	7.1	5.2
LUBELSKIE	7.3	5.5	11.1	6.4
LUBUSKIE	5.9	4.1	5.2	3.2
ŁÓDZKIE	4.8	4.5	6.7	4.0
MAŁOPOLSKIE	7.6	4.8	9.7	8.2
MAZOWIECKIE	9.4	5.8	8.8	8.0
OPOLSKIE	6.4	6.6	6.5	7.7
PODKARPACKIE	10.2	7.9	9.0	9.3
PODLASKIE	5.7	6.1	14.3	5.6
POMORSKIE	4.9	3.9	9.8	4.6
ŚLĄSKIE	7.9	6.2	10.1	6.1
ŚWIĘTOKRZYSKIE	5.5	5.5	6.8	5.2
WARMIŃSKO-MAZURSKIE	5.6	3.0	6.7	4.1
WIELKOPOLSKIE	4.7	4.4	7.8	4.4
ZACHODNIOPOMORSKIE	3.9	3.0	8.6	4.7

Cooperation among companies and other groups of stakeholders is especially important in smaller regions with smaller financial and human capital as it creates space for synergy and more effective utilization of the resources.

In the sub-index of eco-innovation socio-economic activities at the forefront are Mazowieckie, Pomorskie and Małopolskie voivodships, with a significant advantage over other regions. The value of the sub-index above the national level is also recorded in Kujawsko-Pomorskie, Śląskie and Warmińsko-Mazurskie voivodships. Over last five years, as many as 12 out of 16 voivodships have caught up with the leader, and Warmińsko-Mazurskie, Zachodniopomorskie, Dolnośląskie and Kujawsko-Pomorskie voivodships came the closest to the leader.

In the sub-index of resource efficiency smaller economic centers dominate in the leading group. The leader is Pomorskie Voivodeship, followed by Warmińsko-Mazurskie, Podlaskie and Podkarpackie. It should be stressed that over the last five years, a significant number of regions have made great efforts to improve resource efficiency. In terms of carbon dioxide emissions, the position of Małopolskie and Wielkopolskie voivodships has clearly improved. In the analysed period, however, the distance to the leader was shortened the most by Świętokrzyskie and Łódzkie voivodships. In terms of energy efficiency, Wielkopolskie, Mazowieckie, Warmińsko-Mazurskie, as well as Podlaskie and Podkarpackie voivodships are at the forefront. This is a particularly important aspect of eco-innovation in the context of the energy crisis and high costs of energy.

The Eco-index Millennium might be a useful supplement to the analysis of innovation on regional level based on the Regional Innovation Scoreboard. The Regional Innovation Scoreboard provides a comparative assessment of the performance of innovation systems across 239 regions in 22 EU Member States, Norway, Serbia, Switzerland, and the United Kingdom. Cyprus, Estonia, Latvia, Luxembourg and Malta are included at the country level. It follows the methodology of the European Innovation Scoreboard and uses data for 21 out of the 32 indicators used in the European Innovation Scoreboard. Regions are classified into four innovation performance groups according to their Regional Innovation Index: innovation leaders, strong Innovators, moderate innovators, and emerging innovators. The most recent innovation performance of regions The Regional innovation Scoreboard 2023 showed that 15 out of 17 regions in Poland are classified as emerging innovators. It should be added that emerging innovators perform below 70% of the EU average. The least innovative region in Poland is Mazowiecki regionalny district which includes Mazowieckie voivodeship excluding capital city of Warsaw. Its innovation performance is at 37.3% of the EU average. Only Warszawski stoleczny region (it includes Warsaw, the capital of Poland) and Malopolskie voivodeship are classified as moderate innovators with their performance respectively at 95.1% and 80.2% of the EU average. There are 4 out of 17 regions that performs better than the national level – Mazowiecki stołeczny, Małopolski, Dolnośląski oraz Pomorski.

The analysis of conclusions from the Eko-index Millennium might be a valuable follow-up of the analysis of the Regional Innovation Scoreboard that enables to extend the analysis of innovation performance to the

issues related to environmental protection, resource efficiency or CE. In an environment of intensifying ecological crisis and increasingly noticeable climate changes, it is not enough to be efficient and effective (innovative). One should be eco-innovative, i.e. minimize the material footprint, and minimize carbon dioxide emissions to transform the economy from linear to circular. Eco-innovation is a way to combine the need to be economically efficient with the need to care for the natural environment. It is worth to note the leaders of broadly understood innovation are also in the group of leaders of eco-innovation. Nevertheless, there are differences in the emphasis on environmental aspects. The joint analysis of The Regional Innovation Scoreboard and the Eko-index Millennium gives the possibility of a multi-sectional analysis of performance in innovation and eco-innovation potential, as well as the assessment of the degree and scope of implementation of regional policies in both aspects. The identification of the strengths and weaknesses of the regions might allow the focusing of resources on the most important aspects from the point of view of the regional development strategies and might help to reshape the targets in the regional policies. This is especially important in smaller regions with limited financial resources. Big economic and academic centers have more opportunities to increase innovation and eco-innovation performance. Smaller centers should strive to increase the efficiency of the resources and focus on key aspects of the strategies in order to effectively catch up with the leaders in innovation and eco-innovation performance. Taking this into consideration the Eko-index Millennium by identification of strengths and weaknesses of regions can be a useful tool that helps to focus on key drivers of sustainable development of regions and to facilitate the transition from linear to CE. It was underlined during World Circular Economy Forum, which held in Helsinki, Finland, where the World Business Council for Sustainable Development (WBCSD, 2023) announced the launch of the Global Circularity Protocol (GCP) development. This initiative will help drive the global effort to mainstream the circular production and consumption model. The circular model will help address resource deficiencies while advancing the action on climate and nature and improving equity in value chains.

Conclusions

The aim of the Eko-index Millennium should not be only to rank regions, but to analyze the process over the years, to evaluate and to identify the strengths and weaknesses of regions in eco-innovations and to estimate the distance to the leader. Focus on eco-innovation is crucial in the context of the energy crisis to change the behavior of households and companies in the area of energy consumption, water consumption and overall material consumption.

The Eco index Millennium enables also to transfer a discussion about eco-innovation in Poland from the national to the regional (voivodeships) level as investment decisions of particular companies and decisions of particular consumers about expenditures and behavior determine the eco-innovation potential of the whole country. It is especially important in the context that ecological awareness of Polish society is extremely low. According to the PEW Research Center the percentage of citizens who believe that making choices that help reduce the effects of global climate change makes one a good member of society is one of the lowest in Poland among the surveyed countries (36% in Poland compared to 63% on the average in the surveyed sample and ca. 70% for leaders). This is why any initiative to increase the ecological awareness of Polish society is extremely important. Without the high ecological awareness of society, it will be difficult to change consumers' habits and move towards sustainable consumption. Especially when we take into consideration that price is an important criterion for a purchase decision, especially regarding durable goods like house appliances and electronic equipment (PEW Research Centre, 2022).

It is important to build awareness not only among consumers but also among companies, especially in case of small and medium corporates. Stronger accents on eco-innovation, lower waste generation, circular economy, and more effective material usage will require re-shaping of existing business models and strategies of companies to keep productivity and financial efficiency under the condition of climate neutrality and CE.

The Eko-index Millennium is also a unique manifestation of cooperation between the private sector, academic community, and public institutions for eco-innovation. It proved that broad cooperation of various groups of stakeholders can bring real effects and support the growth of eco-innovativeness. It was reflected not only in the report and publication of the index but also in a publication of unique data about eco-innovation patents in Poland (on the regional level) prepared by the Polish Patent Office, on a special request of the authors. Closer cooperation between the private sector/ companies and academia in the area of eco-

innovation is one of the priorities included in the Roadmap for the transition Towards Circular Economy adopted by the Resolution of the Council of Ministers of 10 September 2019 (Circular Roadmap 2019). The Eko-index Millennium helps to build an ecosystem for eco-innovations by creating a platform for a discussion between the private sector, academia, and public institutions.

Such cooperation is very important also to build higher trust in Polish society. Poland still has a relatively low level of trust (only 22.3% of responders agreed with the statement that "most people can be trusted") which has a negative impact on the propensity and willingness to cooperate among companies but between companies and universities, local governments and central administration. Without wide cooperation, it will be much more difficult to release synergy and speed up the improvement in eco-innovation. The cooperation between different groups of stakeholders of eco-innovation is important to understand and to agree on the common aim of eco-innovation, the weaknesses and strengths of each group, and the best way to achieve the target. Cooperation is extremely important not only between companies but also between companies/private sector and central administration. In this context, it is still much work to do in Poland. For example, according to the Polish Statistical Office, a share of enterprises that introduced innovations that brought benefits to the environment (based on decision-making factors in 2018-2020) and for which environmental regulations or taxes expected in the future had a very important weight in the decision making process is low in Poland and amounts ca. 5%. It suggests that regulations are not a strong enough incentive to implement innovations that bring positive environmental effects. The data cited above suggest also that regulations are rather a brake than a catalyst for eco-innovations in Poland. In the survey conducted by the Circular Poland Foundation, ca. 74% of the respondents declared that existing or planned regulations in the CE area, both in Poland and in the EU, influence the company's activity, however, at the same time, 44% said that existing CE legislation does not motivate corporate sector to redefine their strategies and business models in the area of innovations (Raport GOZ!2021). This suggests that the predictable and transparent regulations, consultations during the legislative process, and thus increased trust in the State might be an additional catalysator of eco-innovation in Poland.

There is also a vast space for improvement in cooperation between Polish academia and the Polish private sector/ business. The intensity of cooperation between the higher education institutions and the corporate sector is reflected by the rate of expenditures on research and development financed by the corporate sector and realized at universities. In Poland, this indicator is at 0.16% of GDP (data for 2019) compared to 0.35% of GDP on average in the European Union and 0,75% GDP in Germany. The results of the Community Innovation Survey showed that among the surveyed Polish entrepreneurs, only 5% undertook cooperation in the field of R&D and other types of innovative activity, of which less than half implemented this cooperation with universities. This percentage is similar to the data from Hungary, Slovakia, and Spain (2-3%), but lower than those from the Czech Republic and Italy (5%), not to mention the leader of the ranking - Germany (10%) (Geodecki, Hausner, 2023).

One of the conclusions from this project is also a recommendation for a regular collection of statistical data in the area of eco-innovation at the regional level in order to analyze changes in eco-innovation potential and progress in the implementation of regional development strategies. In this aspect, closer co-operation with the Polish statistical office is recommended to include more variables covering eco-innovation on the regional level into Programme of Statistical Surveys of Public Statistics.

Let's talk about eco-innovations!

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TRACK 6
Cities and regions

6b. Urban and regional resilience

Abstracts

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Influence of location and human behaviour on the reduction potential for summer heat stress in buildings in moderate climates using the example of Germany

Dr.-Ing. habil. Regine Ortlepp, Dr. Christoph Schünemann, Tim Kriesten
Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany

DR.-ING. HABIL. REGINE ORTLEPP

Abstract

We are increasingly facing the consequences of climate change, which is also affecting our cities. For example, rising temperatures increase urban heat island effects. This affects people's outdoor comfort, but also indoor comfort in buildings, especially on the upper floors. Excessively high room temperatures lead to various health problems, which is why it is necessary to adapt residential buildings. In order to be able to plan suitable adaptation measures, it is important to know the main factors influencing the indoor climate, such as location, type of construction or user behaviour. In addition to the location in the urban space, the affectedness of a dwelling depends on the location, geometry and orientation of the interior room within the building. For example, rooms on upper floors are the hottest, and rooms facing east and west are the most affected. However, the extent to which buildings are affected also depends on their location in Germany, as local climates differ into so-called summer climate regions. In addition, the urban heat island effect, measured between the city centre and the outskirts of the city, causes a temperature difference of several degrees Celsius. The annual exceedance of the indoor temperature, measured in overtemperature degree hours, serves as an indicator for the assessment of the affectedness. These are times with a temperature exceeding a defined indoor temperature. The unit of measurement is Kelvin hours [Kh]. Simulations show a strong increase in the calculated overtemperature degree hours when the urban heat island effect is taken into account. Assuming a future scenario compared to the status quo, we also see a climate change effect in the calculation results that can no longer be neglected. In moderate climates, heat can be reduced without air-conditioning systems through clever user behaviour. First, we need to reduce heat input during the day. The windows should not be permanently open during the day; instead, fans are suitable for a draught to reduce the perceived temperature. In order to provide fresh air, we should ventilate every 2 hours even when the outside temperature is high. This does not carry in much heat, because the air has a low heat capacity and the walls and ceilings "buffer" the coolness through their storage capacity. Secondly, at night, we have to ventilate the heat out again. For this, opening the windows for several hours is effective, because the solid ceilings and walls only release the heat slowly. In our simulations, we have found out that the ventilation behaviour has an enormous influence on the heat load in the flat. Depending on the location of the room, there were differences in the calculated overtemperature degree hours of up to a factor of 10 or 30. In summary, we can say that in moderate climates, where night cooling of buildings is possible, in addition to structural adaptation measures, behavioural measures in particular are essential for reducing the heat load in the building in order to be able to make optimum use of the effect of the first-mentioned.

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Proposal of smart-sustainable-resilient cities model based on the urban ecology principles

Prof. Janaina Macke
Caxias do Sul, Caxias do Sul, Brazil

PROF. JANAINA MACKE

Abstract

Climate change and growing urbanization led governments to adopt increasingly complex initiatives to provide their citizens with a good quality of life, prosperity, and social and environmental well-being. Among these initiatives, improvements in infrastructure and urban services in cities and environmental concerns are the most visible examples of this new reality in several metropolitan areas worldwide. Despite the recognition of the importance of the role of cities, the concepts of smart cities and sustainable cities are still not clearly defined. Discussions about the smart city concept began in the 2000s and its focus has changed. According to academics and urban planners, the smart city concept favors technological products and solutions for building a smart city for end users. Initially, the concern was centered on technologies and infrastructures, that is, challenging, technical, and structural aspects of the concept of smart cities were considered. This focus has already been expanded to include soft aspects, such as the social learning necessary for the adoption of technologies and the impact of these technologies on the different dimensions of citizens' lives.

On the other hand, the definition of sustainable cities has as its main challenge the adoption of sustainable policies that mitigate negative impacts and can become regeneration strategies, in addition to affecting natural ecosystems. These policies must also be simple, integrated, cost-effective, and efficient. They must impact environmental sustainability goals and economic and social issues, such as citizens' quality of life, fostering social capital, and a sense of community. This article aims to build an integrative definition of the concepts of smart city and sustainable city, to enhance both perspectives and their adoption by cities. For a proposal for a smart-sustainable city, it is necessary to start from the concept of the city as a living organism and start studying the ecology of natural systems for the creation of resilient urban systems. A resilient city can adapt and rebuild itself in the face of crises, whether natural (environmental disasters) or social (economic crises, for example). For this reason, this connection between smart and sustainable concepts can only be made with the inclusion of a resilient approach.

The study proposes four dimensions for building a smart-sustainable-resilient city: social, structural, cognitive, and political. These dimensions are grounded in theoretical and empirical studies and in cases of policies and programs already implemented in cities worldwide. The unfolding of these dimensions results in eight principles based on the vital principles of ecology applied to economic systems (CAPRA, 2002) and on the Hanover principles for cities (MCDONOUGH; BRAUNGART, 1992). As a result, the proposed model provides key elements for social researchers, urban planners, and public managers in constructing smart-sustainable-resilient cities and hopes to contribute to academia and public managers.

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RESILIENCY OF 11 EARTHQUAKE-AFFECTED CITIES AND THE REGION, TÜRKİYE, FEBRUARY, 2023

Prof.Dr İlknur ÖNER
Fırat University, Elazığ, Turkey

P R O F . D R İ L K N U R Ö N E R

Abstract

This paper will be focusing on the resiliency of urban and rural studies in general and then focuses on comparative observations of regional resilience and lessons from applied experiences of 11 cities in the aftermath of the 6th February earthquakes in Türkiye.

Resilience is a complex issue related to knowledge, interconnected shocks, and stresses. This issue is connected to different phases of disasters. These phases have been gradually discussed historically. Rio, Yokohama, Hyogo, and Istanbul declarations are some of the important improvements. International, national, and local measurements and applications are important. However, sudden occurring issues bring forwards our mistakes and learning process immediately aftermath of the events.

This study focuses on the analysis of preliminary observations and scrutinization of written texts and visual documents related to 11 cities. These cities are namely, Adana, Adıyaman, Diyarbakır, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Şanlıurfa, Osmaniye and Elazığ.

The findings reveal that theoretically issued measurements have handicaps in applications in rural-urban divine. Resilience Alliance, synergies, and increasing solidarities cover mishaps of the system's ability to withstand change. Self-organization of NGOs and institutional applications have become important for the complex and adaptive systems. At this moment transformation of unsustainable and unjust systems and behaviors are under discussion.

These findings will be scrutinized in the frame of all of the major 17 Sustainable Development Goals.

Keywords: Türkiye, 6th of February 2023 earthquakes, 11 most affected cities, resiliency, SDGs

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Fostering resilience through strategies within small scale rural community in transition: Insights from India

Dr. Keya Chakraborty
Srishti Manipal institute of Art Design & Technology, Manipal Academy of Higher Education, Bangalore, India

D R. K E Y A C H A K R A B O R T Y

Abstract

Strengthening global resilience is an essential aspect of sustainable development and it accomplishes the UN's SDG 11.a. According to World Bank it implies that supporting economic, social and environmental links between urban, peri-urban and rural areas is the key element for fostering resilience as a holistic system. This research outlines resilience not only as the ability to withstand shocks but also learning to take the new avenues and/ risks at the intersection of capacity building, empowerment, and building networks. Researchers have been telling many a times that rapid rate of urbanization causes several damages in built environment, climate, and biodiversity as a global multidimensional process. These phenomena result in accelerated rate of interconnected crises and shocks globally, regionally and inter/intra community level which eventually stressing human health and well-being. In this context, well-integrated national-regional-rural (macro-meso-micro level) development planning represents the pragmatism towards building self-reliance community. Planning, strategies and policies acknowledge the population dynamics and ensures equitable, holistic territorial development – which are the two fundamental pillars of community's resilience. Hence, there is a need to examine the process of co-shaping between community's capacity building and efficacy of incumbent strategies and policies at the grassroot level. Present research tries to establish a methodological framework to learn the synergies and trade-offs within the community in transition based on two important queries: i) what are the guiding factors that support communities to build adaptive capacity, enhance community values and identity? ii) how far the central strategies and plannings are conducive to strengthen the network among stakeholders' participation at the intersection of community development and community agency? To understand these questions, a small rural community from India, with a rich cultural heritage in transition (in terms of socio-cultural-technical) has been analyzed. The aspirations and perceptions regarding sustainable, resilient development of the selected rural community have also been taken into account. Based on previous investigations, ethnographic research, and semi-structured interviews this paper acknowledges that there exists a latent complementarity in strategies and community's capacity building and adoptability. The methodological framework, proposed by this paper provides a scaffolding for researchers, community management, social innovators, and policy makers to evaluate the co-shaping processes between the community's perceptions/aspirations, adaptations, and the existing policies. It also offers reach learning opportunities on what works well and doesn't to attain self-sustenance within a rural community during the co-shaping process.

Keywords: resilience, strategies and policies, methodological framework, rural community

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Synergies and trade-offs for Nature-based Solutions in fostering urban water resilience: Social perceptions and preferences

Mr. Riyan Habeeb[1,2], Dr. Regine Ortlepp[2], Prof. Dr. Wolfgang Wende[2,3]
[1]Dresden Leibniz Graduate School, Faculty of Architecture, TU Dresden, Dresden, Germany. [2]Leibniz Institute of Ecological Urban and Regional Development, Dresden, Germany. [3]Faculty of Architecture, TU Dresden, Dresden, Germany

Abstract

Nature-based Solutions (NbS) are currently promoted globally as measures for environmental risks and societal challenges through economic benefits. While the lens of resilience is fitting to assess the environmental risks it is critiqued to have lesser normative social inclusion in comparison to institutional processes. Hence, it becomes imperative to explore the bridging points between NbS and its role in fostering urban resilience in socio-spatial perspective. Taking two major urban water risks of drought and flooding (pluvial) the paper explores the social, environmental and economic aspects of NbS taking into account people's perception and their preferences. First, state-of-the-art literature review was conducted to derive applicable NbS strategies along with their social, environmental and economic benefits; secondly, urban water risks were identified at various hotspots where a household survey was undertaken to understand the perception of people towards these risks and their preferences for various types of NbS as identified in the literature review. The variety of NbS included large-scale/ city-level (e.g. urban parks, wetlands, water squares), medium-scale/ neighbourhood-level (e.g. street trees, rain gardens, bio-swales etc) as well as small-scale/ building-level (e.g. rainwater harvesting, green roofs, green walls) interventions. The collected data was then empirically analysed to assess and establish the link between the spatial and social assessments. From the results it was observed that higher income groups chose NbS with higher environmental benefits while poor-income groups had greater preferences for the NbS with economic benefits. The social benefits ranked almost same in all the groups of poor-income, lower-income, middle-income and higher-income groups. However, from the results it is also evident that most of NbS selected tended to be small-scale interventions for identified water risks. Thus, it can be observed that small-scale NbS had better synergies with social perceptions as compared to large-scale solutions. Hence, spatial scales play more significant role in normative inclusion of social dimension in transformative resilience by creating the opportunity in co-production of NbS.

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"Spirit of locality" Socio-spatial characteristics of human settlements, cultural heritage, identity & territorial development

Dr Annamaria Orban
Budapest University of Technology and Economics (BME), Budapest, Hungary

Abstract

We argue that socio-economic and strategic-security reasons motivated the first permanent settlers, who later became the first city "designers" and builders. One of the most important reasons to create the first permanent settlements were safety and security, in their complex meaning: to be equipped with such socio-spatial characteristics and functions, which provide a protected, safe, convenient – but at the same time quite artificial - life, as compared to the ancestors' natural living conditions prone to various environmental and other kinds of threats and hazards for millennia. The second reason of appearance of the permanent settlements and later of cities – and city civilizations all around the world - , is a cultural-economic one: the discovery of agriculture itself, which made possible the surplus food production, accumulation of wealth and transferring it to cultural-religious built - made - artifacts, which needed a safe place and could be admired. The first settled rural communities with food surplus wanted to have a place for continuous community life as well as a permanent centre for their ceremonies, which can attract even other people from around, becoming a pilgrimage centre, concentrating and accumulating goods – by voluntary gifts and tributes at the beginning - , myths, ceremonies and power. From our research perspective these later are very important terms, belonging to the intangible – even spiritual – dimension of socio-cultural characteristics of local settlements, – be urban or rural – belonging to the question of local identity and the spirit of the place. We suppose that besides the spatial-natural capital, cultural heritage, especially the intangible cultural capital of local settlements – e.g. in the city centres – have long-lasting effect, providing those socio-cultural characteristics and assets which strengthen their community members' belonging, attachment and identification with their place of living as well as "cement" their society, determining factors both in regional/urban resilience and in territorial development program/rehabilitation projects.

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Ecological Dimensions on Adaptive Reuse in Urban Heritage Conservation. Case Study: Kampung Cina Bengkulu, Indonesia

Izazaya Binta[1,2], Prof. Widjaja Martokusumo[1]
[1]Institut Teknologi Bandung, Bandung, Indonesia. [2]Politeknik Negeri Pontianak, Pontianak, Indonesia

IZAZAYA BINTA

PROF. WIDJAJA MARTOKUSUMO

Abstract

Historic buildings already have an inherent carbon footprint from the building process in the past. These carbon footprints can be utilized to be more effective than demolition and new construction, which can increase carbon emissions. Adaptive reuse in historic buildings is considered the most environmentally friendly conservation strategy and can respond to climate change. Adaptive reuse has the potential to extend the useful life of buildings while providing a variety of functions that can provide significant economic, social, and cultural benefits to communities. Therefore, adaptive reuse can increase the resilience of cultural heritage buildings and their communities. Adaptive reuse will be able to contribute to protecting urban cultural heritage (SDGs 11.4) as a whole by considering dimensions other than economic, social, and cultural. This study aims to identify the various difficulties and opportunities associated with adaptive reuse as a climate change strategy. This article is a qualitative descriptive study that analyzes academic literature regarding the difficulties and opportunities in adaptive reuse. Next is the discussion of data from the Kampung Cina Bengkulu field to determine the main dimensions that need to be considered in adaptive reuse. In the case study of Kampung Cina Bengkulu in Indonesia, it was revealed that the preservation of urban cultural heritage areas is related to humans, buildings, and the environment. Conservation through adaptive reuse requires awareness of local culture and the relationship between humans, buildings, and the environment, known as the ecological dimension. Adaptive reuse in Kampung Cina Bengkulu can be a strategy to promote environmental harmony to achieve a green and sustainable urban heritage by considering the ecological dimension. The ecological dimension is important in proving that adaptive reuse is the greenest conservation effort.

Keywords: Adaptive reuse, urban heritage, climate adaptation, sustainable development goals, Kampung Cina Bengkulu

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'Conservation is Development' in Gombak-Hulu Langat Geopark: Sustaining nature and culture heritage for posterity

Assoc. Prof. Dr. Sharina Abdul Halim[1], Assoc. Prof. Dr. Tanot Unjah[1], Dr. Jing Lee[2], Prof. Dr. Norhayati Ahmad[3], TPr. Juwairiyah Ho[4]
[1]Institute for Environment and Development, Universiti Kebangsaan Malaysia, Bangi, Malaysia. [2]Environmental Protection Society of Malaysia, Petaling Jaya, Malaysia. [3]Faculty of Science and Technology, Universiti Kebangsaan Malaysia, Bangi, Malaysia. [4]Iktisas Planners Sdn. Bhd., Gombak, Malaysia

Abstract

Conserving heritage is significant because it reflects and builds local community identities, assists in promoting sustainability and provides sense of place. In Malaysia, there are conservation sites that are recognised under UNESCO World Heritage Sites, Man and Biosphere Reserves, and Global Geoparks. The interactions between humans and their natural environment underlie cultural heritage with aesthetic, unique and outstanding universal values (OUVs). As such, there has to be conscious efforts made to protect and conserve these heritage resources, so as to ensure their sustainability for generations to come. The link between natural and cultural heritage is intricate and intertwined, often transcends the object or subject of conservation. Thus, taking into account the need to balance multiple needs and demands of development is crucial, particularly the risks or threats that may lead to its loss or destruction. Gombak-Hulu Langat Geopark, the eight national geopark in November 2022, is situated in rapid urban setting of Selangor. The challenge to ensure sustainability amidst all planned development is imperative as the state of Selangor continues to face rising cases of environmental issues, related to water resources, natural hazards and anthropogenic disturbance. Hence, 'conservation is development' in Gombak-Hulu Langat Geopark was highlighted in reigniting the aspiration of development that meets presents need without compromising future generations. Geopark is an innovative tool that strives for sustainability in integrated heritage conservation, lifelong education and local socio-economic development. In this paper, we will discuss process and justification involved to develop urban geopark in Gombak-Hulu Langat districts in Selangor. As a national geopark, the next step is getting ready to apply to be a member of the UNESCO Global Geopark accreditation. Shifting the mindset and raising awareness of all stakeholders to embracing 'conservation is development' is an on-going initiative in getting local community and relevant authorities support and action. The success of a Gombak-Hulu Langat Geopark not only will make this city a better place to live, but also add on to examples in the world where conservation and human development is no longer an either or proposition, and that there's still hope.

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Toward Sustainability of Ports

Professor Lance Manuel
The University of Texas at Austin, Austin, USA

PROFESSOR LANCE MANUEL

Abstract

Introduction

Ports are critical points in complex multi-modal transport networks and are also vital to all types of supply chains we depend upon. Sound and sustainable design and management practices at ports have a direct impact on economic growth, on response efforts during crises, and on protection of the environment. Proactive measures taken, with support from communities affected, ensures that a long view is taken, with an eye on strategies that are acceptable to the environment, that seek sustainable development on par with economic development, and that are transparent and become shared knowledge – all of this, while still allowing for innovation in technology. In order to ensure that sustainability considerations are central at our ports, there are several issues that need be accounted for. They include: (1) the quality of the environment including in the supporting terrain, the air, the water and noise; (2) considerations for climate change including mitigation and adaptation strategies; (3) safeguarding of ecosystems; (4) diversified stakeholder engagement; (5) fair, innovative and proactive port authority and corporate governance; (5) energy efficiency; and (6) materials and waste management. Even though ports are fundamentally viewed as sites buzzing with economic activity, when environmental protection is complementary in consideration, along with social engagement and justice, a shift toward sustainability becomes easier to realize. Climate change, transitions toward clean energy alternatives, job creation, technology innovations can serve as catalysts in this light. Port authorities and all its stakeholders must manage operations and future growth in plans for how the physical infrastructure harmoniously interacts with nature, and with the city. In such a sustainable port paradigm and with fair and safe environmental permitting and regulation, long-term goals and advances can deliver benefits toward the success and viability of the port itself and they can also serve to attract new market activity and industry innovation. In the context of the various issues, common challenges are identified and strategies to address the issues are offered for selected example ports. Next, the impact to stakeholders is discussed. Sustainable response options are presented to deal with the issue. Resilience will feature prominently in proposed strategies. Overall, the framework demonstrated allows one to incorporate conscious sustainability practices. This framework can simultaneously take into consideration issues affecting the environment, economy, social engagement, management, energy use and choices, climate change, innovation, and planning.

Full Paper

Resiliency of 11 Earthquake-Affected Cities and The Region, Turkiye, February, 2023

Ilknur ONER[1],

[1] Firat University, Faculty of Humanities and Social Sciences, Department of Sociology. 23159-Elazığ/Turkiye

ioner@firat.edu.tr

Abstract. This paper will be focusing on the resiliency of urban and rural studies in general and then focuses on comparative observations of regional resilience and lessons from applied experiences of mostly affected 11 cities (Adana, Adıyaman, Diyarbakır, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Şanlıurfa, Osmaniye and Elazığ) aftermath of the 6th February earthquakes in Turkiye.

Resilience is a complex issue related to knowledge, interconnected shocks, and stresses. This issue is connected to different phases of disasters in time. Rio, Yokohama, Hyogo, and Istanbul declarations are some of the important improvements. International, national, and local measurements and applicationsare important. Disasters may reveal inequalities, mistakes and learning process immediately aftermath of the events.

The preliminary observations, scrutinization of written texts and visual documents related to 11 cities are main sources will be analysed in the frame of all major 17 Sustainable Development Goals.
The findings reveal that theoretically issued measurements have handicaps in applications in rural-urban divine. Resilience Alliance, synergies, and increasing solidarities cover mishaps of the system's abilityto withstand change. Self-organization of NGOs and institutional applications have become important for the complex and adaptive systems. At this moment transformation of unsustainable and unjust systems and behaviours is under discussion.

1. Introduction (11pt Times New Roman)

There are important interlinkages between sustainability and disaster studies in the line of aperance of resiliency issues in the previous international declarations and forthcoming plans for the future.
According to Keleş (2023), it is not possible to take dates much back for environmental problems in the World and Turkey; take action and organizations for the creation of solutions for the environmental problems. They are relatively newly emerged issues. This is due to:

Unbalance between humans and nature has become a contemporary issue at the core of the contemporary World wide agenda, especially after the industrial revolution, particularly as a principle when capitalism has given all values under the control and command of capital.

Development of human awareness has followed the same line, therefore, only these sorts of actions, intentions for organization, and construction attempts for policies have to wait for mid-19. century and even at the end of 19. century.

However approaches developed in time.

Resilience is a complex issue related to knowledge, interconnected shocks, and stresses. This issue is connected to different phases of disasters. These phases have been gradually discussed historically. Rio, Yokohama, Hyogo, and Istanbul declarations are some of the important improvements. International, national, and local measurements and applications are important. However, sudden occurring issues bring

forwards our mistakes and learning process immediately aftermath of the events.

I would like to discuss resiliency in the frame of previous studies, some of them are from international studies and some others from my own field study results. Then I will move on the discussions of recent Kahramanmaraş earthquakes and their impacts on mostly affected 11 cities.

Smith's map of the "World City Populations 1950-1935" based on UN records in 2018, reveals thatthe proportion of the urban population is increasing. Although Covid-19 conditions created a counter- back migration to rural areas we do not know what is the intensity or length of these stays yet. There are many publications on urban areas, cites but disaster-related studies come to forward firstly individualcase studies then collaborative studies in time. The geographical distribution of these earliest studies was from America, Japan, Italy, the Netherlands. This increase in the number and populations of cities and possible climatic changes have been requiring evaluations of possible risks before they cause any sorts and intensity of disasters.

On the 30th of October 2018, UN DESA (United Nations Department of Economic and Social Affairs) warned about the world's cities being highly exposed to disasters. "1,146 cities with a population of at least half a million people, were vulnerable to either cyclones, floods, droughts, earthquakes, landslides or volcanic eruptions-or a combination of those. Some large cities are exposed to as many as four or five different types of natural disasters". It has been indicated that at least 500,000inhabitants were at a high risk of a natural disaster. Moreover, the importance of "the need for cities to be able to absorb the impact of hazards, protect and preserve human life and limit damage and destruction while continuing to provide infrastructure and services after a crisis" was revealed (UN, 2018). These reminds Harvey's another type of human right, "right to the city" which is a working slogan and political ideal by focusing on the question of *who commands the necessary connection between urbanization and surplus production and use*. He reveals the importance of the democratizationof that right, construction of a broad social movement to enforce its will (2008:40). Urban citizens wereaccepted as active people, not passive recipients. For Harvey, the right to the city is more than the individual liberty to access urban resources. It is a *right to change ourselves by changing the city*. He mentioned *dependency of the transformation to the exercise of a collective power to reshape the processof urbanization and the freedom to make and remake our cities and ourselves* is most neglected of our human rights (Harvey,2008:23). This is in our mind and we can now consider current situations as follows.

Mitchell indicated that disaster studies should focus on neglected urban areas and cities (1999 b, c). Mitchell and friends exemplified their studies from Tokyo, Seoul, Dhaka, Sydney, London, Lima, Peru, Mexico City, San Francisco Bay Mega-city, Greater Los Angeles, Miami (Mitchell, 1999a). As it can be seen in many disaster-related studies their focus on hazards and disasters might be different. The disaster-related processes in earlier times were focused on the classification of before, during, after periods, and activities in them (Quarantelli, 1989; UNISDR, 2011). However, in time these classifications were subdivided to include other detailed periods such as preparedness, mitigation, response, recovery to cover combined clear-cut rules and applications, unclear measurements, and spontaneous behaviours. The number of disaster research centres, their focused issues, and collaborations increased in different countries. The definition of disasters broadened to cover up different issues in time. Disasters differ in their impacts in relation to disaster types such as biological, manmade, earthquake, slide, hurricane, etc.

Some collaborative studies increased in relation to cities, disasters, and community disaster resilience. Climate and Disaster Resilience Initiative (CDRI) is one of them. It is regarded as a joint initiative of the Asia Regional Task Force on Urban Risk Reduction (RTF-URR) which is established in 2008. Members are from Kyoto University, CITYNET, UNISDR, RTF-URR, United Nations University. They reveal that by 2030, two out of three people on earth will live in urban areas and thereis constant pressure on uncontrollable urban expansion and the generation of more vulnerable to disasters. Density of city population and linkage to an affected number of people with typical disaster event, economic losses in the region and vulnerability of the region to the disasters were indicated. According to them aimed Millenium Development Goals, without the recognition of disaster risk reductions prioritization in development planning in general and urban development, in particular, cannot be achieved (CDRI, 2021:3). They

focused on a disaster-prone region and 15 cities from 9 countries, from five dimensions. These cities and countries can be named as follows: Banda Aceh- Indonesia, Bangkok- Thailand, Colombo- Sri Lanka, Danang-Vietnam, Dhaka-Bangladesh, Hanoi- Vietnam, Ho Chi Minh-Vietnam, Hue-Vietnam, Iloilo-Philippines, Makati-Philippines, Mumbai-India, San Fernando La Union-Philippines, Sukabumi-Indonesia, Suwon-South Korea, Yokohama-Japan. Mentioned dimensions are *Natural:* topography, disasters, natural environment degradation, hydro- meteorological situation. *Physical:* History, location, accessibility, infrastructure and utilities, housing condition, land tenure, environmental degradation. *Social*: Population, health, education, knowledge andawareness, social capital, conflict, crime. Economic: Income, employment, expenditures, assets, Accessto financial services, financial coping mechanisms. Institutional: Internal and external institutions, institutional collaboration, coordination, and cohesion (CDRI, 2021). It can be seen that disasters issuesrelated to cities and urban areas becoming more complicated and cover different disaster types and periods. Networks are getting more important with the linkage of coverage of wider disaster areas and their impacts or experienced activities of other countries and settlement locations. This brings to mind Castell's indication of "*Network Society"* and its importance (1983).

The combination of these issues sometimes spontaneously develops urban social movements as follows. The protests against the restrictions or usage of masks as a prevention measure from Covid-19or solidarity aid groups like Ahbaps and Map of in Need (Ihtiyaç Haritası) from Turkey and Fumbaro movement from Japan to help accumulation and distribution of needs of the disaster victims. Urban citizenship requires participation and observance related to urban issues in all conditions organized or disorganized. In the definition of social movements, the challenging attitude to the convention can spark counter-movements about blockage of their goals in the mainframe. Change and opposing counter-movement to resist change and reinforce the status quo (Macionis and Plummer, 2005: 416). The existence of social movements is linked to resisting or encouraging social change.

Disaster processes requires responsible, accessible, purposive social awareness and movements to change the current conditions related to disasters and consider UN SDGs and Sendai Frameworks.

According to Macionis and Plummer, Aberle (1966), Cameron, (1966), Blumer, (1969) grouped criteria to define types of social movements.

Macionis and Plummer mentioned *four types of social movements* in a figure by basing on David. F. Aberle's 1966 study. These types are defined about *two questions*: Who is changed? Specific individualsor everyone. How much change? Limited or radical.
Types of social movements:

Alternative social movement (limited change of specific individuals)
Redemptive social movement (radical change of specific individuals),
Reformative social movement (limited change of everyone), Revolutionary
social movement (radical change of everyone), (2005: 416).

Macionis and Plummer define "*stages in the life of social movements*" based on Blumer, Mauss, and Tilly (2005:417, 418). Social movements are accepted as dynamic and have different levels of appearance:

"1-Emergence: Perceptions, dissatisfaction, intention to increase public awareness are important.
Examples are gay and lesbian rights movements and women's movements.

2- Coalescence: Defining itself and developing a strategy for publicizing. Includes tactics, building morale and recruiting new members, collective actions like rallies or demonstrations, and alliances with organizations.

3- Bureaucratization: To be recognized as an established political force and develop a formal structure for a social movement bureaucratization is accepted as an essential stage. It is a kind of going from thetalent and charisma of leaders to more capable of staff. Greenpeace is an example.

4- Decline: Success, failure due to organizational weakness or internal strife, coopting of leaders, repression, the establishment within the mainstream".

The new issues expected to emerge from social movements in the linkage of environment, gender, peace, sexuality, race, development, participatory politics, or distinctions public-private (2005:418).

According to Klaus Offe's 1985 wording about the new social movements, it is not possible anymoreto sort out the conflicts and contradictions by the state or increasing bureaucracy in advanced industrial societies. The new social movements are indicated as a solution (Macionis and Plummer, 2005:418).

Disaster studies have a long history. However, the inclusion of disasters and social movements hasa combination of growing awareness through case studies and Global international impetus that dates back to UN activities in time. The *International Decade for Natural Disaster Reduction* was declared between 1990-2000 in 1989 by the UN. World Conferences and declarations of Yokohama Strategy andPlan of Action for Safer World: Guidelines for Natural Disaster Prevention, Preparedness, and Mitigation (UN-IDNDR-23-27 May 1994) was the earliest frames. Then the Hyogo Framework for Action (HFA) has indicated the importance of disaster risk reduction between 2005 and 2015. These frames were recognized Global blueprints. Through the Hyogo framework, the focus shifted on buildingthe Resilience of Nations and Communities to Disasters. Through HFA, ISDR (International Strategy for Disaster Reduction) five priority areas for the action -Disaster Risk Reduction (DRR) were revealed.DRR is accepted as a national and a local priority with a strong institutional basis for implementation.
- Identification, assessment, and monitoring of disaster risks and enhancing early warning,
-Usage of knowledge, innovation, and education to build a culture of safety and resilience at all levels,
-Reducing the underlying risk factors,
-Strengthen disaster preparedness for effective response at all levels were recognized (UN-ISDR;18-22 January 2005),

The current period is framed by Sendai Framework for Disaster Risk Reduction (UN- 2015-2030) adopted at Sendai, Miyagi at the 3rd World Conference on March 18, 2015. Sendai framework put forward seven Global targets:

-The continuity of work done, understanding disaster risk.

- The significant shift on disaster risk management (governance) to manage disaster risk as opposed to disaster management. Preventing new risk, reducing existing risk, and strengthening resilience; primary responsibilities of states to prevent and reduce disaster risk, all society, and all State institutions. The frame of disaster risk reduction has been broadened by focusing on both natural and man-made hazardsand related environmental, technological and biological hazards and risks. Moreover, health resilience promotion was emphasized as well. Disaster risks, exposure dimensions, vulnerability, hazard characteristics, strengthening of risk governance (national platforms, recognition of the role of stakeholders) were mentioned.

-Disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and recovery, health infrastructure, cultural heritage were indicated.

–Investing disaster risk resilience, international cooperation, financial support, and International financial Institutions'loans were pointed out.

-Importance of International cooperation and Global partnership was revealed. Global Platform for Disaster Risk Reduction and regional platforms, the importance of monitoring and reviews were recognized. UNISDR is responsible for supporting the implementation, follow-up, and review of the Sendai Framework.

Resilience is defined as "The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (UN-

Sendai Framework, 2015:9) When we consider the Sendai framework and the concept of resiliency UNDRR, defines the concept **"**the ability of a system, community or society exposed to hazards to
*resist,
*absorb,
*accommodate,
*adapt,
*transform
*recover
from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management" (UNDRR, 2023)

Movement term mentioned in the Sendai framework once; under the Priority 6: International cooperation and global partnership section within the subtitle of support from international organizations article 48/e. It was revealed about Climatically change and supporting international bodies with an indication of Red Cross and Red Crescent Movement to support developing countries to implement the present Framework, in coordination with other relevant frameworks under the goal of support from international organizations for the implementation of the frame (UN-Sendai Framework, 2015:26).

The *urban term* is firstly included in linkage to Sendai Framework Priority 2:Strengthening disaster risk governance to manage disaster risk under the article 27-National and Local levels achievement section d as follows:

27/d- "To encourage the establishment of necessary mechanisms and incentives to ensure high levelsof compliance with the existing safety-enhancing provisions of sectoral laws and regulations, includingthose addressing land use and urban planning, building codes, environmental and resource management,and health and safety standards, and update them, where needed, to ensure an adequate focus on disasterrisk management" (UN-Sendai Framework, 2015:17).

The second and third appearances of the urban concept are under the Priority 3: Investing in disaster risk reduction for resilience section article with the subheading of National and local levels 30/b and 30/f as follows:

30/b-To promote mechanisms for disaster risk transfer and insurance, risk-sharing and retention, and financial protection, as appropriate, for both public and private investment to reduce the financial impactof disasters on Governments and societies, in urban and rural areas;" (UN-Sendai Framework, 2015:19).

30/f-"To promote the mainstreaming of disaster risk assessments into land-use policy development and implementation, including urban planning, land degradation assessments and informal and non- permanent housing, and the use of guidelines and follow-up tools informed by anticipated demographic and environmental changes" (UN-Sendai Framework, 2015:19).

When we consider details of the Sendai Framework many sections can cover current conditions linkedto disasters. They have to be discussed in long run with real experience examples. Some of the entries of this framework can be mentioned as follows to take attention to the complexity of the topic:

-Access to data, -Live-saving services, -Risk information /risk assessment, -Case registry for morbidity, -Affected persons, -Capacity strengthening, -Centers for public awareness, centers for stockpiling rescue/relief material, -Child health, -Animals, -Women, -Area-based support systems, -The social impact of disasters,- Periodic assessment of national/local progress,

-Impact assessments (economic, social, technological, structural) -Commitments for implementation (by developed countries, states, stakeholders, political), -Disaster losses evaluation,- Recording, -Sharing information, -Disaster medicine, -Disaster-prone countries,

-Disaster risk creation, -Disaster risk effects on a spatial, social scales. -Disaster risk management, -

Incorporation into post-disaster recovery/rehabilitation, -Obstacles, -Research,

-Certification, -Challenges -Disaster risk zones/disaster-prone areas, -Ecosystem-based approach to disaster risk reduction, -Food security,-Food supplies, -Forecasting, -People-centered multi-hazard, people-centered multisectoral, -Forums for government coordination, cooperation, -Frequent disasters, infrequent disasters, -Human settlements (informal, marginal), -Safe areas, -Housing as a social safety net mechanisms, -Households affected by disasters,

-Resilience, -Hospitals, -Coordination/engagement with Government and public sector, -Knowledge (of government officials, local, civil society, communities, migrants, stakeholders, volunteers, indigenous), -Laws (developing and upholding), -landlocked developing countries, -Large-scale disaster,-Making cities resilient campaign, -Mapping, -Supply chains (complexity, resilience), -Vulnerability (assets, persons, assessment, information, reduction of people in vulnerable situations), -Workplace resilience, etc.

2. Literature Reviews

Urban citizenship requires participation and observance related to urban issues in all conditionsorganized or disorganized conditions about disasters.

There are many different appearances of the movements concerning urban areas and disasters under the consideration of the above-mentioned classification and definitions of social movements, disasters,and urban areas.

Johnson (2011) gives an example from Turkey under the title of "Kernels of change: Civil society challenges to state-led strategies for recovery and risk reduction in Turkey". She evaluates three civil society groups at a comparative level by considering only recovery and risk reduction phases of the disasters in Duzce city, *11 years after the 1999 earthquake* in the region. The evaluated groups are as follows: DEPDER Düzce-Seven disaster-affected People's Associations founded in the surrounding towns of Kocaeli, Gölcük, Adapazarı, Değirmendere, Halıdere, Yalova, and Avcılar: DEPDER was active for the housing rights of people affected by the earthquakes. IMECE-(Turkish word meaning a sort of solidarity)- In this group; Aksu, Çayköy, and Hacı Süleyman Bey villagers were in solidarity andactive in the construction of 57 housing units between 2002-2005. Kadın Emeğini Değerlendirme Vakfı-KEDV (Foundation for the Support of Women's Work): This group was established in 1986. Their focus was on the poor women to organize and respond to basic needs, develop capacities to improve their lives and communities. Their long-run established relations were able to ease the bureaucracy morethan the other two. Following the earthquake and reconstruction phase, women became concerned aboutearthquake safety of the permanent housing, lack of inclusiveness in government-led projects. They callinto question how the government was selecting contractors.

Johnson evaluated those three in the historical sequence with their interactions in themselves and their interaction with the government. Two of them are grassroots organizations, initiated and led by the people. The third group is an Istanbul-based civil society group that initiates and advises locally basedgroups, which then become autonomous organizations. She reveals that the *right to the city* concept and*claiming these rights* are important and it is an inner part of resiliency. She takes attention to many different points but the anonymity of the multiple rights by referring to Marcuse has interesting relevance to the present study and recent aid activities of NGOs and some local government units duringthe disaster processes which will be mentioned later.

Johnson takes attention to the importance of the groups in the creation of solidarity, networks, and capacity to act. She reveals three important findings as to the outcome: The small scale of the activitiesof initiatives, the necessity of arranging legal rules to create better forms of communications between community and state, challenging power relations to exist, and requiring change (Johnson, 2011).

Bhopal-India Gas Leak in 1984 was one of the important *industrial disasters* which were caused by a leak of poisonous gas from the pesticide factory causing 4000 immediate death of people and others

injured in Bhopal city and surroundings. This example is important in the case of the legal achievementsof the social movements. An International Campaign for Justice in Bhopal (ICJB) and a coalition of social movement organizations (SMOs) sought justice with commemorative work. They contested the settlement and demanded liability from the transnational Corporation and the state at local andinternational levels by mentioning unequal power relations. Indian State and Corporation in the end settled with a 470 million dollar payment. Bisht analyzed multiple scales of meaning and regulations byconsidering archive materials and ethnographic materials of this case (Bisht, 2018).

Disasters and observed failures in the warnings of cities, construction processes of the housing units, and the built environment units have become a focal point in disaster concerned issues. Many social movements framed them. Following the *2009 Laquila Italy earthquake* case, six scientists and a government official were sentenced to six years manslaughter due to failing to give adequate warning of the earthquake, accused of negligence and malpractice in evaluating the danger and keeping the central city informed of the risks (Sisto, 2012).

A Turkish constructor's case following the *1999 earthquakes* was an important judgment and legal result of the movements. The Turkish constructor punished after the death of people in the 1999 Marmara earthquakes was released in 2011(although initial punishment was 18 years 9 months in jail resulted only in 7,5 years punishment) (Erdin, 2018).

Moreover, following the *nuclear accident experiences* created accumulated knowledge to develop counter movements towards nuclear plants. Three of them can be mentioned as influencing experiences namely the Three Mile Island accident (28 March 1979), the Chernobyl accident (26 March 1986), andthe Fukushima Daichi Nuclear Plant accident following the Tohoku earthquake and tsunami (11 Mart 2011). After Fukushima, I have personally observed shifted attitudes of Japan, Taiwan, and South Koreaduring a conference in Taiwan in 2017 about nuclear power plants and their usage. The most importantvisible attitudes after Fukushima come from the German Government to pass to clean energy and shut down its nuclear plants 3 out of 6 (Thomasson, 2022). This was an example of changing attitudes of some of the countries concerning nuclear power plants and their dangers in surrounding settlements bygovernments with the result of community and state-led awareness. This did not give similar results in each country.

Another example can be given in the frame of *wildfires* and their connections with settlements, animals, ecological chains, and some counter-movements about them. Wildfires are becoming regularlyand widely experienced disasters. They have many impacts on the ecosystem and human settlements aspart of this system we have faced the most recent examples from the USA, Australia, Turkey, and Greece. A recent example will be given from Australia. Bush fires, climatic changes, damages in settlements due to camel's and wild horses search for water and culling camels in South Australia tookattention to animals right to survive and humans survival clashes following disasters such as bushfire orrapid climatic changes (BBC, 8 January 2022). The rights of settlers and animals at the disaster processes have been discussed in many different disaster cases.

I can mention my observations on that issue concerning recent earthquakes in Turkey from my fieldworks. The observed solidarity to preserve animal rights to live and protect income sources in Okçular- Karakoçan, Elazığ *Earthquake* in Turkey was very visible. Some of the neighbouring villagers protected animals of damaged villages in solidarity on 8 of March 2010 and following days. On the other hand, the 30 October 2020 Samos (Sisam) *Earthquake* revealed awareness of the pets in damagedhousing units in Izmir.

Concerning Covid-19 cases, many different examples can be given as follows from the different countries:

In earlier stages of the Covid-19, earlier questions of disasters studies were asked again and again. Whose disaster is it? Who is responsible? Thus labeling theory was revisited (Becker,1963, Lemert,1951,) and segregation of people who were accused of spreading the Covid-19 have become regular application in some places in time. Who gets labeled and who labels them questions have takenattention at some point. Some of them resulted at racial segregation level and/or some of them destroyedearlier established relations

of citizens. Some others were on the contrary side and created networks andhubs to help each other in neighborhood units. The Covid-19 was labeled as the disaster of Wuhan and/or some indicated that caused by lab production or on cultural eating and consuming habit of some animals. These are still under controversial discussion. Labeling a town or destroying images of citizenswith prejudices created different social movements such as Anti-Asian Racism and segregation of Asian-looking people without differentiation between the Chinese, Japanese or Korean origins. Cabral reported on the BBC about rising Covid hate crimes against Asian Americans on the 21 st of May 2021.Warning reports on that issue by the UN and 2800 received hate incident reports were informed. The establishment of an advocacy group of *Stop AAPI Hate* (Asian Americans and Pacific Islanders) (Cabral, 2021) and their activities were an interesting movement. Grabmeier later summarised Hyunyi Cho and Lenbo Li's study on this issue. That study was based on a nationwide survey of 842 American adults between May 11 and May 19 (Grabmeier, 2020).

Covid-Protests took in some places by the citizens and/or certain occupational groups concerning legal changes and restrictions.

Truck drivers protested in Ottawa against unconstitutional rules of the requirement of full vaccinationor 14 days quarantine, vaccine mandate, and truckers' possible legal punishments. The speed of their movement and anonymity of donations, support on social media took the attention. The convoy was a big group consisting of around 40,000 supporters on the encrypted messaging app Telegram and 275,000 supporters on Facebook. They raised 5.5 m Canadian Dollars from 70,000 donations on Go Fund Me (The Guardian, 28 January 2022). The social movements and their speed and fast gaining impetus fromsocial media are recently important discussion points of the scientists and politicians.

Bailey, Clark, Colombelli, and their friends (2020) mention that at the time of Covid-19 it is necessary*to reconceptualize the urban* by considering short, medium, and long term impacts. According to them,short-term and emergent overnight Covid-19 has acted as a *catalyst*. That is to promote ideas that havelong been desired among specific groups of policy-makers and urban residents. Some of their exampleswere given as the promotion of bike-lane infrastructure and development of pedestrian spaces in time, usage of central spaces, the emergence of working home, and taking technology companies as an option(Twitter and Facebook). Shifts in socio-spatial implications around face-to-face or distance engagementand how they will be achieved and ensured, challenges of existing neighbourhoods across the urban region. They exemplify implications of the usage of office and the knock-on effect on the real estate industry (Bailey, Clark, Colombeli, et al, 2020:1168, 1169). Thus lifestyle, working habits, daily transportation habits, and urban infrastructures in some places were also affected by the Covid-19 periods and awareness.

Lockdown cities were announced and restrictions have been reclassifying the cities or the regions according to the impacts of the different periods of COVID-19 and its variants (Delta, Omicron, and so on.) in different countries. The following case from India can be given as an example. Between May 4-17, 2020, 733 districts of India were divided into three zones (red, yellow, green). But *zonal classification* was abolished on May 17. This indicates that conditions of cities and citizens are changingquickly according to the progress of the Pandemic, management, counter-responses, and under the impact of many other factors. We can see definitions of *contaminated areas*, *red zone*, *orange zone,* and*green zone* areas. Contaminated areas are restricted for the entry and exit of people and some certain clusters can be added or closed fully as well. Only permission is given for the supply of essential goodsand services. Almost everything remains shut. Red zone, orange zone, and green zone restrictions differentiate with regulations on transportation units, public or private transportation, and usage conditions of them; operations of certain shops, usage of e-commerce, distinctions of essential and non-essential items. Each zone and settlement are listed under each zone. The timing of restrictions is announced regularly. Classifications of the red, orange, and green zones are based on the following factors. Number of novel coronavirus cases, the doubling rate of Covid-19 cases, the extent of testing and surveillance. They are identified by local authorities (India Today, 2020). Similar conditions and classifications are observed in many countries, however, criteria of accepting one citizen as covid case and numbers (counted-uncounted, formal-informal) are still suspiciously approached due to political framing of the applicable rules and data

recording conditions. The data records and their validity and applicability have been under discussion by many scientists, doctors, journalists since the beginning ofCovid-19. We all observed some citizens labeled as affected people who resisted getting out of their houses and were forced to go to quarantine and forced to stay in quarantined settlement locations (voluntarily or involuntarily) and sometimes forced to pay their spending in that locations. Therefore, as the citizens of different sections of the World settlements, each location had its constraints and supporting conditions for their citizens, and the citizens' basic rights were re-framed in time by considering drawing the line of the end of right next to other citizens right. Some citizens took place andparticipated in decision-making processes about themselves and some others could not find this opportunity. Fordham indicates the importance of the distinction between consultation and participationby a referral to Arnsteins' leader of Citizen Participation in case of flood issues in 1998 Britain. It is very difficult to study all cases but they will come out in a longer period as people will begin to speak out or studies will reveal them.

Before the Lunar New Year and Winter Olympics and China's decision to lock down more cities (Yuzhou and Xi'an) to prevent the spreading of the Covid was one of the recently taken measurements (BBC, 4 January 2022). However, restrictions, distribution of vaccines, unequal access to health servicesin the cities under conflicts, situations of refugees in foreign countries cities and requirements of open space in the city and space in busy households are important research topics concerning Covid that haveto be worked on in detail later on as well.

Mapping of needs and quick response to them is very valuable in times of disaster periods, therefore, creating, collecting, and distributing formal and informal, governmental, and non-governmental aids are important. Current complicated social relations, power relations reveal the importance of the establishment and usage of social networks and the creation of solidarity even under conflicting interestsand applications.

My earliest engagement of disaster issues and aid case based on our university students' earthquake experiences from Van in 2011 and question of "how can we help our students" then an example from Japan took my attention in 2011 (Itoi, Saijo, 2011). Saijo's *Fumbaro disaster aid frame* appeared as an important organization following an earthquake. Sometimes aid groups or aid movements were developed at certain cities and certain universities with an impetus of a person and/ or a group and createhigh disaster awareness and resiliency approaches of those institutions (Waseda and Kyoto Universities)and enlarge in time. Fumbaro Project which is created in Eastern Japan following the Great East Japan Earthquake and Takeo Saijo's efforts can be given as an example from Japan (Oner, 2013; Saijo, 2022).The Fumbaro Project and the question of "What Can We Do Now? Proposals for the New Support System to Link People's Wishes" (Saijo, 2022). Saijo's efforts were started with the disaster that affected the original settlement and the loss of his uncle. But important pressures were indicated. First the distance to settlements and creation of avoidance of awareness of impacts of the unseen disasters in-depth. I agree with Saijo. When he developed a search for his missing uncle, recognized the long-run impacts of disasters in settlements, and created a link to help people. We have a similar attitude on the definition of affected people and the importance of approaches. I mentioned in our university students'study from Van province of Turkey that short, medium, and long term impacts have to be followed without limiting possible impacts by considering the length of distance to the disaster epicenter. Even students of disaster origin living far from the epicenter can be affected widely by the disasters. My studywas from Turkey. However, Saijo gives examples from Japan. He indicates Tokyo, the Watanoha area of Ishinomaki City, Minamisanriku, and his hometown Sendai and other settlements in the coastal line.He was recognizing that conventional system-where supplies are sent up through the chain is missing responses to the rapid changes in the needs, time lag, and possibility to reach all. He was mentioning unfair reaching timing to the evacuation centers, private evacuation homes, and local governments. Theother indicated important point was the receiving of unnecessary items to the people while they neededtrue essentials. These all were coming out discussions on fairness according to him. He has come out with several contact projects under the Fumbaro:

-The Fumbaro East Japan Support Project: It is a contact centre for people who distribute relief suppliesto nearby people at each evacuation centre, private evacuation home area, etc. when they transport the supplies to the disaster areas. He indicates that they bridge the gap about what is needed and how muchof it is needed by phone and post it on their website. This information is given through his Twitter account.

People who see the information can directly send whatever they can, and the calls for support ends when the supplies that are needed are distributed at their destinations. They are in collaboration with Amazon for the transfer of goods. Through this way, supplies are sent to victims smoothly withoutthe need for classification. As I have observed on my fieldworks in Elazığ in 2005, 2011, and 2020 earthquakes and wildfires in 2021 Muğla, Marmaris in Turkey. Collecting and classifying and supplyingaid materials are a heavy burden. However, using social media messages is a recent trend that quickensresponses in Turkey as well. They are used by central, local governmental units and NGOs.

When we return to Fumbaro Project it contains other activities as well. Due to loss of jobs following disasters Saijo launches "Heavy Machinery Licenses for Victims! Project"- Clearance of debris in towns, construction in the afflicted areas have become necessary and letting victims obtain licenses forfree even while they are in evacuation centers. Thus the creation of self-support and starting new lives have become the core of this Project. Saijo gives example from Rikuzentaka city.

As I have observed in Tokyo and other cities of Japan, there are many people in the city measuring radiation levels in 2014 at the time of the World Congress of Sociology. It is very exciting to the following inclusion of such a kind of measurement and usage of it in the Fumbaro Project as well. The"Geiger-Counter Project" was created to follow radiation levels in settlements to enable individuals to assess the level of risk. Saijo indicates that tragic disasters should be taken positively and believe in thefuture and the ability to overcome such situations by giving the victims hope, provision of basic life andhome appliances, furniture, and jobs (Saijo, 2022).

Ihtiyaç Haritası-(Needs Map) is a nongovernmental aid association and identifies itself as Social Cooperative which was established in 2015, in Turkey. It aims to bring people in need together with individuals, institutions, and organizations that want to support them (İhtiyaç Haritası, 2015). Its famous face is popular actor Mert Firat works with 6 other people and many volunteers. Their difference is theyuse map technology and community-based verification. They have won the CIS award of Crisis Management at Esri Work Partnership Conference 2021 and Social Economy Awards 2021 in Social Innovation Category. Ihtiyaç Haritası was one of the active non-governmental group after the Kahramanmaraş earthquakes as well.

A later launched similar aid group is Ahbap in Turkey. Ahbap word is used in Turkey in the meaningof buddy, pal. This group is a nongovernmental aid association established in 2017, in Turkey. Well- known singer Haluk Levent is the visible face of the group but the main core of the group includes businessmen and women, volunteers as well. Their aims can be listed as follows:

-To help people and animals in need (in-kind and cash),
- To strengthen the solidarity awareness in the society,
-To serve the construction of good people and a good society,
-To create contemporary and sustainable solidarity, and aid networks with new partnership models and projects,
-To participate in the development of the local culture by protecting it and using current technological opportunities and transferring to the future (Ahbap, 2022). The group has opened two new entries on their web page concerning disasters. The first one is Ahbap Yardım Portal Afet Yardım Aydınlatma Metni-Ahbap Aid Portal Disaster Relief Enlightment Text. That informs people on the personal data terms of usage conditions. The other entry is on the Express of consent to use applicants' data in the frame of the Turkish law regulation numbered 6698 on the usage of personal data (Ahbap, 2022). Theyinclude disasters in cities, towns, villages, and other settlements by including different types of disasters and collecting information about the impact (people, housing unit, livestock, income source, health, settlement, etc.) and requested type of aid next to their other aid areas. They inform applicants about their legal frames as well. They have members and volunteers in cities, towns, and villages. They can motivate more members during calls on social media. Their activities were observed in Elazığ-Malatyaand Izmir Earthquakes in 2020 and wild forest fires in 2021 in rural and urban areas in Turkey. One of their important aid activities of them was to pay musicians, stage workers, Rodi, sound makers, and lightmakers unpaid electricity, gas, and water bills (up to 400 Turkish Lira) following lockdowns. The visible faces and initiators of this group were Turkish artists and singers such as Haluk Levent, Burhan Şeşen,Ceylan Ertem, Gripin, and Manga (Gazete Duvar, 2021). AHBAP was one of the active non- governmental group after the Kahramanmaraş

earthquakes as well.

3. Methodology

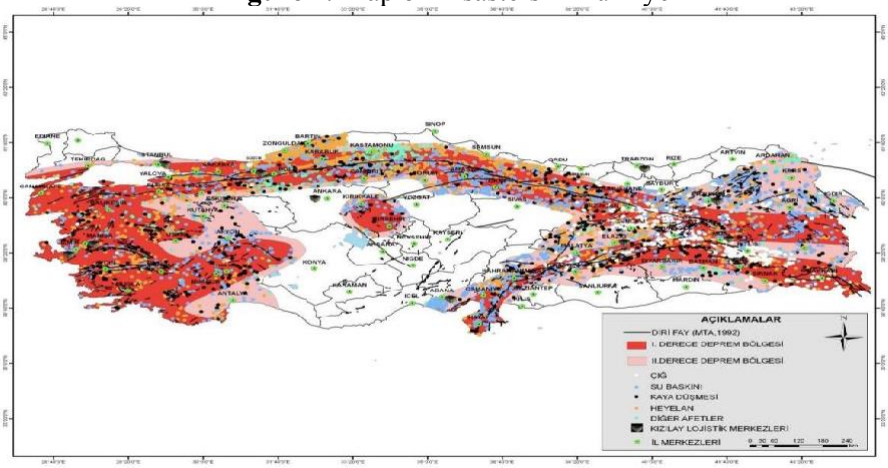
This paper will be focusing on the resiliency of urban and rural studies in general and then focuses on comparative observations of regional resilience and lessons from applied experiences of 11 cities in the aftermath of the 6th February earthquakes in Turkiye. However, due to continuity of afterschoks and our city was one of the mostly affected 11 cities, I had to postpone fieldwork. Therefore limited preliminary data will be mentioned here.

The main findings of this study was derived from analysis of preliminary observations and scrutinization of written texts and visual documents related to 11 cities. These observations and field studies covers before, during and after phases of the disasters. These mentioned cities are namely, Adana, Adıyaman, Diyarbakır, Gaziantep, Hatay, Kahramanmaraş, Kilis, Malatya, Şanlıurfa, Osmaniyeand Elazığ. Some other findings will be scrutunized from literature review on experiences of the NGOs,governments, and different countries. The findings will be evaluated by considering the types and phasesof disasters and the different reflections of the social movements through comparative examples, in theframe of 2030, 17 Sustainable Development Goals and their sub division goals (UNDP, 2023).
How

4. Results and Discussion

Theoretically issued measurements have handicaps in applications in rural-urban divine. Resilience Alliance, synergies, and increasing solidarities cover mishaps of the system's ability to withstand change. Self-organization of NGOs and institutional applications have become important for the complex and adaptive systems. At this moment transformation of unsustainable and unjust systems andbehaviours is under discussion.
Map of disasters in Turkiye prepared by AFAD: Afet ve Acil Durum Yönetimi Başkanlığı- The Headquarter of disaster and emergency management. Turkiye is in conjunction of multiple disasters. This can be seen in Figure 1. This map includes earthquake areas (1st and second degree) faults, avalanches, floods, falling rocks, landslides and others

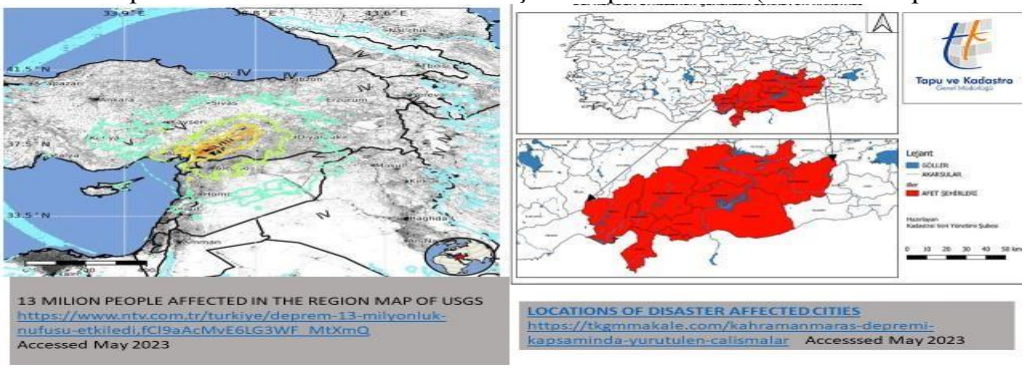
Figure 1: Map of Disasters in Turkiye



Source: AFAD, (2023) Afet Haritaları. Accessed: February 2023. Available: https://www.afad.gov.tr/afet-haritalari

On the account of complex disaster maps, recent complex earthquakes have created their own earthquake basin which was expected but its coverage was not expected to cover in a short time and in such a bigger area.
Recent Kahramanmaraş Earthquakes impacted a vast area and affected over 13 million people. The covered area can be seen in following Figure 2.

Figure 2: The Impact Areas of the Kahramanmaraş Earthquakes 2023 (NTV and Tapu ve Kadastro)



Sources: NTV (2023) Deprem 13 Milyonluk Nüfusu Etkiledi. Accessed: 6. February. 2023. Available: https://www.ntv.com.tr/turkiye/deprem-13-milyonluk-nufusu- etkiledi,fCl9aAcMvE6LG3WF_MtXmQ Salgın.Ö. (22.04.2023) Kahramanmaraş Depremi Kapsamında Yürütülen Çalışmalar- *Tapu ve Kadastro Genel Müdürlüğü, Mülkiyet.* Accessed May 2023. Available: https://tkgmmakale.com/kahramanmaras-depremi-kapsaminda-yurutulen-calismalar

There have been warnings about disasters and resiliency. I was one of them who indicated the importance of preparedness together without segregation of any location or any community. No patchwork, resiliency in a holistic way in coverage of all residential areas without segregation of hazardsor types of disasters since 1999. However, these sort of warnings has increased by other scientists suchas Naci Görür a civil engineer. The movements and studies in such perspective are growing.

There are initiatives to increase their numbers. TUBITAK-The Scientific And Technological Research Council of Turkiye has come forward with a call immediately after the 6th of February 2023 similar tothe 2020 Elazığ earthquakes to carry on field studies and supported some of them financially. Their reports are accumulating.

Some of recently revealed issues are concerning out mobility and transfer of student population (from government and private units) from the mostly affected 11 cities. When we consider the numbers these cities can be listed sequantily as follows: Antakya (66916), Kahramanmaraş (50245), Malatya (36900), Adıyaman (21629), Gaziantep (13706), Osmaniye (3853), Elazığ (3750), Şanlıurfa (2803) and Kilis (322) (TRT Haber, 2023). This is an important issue for students to provide their educational rights, safety and equality after disaster.

Another finding was about the necesssity of disaster housing units acording to damage evaluations (Çevre, Şehircilik ve İklim Değişikliği Bakanlığı, 2023). 405005 housing units and 83149 village housewill be constructed. However, their distribution was not equal in each cities. Acording to proportion ofnecessary building construction numbers can be listed as follows. Hatay (146650), Kahramanmaraş (88500), Malatya (66230), Adıyaman (47350), Gaziantep (27150), Osmaniye (12425), Diyarbakır (6000), Elazığ (4500), Şanlıurfa (3000), Adana (1900) and Kilis (1800). However, under the consideration of vilage housing units, the list changes as follows.

Malatya (21549), Kahramanmaraş (18874), Hatay (14997), Adıyaman (13987), Gaziantep (6506), Osmaniye (2731), Elazığ (1602), Kilis (1368), Şanlıurfa (812), Diyarbakır (812) and Adana (7). This findings reveals that some cities affected more from urban dwellings and some others rural.

There are detailed statistics related to 11 cities but each variable has to be scrutunized carefuly.

SBB's -Strategic and Budget Directorship reveals some of findings as follows in 2023

- Population structures
- Basic indicators of workforce
- Activities in the private sector which have the biggest proportions
- Their share in national income
- Their share in nations' import and export
- Number of housing
- Distribution of risky areas and housing units

- Distribution of house earthquake insurance
- Teacher numbers
- Student numbers
- Number of dormitories and their current situations
- Conditions of buildings in the health sector

Evaluations on the resiliency and sustainability requires a clear-cut definition of past and present conditions to set goals for future planning. Collaboration of a variety of areas are necessary.

Urban areas are not separate from rural or close neighbours and their networks. These following examples can be given from experiences.
Black Sea region could not cultivate tea for a while when there were restrictions to move during lockdowns then volunteers, relatives have been given special permission to cultivate tea in certain areas.Following recent Kahramanmaraş earthquakes some of the cities could not activate water systems governmental and nongovernmental national aid arrived but still, there are shortages
They could not bake bread in early days and national emergency aid services and neighboring cities moved in with mobile bakeries to the earthquake basin. Besides this, we have collected bread and manyother aid in our university and sent it to the neighbor cities namely Malatya, Adıyaman although we were one of them as mostly affected 11 cities.
In Turkiye we have aid regions which are responsible to help each other in subdivide during the disasters. However, the severity and covered area of recent disasters were bigger. Therefore, spontaneously emerging aid networks have become more active and took place next to governmental actions. Besides this we had to call international aid.
AFAD has released recent humanitarian aidpoints in maps (AFAD, June 2023)
Aimed analysis will be carried on after fieldwork in the eartquake affected basin in the future.

5. Conclusion

The impact of earthquake hazards in short, medium, and long terms can affect different segments and different settlement locations. If the populations are active and mobile for different reasons (seasonal migrants, regular occupational mobilities, in turn, mobilities for educational purposes, presence of family, relatives, friends, and colleagues. If aid is necessary to be provided by locals, nationals, and international groups. It would be better to be prepared according to hazards, risks, and strengths of the communities, and societies together instead of a patchwork of preparedness for the types of disasters and phases for selected hazards or risks. Disaster regions in Turkiye are in close connection but the recent earthquakes have broken or weakened the formal aid circle chain in some cities and affected wastarea. Therefore collaborative actions and multiple perspectives are essential, segmentation or basin approaches are necessary for certain priorities of expected hazard locations should be given for disasterperiods. The resiliency of 11 cities will be dedailed after receiving necessary official data, analyzing them and completing field works. The complexity of the situation requires more studies.

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TRACK 6
Cities and regions

6c. The power of art and culture in sustainable cities and communities

Abstracts

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Analyzing the cultural heritage conservation to attain cultural sustainability: Insights from India

Ms Nithya Ayyaswamy, Dr Keya Chakraborty
Srishti Manipal Institute of Art, design and technology (SMI), Manipal Academy of Higher Education (MAHE), Bangalore, India

MS NITHYA AYYASWAMY

DR KEYA CHAKRABORTY

Abstract

Cultural heritage is a community's intangible and tangible heritage assets that have been passed through the generations. It encourages the identification, protection, and preservation of cultural (that embraces built and living heritage) and natural heritage and protects exceptional human knowledge. Thus, the preservation of cultural heritage with diverse values is an essential step towards supporting and contributing to sustainable development goals (SDG 11.4) Agenda 2030. SDG (11.4) not only promotes the strengthening of the efforts to protect and safeguard the world's built and natural heritage but also the living heritage sites. Also, the 'Heritage at risk' report of the International Council on Monuments and Sites (ICOMOS 2020) found that 65% of the world's built heritage was neglected and in poor condition – causing them to lose their cultural, artistic, and economic value over time. Research says the participation of the local community in the protection of cultural heritage is exceptionally essential for the cognizance of progress toward sustainable development. It is observed that living heritage-based conservation promotes the idea of long-term conservation and only becomes successful when the community participates and gains the consequential benefits. Furthermore, this helps to preserve the cultural sustainability of living heritage sites and provides resilience towards present climate change. Thus, a culturally sustainable ecosystem can be attained by consolidating ecological consciousness. However, the existing conservation guidelines don't take into account the value of these sites, as are more focused on tourism and economic benefits. This results in the eviction of communities from the heritage sites and leads to the disintegration of the built and living heritage ecosystem. Against this context, the objective of the present paper is how built and living heritage can be conserved together for attaining cultural sustainability that embraces the intersectionality of social, economic, and environmental aspects of any community. This paper tries to explore the vitality of living heritage within a built heritage, based on ethnographic primary research. Through the practices of sketching and photographic documentation, this research further tries to establish ecological consciousness among the stakeholders within the ecosystem as well as the researchers. From 19th century India, Chettinadu's palatial houses (center of Tamil Nadu, in the southern part of India) are examples of such a rich cultural ecosystem. These houses were built by the merchants in a harmonious blend of Southeast Asian and European styles, giving the city its distinctive built heritage, cultural values, and nature-based urban planning. This research tries to design a framework by analyzing the two important aspects, viz. architectural (built) and living heritage of the Chettinadu region through the lens of cultural sustainability in transition. The application of this framework is not restricted to Global South but also be helpful across world heritages to guide researchers, conservationists, and inter and intra-sectoral stakeholders to put forward, how to address the issues associated with cultural heritage conservation.

Keywords: Cultural heritage, cultural sustainability, ecological consciousness, heritage conservation, eviction of communities

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A transition for sustainability: Through the craft of Kaudi.

Ms Abhigna B, Dr Srisrividhiya Kalyanasundaram
Centre for Reimagining Transitions; Srishti Manipal Institute of Art, Design and Technology (SMI), Bengaluru; Manipal Academy of Higher Education (MAHE), Manipal, India, Bengaluru, India

MS ABHIGNA B

DR SRISRIVIDHIYA KALYANASUNDARAM

Abstract

Indian traditional arts and crafts have sustainability embedded in them through their use of natural materials, local production, preservation of skills and knowledge, support for local economies and communities, and incorporation of reuse and recycling principles. This encompassing virtue of Indian arts and crafts leads to a new perspective and revival of a sustainable lifestyle. The paper identifies one such craft form in the grassroots of North Karnataka - Kaudi, a traditional textile craft. It focuses on proposing a design intervention approached through a framework of transitions that will impact not only the revival of the craft but the impact of a traditional craft on sustainability, waste management, environment, and making.

“Kaudi” means blanket or quilt in Kannada. Thus, Kaudi is the art of quilt-making involves stitching pieces of old clothes and rags to create intricate and colorful patterns. The women artists consider making the quilt with new fabric a sin. Thus, it indicates the revival of the craft as a natural direction for sustainable transitions.

The brightly colored fabric scraps and the thread tying them together tell the tales of their creators and users, frequently preserving intimate, cross-generational narratives in form and texture. Kaudi is the voice of women for whom quilting is a way of life, an art form that allows them to express their aspirations, creativity, and culture.

In contemporary times, the craft has traversed a new language of aesthetics and materiality that shifts its focus from sustainability towards commercialization. The contemporary approaches to the kaudi revival move away from the original kaudi aesthetics and their grassroots voices, resulting in global aesthetics devoid of the distinctive identity of these communities. Furthermore, the paper proposes a framework that will impact the traditional craft through sustainability in conserving fabric waste and reducing fashion waste from landfills.

The fashion industry is one of the most polluting industries in the world and is responsible for a significant amount of waste. The industry produces approximately 92 million tons of waste each year, much of which ends up in landfills. An intervention through Kaudi could have the potential in reducing fabric waste from the fashion industry. It can be made from clothing waste, diverting these materials from landfill and creating new value for them. It will aid in upcycling overproduction; design for longevity and prove as a sustainable model for women and the environment.

Through participatory design processes and in-depth narrative interviews of Kaudi practitioners, many of the concerns, challenges, as well as original visions and desires of this community, were studied. The paper proposes an intervention to reduce fabric waste from the fashion industry through the production of meaningful art by the Kaudi community. We propose an intervention grounded in the values of the craft and the community. Through a participatory process with the community, we suggest an intervention grounded

in the beliefs and values of this traditional form rooted in sustainability towards adapting their craft to design sustainable transitions with and through the fashion industry waste.

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Creative Placemaking Key Contribution on Thematic District: An Exploratory Review

Ms Amanda Rosetia, Mrs Nor Zalina Harun
Universiti Kebangsaan Malaysia, Bangi, Malaysia

MS AMANDA ROSETIA

MRS NOR ZALINA HARUN

Abstract

The process of creative placemaking is fostered by inventive individuals, including makers and initiators. It begins when people simultaneously create and experience space. In this study, creative placemaking intersects with various trajectories, including economic growth, art and cultural experiences, participatory stakeholder, and management with a similar orientation. This suggests that creativity reinforcement made the key contributions of creative placemaking less important because the creative placemaking process affected different people's interests. Despite the fact that a large number of studies have demonstrated the process of creative placemaking, little is known about its capacity to elaborate an expansive mechanism of subject, location, and individual creativity. This paper's goal is to explain how creative placemaking contributes to sustainable development in a specific or themed setting, like a historical or protected site. This study will focus on creative placemaking strategies as an important part of significant socio-spatial concept to a specific geography, including their distinct natural features. A systematic literature review was conducted using the PRISMA 2020 instrument as the guideline to examine research on creative placemaking from around the world and throughout the year from the three largest database platforms, namely Scopus, WOS and Science Direct. The searching process undergoes identification, screening, and eligibility steps for selected articles, referred to an established review guideline for an SLR procedure. During the review process, five thematical studies has been discovered under creative placemaking: (1) community well-being; (2) revenue generate; (3) cross-sector inclusivity; (4) art and creative endeavour; and (5) special subject setting.

Keywords: creative placemaking; key contribution; thematic district; systematic literature review

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ARCHITECTURAL UNIQUENESS AND ITS BENEFITS TO THE RESIDENT IN THE TRADISIONAL SETTLEMENT

Ms. NAZATUL HUDA RUHIZAR[1], Associate Professor Dr. NOR ZALINA HARUN[1], Dr. SITI MARZIAH ZAKARIA[2]
[1]Institute of Malay world & Civilization (ATMA), Bangi, Selangor, Malaysia. [2]Faculty of Social Sciences and Humanities, Bangi, Selangor, Malaysia

MS. NAZATUL HUDA RUHIZAR

ASSOCIATE PROFESSOR DR. NOR ZALINA HARUN

DR. SITI MARZIAH ZAKARIA

Abstract

In general, architecture encompasses more than simply stone and wood structures; it also represents the local culture and traditions, particularly in traditional settlements. Buildings with distinctive architecture and design can be regarded as national emblems and cultural heritage. In traditional settlements, the architectural structure of buildings constructed with timber parts is dwindling and is regarded as desolate by the community. So, it's important to celebrate and make use of the fact that some settlements have managed to preserve at least some of their original, traditional architecture. This is due to the perception that the preservation of traditional architecture is intrinsically linked to community-wide conservation measures. Considering these benefits, the purpose of this study is to examine the uniqueness of architecture based on different typologies and the advantages acquired by residents of traditional settlements that have preserved the bulk of their architecture. A traditional village known as Kampung Pulau Sekati (KPS) in Kuala Terengganu has been chosen as a research area due to its age and physical characteristics, which have been conserved despite the threat of urbanisation in this study. Furthermore, the Trengganu State Structure Plan 2050 has nominated this village as a heritage village. This qualitative study employs observation and interviews with 24 people of KPS who have lived there for at least 30 years. Observation, meantime, is conducted using a structured survey based on a check-list separated into building type, building environment, demarcation, accessibility, natural components, and social and cultural area. Seven architectural typologies have been recognised in KPS, including residential dwellings, mosques, wooden bridges, community halls, jetties, gazebo, and retail outlets. In the context of residential houses, this study identifies five categories of uniqueness, namely the use of wood as a building material, construction of structures by the occupants, the variety of spatial functions, the presence of mature plants, and the ease of access to food and water sources. According to the survey, the usage of eco-friendly building materials such as wood creates a serene environment in the home. In summary, this distinctiveness has offered different social, cultural, economic, and environmental benefits to the community. In fact, each type of this architecture is discovered to give occupants with a variety of advantages. In the context of residential houses, this study revealed five categories of uniqueness, namely the use of wood as a building material, the construction of structures by the occupants, the variety of spatial functions, the presence of mature plants, and the ease of access to food and water sources. According to the survey, the usage of eco-friendly building materials such as wood creates a serene environment in the home. In conclusion, this distinctiveness has offered different social, cultural, economic, and environmental benefits to the inhabitants. In addition, the distinctiveness of architecture in traditional settlements can establish a distinct identity for the village and a desire to conserve residential architecture for

future generations. This study demonstrates that architectural preservation programmes encourage the participation of neighbouring villagers and have a favourable effect on social sustainability and local tourism.

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Design of digital entrepreneurial mode of Chinese Traditional Fragrance culture —— Technological innovation and cultural sustainable development

Design of digital entrepreneurial mode of Chinese Traditional Fragrance culture —— Technological innovation and cultural sustainable development 冰清 徐, Design of digital entrepreneurial mode of Chinese Traditional Fragrance culture —— Technological innovation and cultural sustainable development 琳琳 谢

Anhui Normal University, Wu Hu, China

DESIGN OF DIGITAL ENTREPRENEURIAL MODE OF CHINESE TRADITIONAL FRAGRANCE CULTURE —— TECHNOLOGICAL INNOVATION AND CULTURAL SUSTAINABLE DEVELOPMENT 冰清 徐

DESIGN OF DIGITAL ENTREPRENEURIAL MODE OF CHINESE TRADITIONAL FRAGRANCE CULTURE —— TECHNOLOGICAL INNOVATION AND CULTURAL SUSTAINABLE DEVELOPMENT 琳琳 谢

Abstract

With the concept of cultural sustainability proposed by people and the progress of science and technology in recent years, cultural creative industry has become a new driving force of regional economy. Digital technology brings multiple opportunities for traditional cultural innovation. Digital creative industry is a new form of business produced by the integration of new digital technology and cultural creative industry. The inheritance and development of fragrance culture has a long history in China. Under the tuyere of olfactory economy, the world fragrance field has ushered in a big explosion in the past two years. Fragrance has gradually integrated into the daily life of the new generation of consumers and become an important medium to express personal style. In today's social media communication environment, the pursuit of life style by the young generation of consumers and the life mode assisted by digital technology have increased people's new demand for the function and value dissemination of fragrance products. Using modern digital technology means to electronize and materialize fragrance, and deconstructing digital fragrance with Chinese cultural concepts, the participation of digital tools will subvert the way of creating fragrance products. This comprehensive innovative interaction design, which combines traditional fragrance culture and modern digital technology, is of innovative value to the study of cultural sustainability communication. This paper aims to comprehensively explore the function and value of fragrance culture in the current digital media environment, dig the sustainable cultural core of fragrance traditional heritage, and carry out in-depth discussion on the digital entrepreneurial mode of fragrance culture, in order to promote the sustainable development of traditional culture represented by fragrance.

Key words: digital technology, culture, sustainable fragrance, culture, innovation and development

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Research on Digital Design Strategy of Macau historic District based on VR

xin hu
City University of Macau, Macau, China

XIN HU

Abstract

The development of VR technology provides more opportunities for the dissemination of architectural cultural heritage. As a cultural heritage of the integration of Chinese and Western cultures for more than 400 years, the historic City of Macao is centered on the Old City of Macao, with more than 20 historical buildings connected, which are densely distributed in strips, showing the historical context of Macao. Three-dimensional scanner equipment is used to scan the texture (such as walls, floors, patterns and colors) of Macao's historic buildings, classify, analyze and identify relevant data, extract the main texture features of Macao's historic blocks, transform them into digital situations through three-dimensional modeling, and take VR as the carrier to propose a digital narrative strategy and feasibility centered on tourists' perspective. This study will provide cross-innovation ideas of design for the development of digital experience of architectural cultural heritage.

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Implementation of Mapping as a Historic Town Conservation Effort in Chukai Town, Kemaman

Mr. Muhammad Afiq Wasie Mohd Asri, Associate Prof. Dr. Nor Zalina Harun
National University of Malaysia, Bangi, Malaysia

MR. MUHAMMAD AFIQ WASIE MOHD ASRI

ASSOCIATE PROF. DR. NOR ZALINA HARUN

Abstract

Mapping is an early step in the conservation efforts of the historic town. It serves to identify the details of the local heritage in full. Without good mapping data, the survival and effectiveness of conservation work will be affected. In contrast to large-sized historical town, mapping data on small-sized historic town is often incomplete to the detriment of conservation development. To the detriment of the heritage and morphological image of the town. Thus, this study was carried out to look at the development of mapping and its implications for conservation work in small-sized historical towns. This study has chosen Chukai Town as a study site as it has an important historical background as one of the administrative locations of the colonial parties in Terengganu a long time ago. Analysis of map documents that have been carried out and semi-structured interviews on stakeholders are methodologies applied to achieve the results of the study. This study refers to the implementation process of the Historic Urban Landscape approach as a guideline analyzing conservation actions that have been carried out. As a result, there was a delirium in the implementation of the mapping resulting in the neglect of the existing heritage by the local authorities themselves. However, there is no denying that significant conservation efforts have been undertaken by this party. This study concludes that mapping should be a mainstay in the implementation of urban conservation as emphasized through the Historic Urban Landscape approach.

Keywords: Mapping, historic town, historic building, Historic Urban Landscape.

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Environmental interactions as the primary determinant of the viability of museums in historic site

Ms Amirah Athirah Yaacob, Associate Prof. Dr. Nor Zalina Harun
The National University of Malaysia, Selangor, Malaysia

MS AMIRAH ATHIRAH YAACOB

ASSOCIATE PROF. DR. NOR ZALINA HARUN

Abstract

This study begins with the notion that the difficulty of maintaining the sustainability and functionality of local museums can be circumvented by enhancing the quality of the museum environment. However, in the context of this study, the historical element, old city landmarks, and natural environment, as well as their impact on the attention of tourists and the sociocultural community, will be analysed in more depth so that the role of the museum can be strengthened. Even though many research on the sustainability of museums have been undertaken, however these studies have primarily focused on management and marketing. Insufficient and scant research has been conducted on the topic of empowering museums located on historic site. As a preliminary step, a study of four local museums located in heritage sites was done to determine whether their implementation is consistent with the strategy of museums that have successfully been preserved, notably Borobudur and Angkor Wat. To achieve this aim, two main objectives were developed: to identify how museums in heritage sites are empowered from the perspective of the of spatial planning and facilities that support the role of the museum; and ii) to examine the issues and obstacles faced by four local heritage-site museums. Using document analysis techniques and articles on the strategies and sustainability of museums in Borobudur and Angkor Wat, this study highlighted three primary strategies that might potentially be implemented to the four analysed local museums. The study's findings indicate that the three primary strategies are closely tied to complete infrastructure facilities, preservation of the original physical landscape character, and involvement of the local community. In accordance with the third core listed by the National Cultural Policy (DAKEN); cultural heritage must be preserved through preservation and conservation efforts to ensure the high aesthetic value of national treasures, it is anticipated that this study will serve as a reference for addressing the problem of maintaining the physical sustainability of museums as one of important cultural hub.

Keywords: museum in heritage sites, heritage sites, environmental relations, role and function of museums

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Integrating Sustainability into Art and Design Education: Curriculum Development

Mahsa Mapar[1,2], José Bidarra[3], Sandra Caeiro[1,2], Pedro Alves da Veiga[4], Paula Bacelar-Nicolau[1,5]
[1]Department of Science and Technology and CEG, Center for Global Studies, Universidade Aberta, Lisbon, Portugal. [2]CENSE, Center for Environmental and Sustainability Research, Nova University Lisbon, Lisbon, Portugal. [3]Universidade Aberta, Lisbon, Portugal. [4]Research Center in Arts and Communication, Universidade Aberta, Lisbon, Portugal. [5]CFE, Center for Functional Ecology, University of Coimbra, Coimbra, Portugal

MAHSA MAPAR

JOSÉ BIDARRA

SANDRA CAEIRO

PEDRO ALVES DA VEIGA

PAULA BACELAR-NICOLAU

Abstract

Sustainability is an important factor in art education. Several artists, in line with the UN Agenda 2030, have embraced the idea of art for sustainability in different ways to reflect the protection of natural landscapes, the consequences of industrialization and the growth of cities, and the use of resources. However, these topics are rarely taught to art students in higher education, considering belonging to science subjects. On the other hand, to change art students' attitudes toward sustainability, it is essential that social conscience and responsibility emerge from both knowledge and values. In this context, the ERASMUS+ ARDES project - Short Learning Programme (SLP) for ARt and DEsign and Sustainability with special focus on environment and climate change (CC) (2022-2024)- has been set up through a strategic partnership among 5 European partners: MyDocumenta (Spain), European University Cyprus (Cyprus), Universidade Aberta (Portugal), EINA (Spain) and the associated partner LABA Valencia (Spain). The project intends to provide open educational resources for art students by integrating knowledge and values associated with sustainability and CC through art activities, design techniques, and digital solutions. This paper aims to present the initial results of the curriculum development of this SLP through formal learning modules and extracurricular community work concerning sustainability and CC.

The SLP, made of 156 academic hours plus an extracurricular community activity, consists of 3 main modules: i) Module 1- Art, Design, Sustainability, and CC within historical and contemporary contexts; aiming to introduce the concepts of sustainability, the link with art and design, and sustainability assessment methods in art and design context; ii) Module 2- Art and Design for Communicating Sustainability and CC; aiming to use art and design as strategic tools for utilization of visual communication, thus helping students to compile design projects concerning sustainability and CC; and iii) Module 3- Digital tools for the interactive engagement of audiences with Art and Design; aiming to introduce the concepts and application of big data and the principles of audience engagement.

Two learning plans were developed: 1) a "Module Plan" containing the modules objectives, competencies, essential questions, resources, and assessment methods, and 2) a “Lesson Plan” covering the details of the educational materials and activities in each lesson. Various learning materials were developed, including text, slides, videos, and engaging tools. Also, diverse individual/collaborative activities were designed, classified from project-based activities, reflection on existing art productions, designing artwork, working with European and local databases, and live performance, all in the concept of sustainability and CC.

In the next step (Oct 2023), the SLP will be piloted in partner Universities, targeting postgraduate students in art studies. The effectiveness of the training will be later assessed through a questionnaire. It is expected that by the end of the training, the students will be able to recognize how sustainability and CC integrate into the concepts of art and design, to later enhance their motivation, opportunity, and ability for sustainable actions in society, thus contribute to SDG 13, target 13.3 and SDG4, target 4.7.

Keywords: Sustainability, Climate Change, Art, Design.

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Murals and the peace process in Northern Ireland: evidence from the City of Derry.

Dr Ilona Hunek
Kozminski University, Warsaw, Poland

D R I L O N A H U N E K

Abstract

Building sustainable peace in a society divided by violent conflict for many years is complex. Peace theorist Johan Galtung brought forward the concept of positive peace (1969) – a relationship between parties characterised by harmony and coexistence despite differences (in contrast to negative peace, which is merely an absence of violence). According to Galtung, culture and art is a vital element of both creating violence and peace. In this study, I examine the murals in the City of Derry, Northern Ireland, from 2001 to 2022. Since the Good Friday agreement in 1998, the country has been considered in transition to peace. Observing the transition process made me ask the question: how do the murals reflect (and contribute to) the peace process? Murals are uniquely positioned in Northern Ireland's culture and the sectarian conflict. They are a particular art form: created organically by muralists in working-class areas on both sides of the conflict, they are shaping the urban space. Painting murals was a political act, and the murals themselves were political statements, showing the aspirations of the two communities. Murals served many roles: segregating space, displaying resistance, breaking boundaries, voicing opposition, and commemorating the dead. They also became a tourist attraction providing a 'simple insight' into a conflict for the outsiders (Jarman, 1998). During the peace process, the state art establishment made some efforts (and provided funding) to replace the most violent and offensive murals with pieces of public wall art. This resulted in the creation of new and different murals in Northern Irish cities; however, these efforts brought mixed feelings – as they are seen as a form of watering down the difference between communities and silencing the political voice (Rolston, 2012). The data used for this study includes photographic evidence of murals in the City of Derry taken between 2001 and 2022 (published and unpublished – taken by the author), interviews with the artists painting the murals (published and taken by the author in 2022) and interviews with community members. Murals are studied from three perspectives: the content, the context (murals as an element of urban space) and the process of creating, involving three key actors: the artist, the recipient (community) and the sponsor (who commissioned the mural).The evidence shows the changes in the content: less violent, less political, and more neutral images, but it also indicates that merely changing the content is not enough to build sustainable peace, as there is a perception of silencing of part of the community voice. At the same time, there is evidence of the positive impact of new murals on the community – especially in engaging young people in the act of creation. This study contributes to the conference theme by examining the role of wall art in the process of building peace. It contributes to SDG 16 "Peace, justice and strong institutions", section 16.1 "Reduce any form of violence".

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Artful Expressions of Urban Communities

Associate Professor Malin Gawell[1], Dr. Ann-Sofie Köping Olsson[1], Professor Monika Kostera[2,1]
[1]School of Social Sciences, Stockholm, Sweden. [2]Sociology, Warsaw, Poland

Abstract

In the urban space there are several different types of artful expressions such as public art or streed art. At times, these expressions are closely alligend with urban planning and visions expressions of contemporary expressions of actors responsible for or involved with the construction of urban infrastructure, housing etc. But there are also arful expressions that can rather be seen as responses to urban constructions and contemporary society. Street art, or even Artivism, are examples of such expressions. In this paper, we explore artful expressions in the urban community Flemingsberg and Fittja; two suburban areas in the outskirts of Stockholm. These places were built inte late 1960's and 1970's as the urban region of Stockholm expanded due to demographic growth. They were build in a time characterized by 'social engineering' and a modern rationality. Today they are rather characterized by places with socio economic challenges, segregation, high crime rates etc, but they are also subjects for great investments due to ambitions to develop the region to a new regional city center. We compare these expressions with artivism present in the Muranów disctrict of Warsaw, Poland, which has been constructed in the early 1950s and is an area known for its community spirit, as well as abandoned industrial areas of Sheffield, UK, famous for its' strong cooperative artistic engagement. Empirically, we mapp different types of artful expressions in these three places in suburuban Stockholm, urban Warsaw and Sheffield. We will then analyse different types of artful expressions and relate those to contemporary debate on urban community and societal development. We will mapp through digital exploration, walks and interviews with experts in the field (including some artists). The aim is to mapp and reflect, but also to design next step in a more thorough study and analysis. Findings are related to different types of public art as well as street art such as grafitti, knitgraffiti, street music or artivism initiatives. This abstract relates to a nuber of SDGs and we lean on UNESCOs thematic indicators for cutlrue in the 2030 agenda; culture and participation (SDG 9, 10, 11, 16), knowledge and skills (SDG 4, 8, 9, 12, 13), prosperity and livelihoods (8, 10, 11), environment and resilience (2, 6, 9, 11, 12, 13, 14, 15, 16). Discussions will also be related to the conference theme "Half-way through Agenda 2030: Assessing the 5Ps of SDGs (people, planet, prosperity, peace and partnership)" through a structured reflection on that current status and transformation direction.

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Balancing The Development and Heritage Using the Heritage Impact Assessment: Case Study Of Melaka Coast

Yasmin Amirah, Amir Husaini, Associate Professor Dr. Asyaari Muhamad
Institute of the Malay World and Civilization, National University of Malaysia, Bangi, Malaysia

YASMIN AMIRAH

AMIR HUSAINI

ASSOCIATE PROFESSOR DR. ASYAARI MUHAMAD

Abstract

Under the principle of sustainable development, in meeting the needs of the present, the ability of future generations to meet their own needs must never be compromised. Hence, balancing between urban development and conservation, be it for natural or cultural heritage, is a must and should always be observed. Criticism towards development and urbanization, especially in the coastal areas, is expected to take place, especially after the strategic development planning of Melakaku Maju Jaya 2035 (PSMJ 2035) was introduced by the State Government of Melaka in the plan to boost the state's economy and further increase its competitiveness in attracting foreign investors. The coastal area development involved approximately 10,117 hectares of shore in the Central Melaka district through the Melaka-Waterfront Economic Zone (M-WEZ) project. One of the main issues in the Melaka development project M-WEZ is the existence of the Malaysian National Heritage Department's Protected Maritime Zone within the state's coastal and maritime area which makes any further modern development in the state's water area becoming more sensitive, and a lot of aspects and considerations need to be looked and studied at through many agencies. Through UNESCO's 17 Sustainable Development Goals (17 SDGs) number 8 which promotes sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all, this article is going to depict how Heritage Impact Assessment (HIA) which was formed through the ICOMOS guidelines can be used as a tool for balancing both heritage and development aspects in Melaka coastal region. While the economy in Melaka can be preserved and sustained through coastal tourism, heritage management can be further upheld and enhanced. HIA can also provide recommendations and mitigations for the developers that need to take place in any area that is being developed in order to maintain well-balanced heritage management with the development.

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Image coopetition of artists and cultural organizations in achieving sustainable development goals

PhD Katarzyna Plebańczyk, Prof. Marzena Barańska
Jagiellonian University, Faculty of Management and Social Communication, Institute of Culture, Krakow, Poland

Abstract

Activity in the field of culture has not only an artistic dimension, but also often affects social development. Instrumental treatment of culture is part of the scope of public management and is conducive to persuade societies to adopt specific attitudes and behaviors required to achieve objectives consistent with the public interest. Organizations operating in the culture area are beginning to adapt their activities to them, while trying to maintain their artistic goals. Entities from the cultural sector often build their image and brand based on the personal branding of the artists associated with them. This build a coherent image of the artist and the organization. It has been embedded in a specific system of values, striving to achieve socially significant goals, and the artist himself, at a conscious or subconscious level, participates in the implementation of goals set by both organizations and sustainable development strategies. The topic results from the research carried out by the authors on the management of artistic career. For its needs, a component concerning cooperation between cultural organizations and artists was separated from them, limited to the Polish market. In the name of the public interest, image coopetition between artists and organizations is an important tool in building pro-social attitudes, even at the cost of losing artistic freedom. The fundamental question was: does the public interest create the phenomenon of coopetition of artist's personal branding and cultural organization? In order to obtain a greater saturation of the data and obtain their better representativeness, qualitative research was carried out. To collect the research material, triangulation of data obtained from various sources was used - collected in the years 2019-2023, in different locations (large and smaller towns in Poland), among various interlocutors (artists and cultural managers). The research techniques included: a) secondary qualitative data analysis - 20 interviews with artists and representatives of cultural organizations; b) analysis of 10 semi-structured interviews with persons representing cultural organizations and artists (purposive selection); c) analysis of the content of press materials (based on keywords) - deepening knowledge on the topics discussed during the interviews. Activities undertaken in culture areas can support communities in tackling global challenges with the use of tools and techniques. Artists represent a potential that is not always noticed. Mechanisms for implementing sustainable development strategies in public management generate both ideas for a career - from the artist's perspective, as well as activities on the part of the organization. The potential resulting from the symbiosis in the approach to understanding socially important issues builds new perspectives for cooperation, inclusive solutions and practices aimed at building resilience among the global society. Coopetition should be perceived as an innovative way of activating artists and public institutions, motivating them to take risks in important matters. In the global dimension, it is a forum for cooperation between organizations. In relation to individuals, an attempt to find a balance between the constant pressure of the environment and the artist's personal beliefs, choices between ego and omnes.

Full Papers

The Implementation of Mapping Techniques for the Preservation of Chukai Town

Muhammad Afiq Wasie Mohd Asri[1] and Nor Zalina Harun[2]

[1] Institute of The Malay World and Civilization, National University of Malaysia
[2] Institute of The Malay World and Civilization, National University of Malaysia

[1] p119285@siswa.ukm.edu.my
[2] nzalina@ukm.edu.my

Abstract. Mapping is an early step in the preservation efforts of the historic town. It serves to identify the details of the local heritage in full. Without good mapping data, the survival and effectiveness of preservation work will be affected. In contrast to large-sized historical town, mapping data on small-sized historic town is often incomplete to the detriment of preservation development. Up till disturbing the heritage and morphological image of the town. Thus, this study was carried out to look at the development of mapping and its implications for preservation work in small-sized historical towns. This study has chosen Chukai Town as a study site as it has an important historical background as one of the administrative locations of the colonial parties in Terengganu a long time ago. Analysis of map documents that have been carried out and semi-structured interviews on stakeholders are methodologies applied to achieve the results of the study. This study refers to the implementation process of the Historic Urban Landscape approach as a guideline analyzing preservation actions that have been carried out. As a result, there was a delirium in the implementation of the mapping resulting in the neglect of the existing heritage by the local authorities themselves. However, there is no denying that significant preservation efforts have been undertaken by this party. This study concludes that mapping should be a mainstay in the implementation of urban preservation as emphasized through the Historic Urban Landscape approach.

Keywords: Mapping, historic town, historic building, Historic Urban Landscape.

1. Introduction

Preservation can generally be understood as an act of care and repair of heritage values based on a careful and appropriate planning plan to avoid any threat of damage. B.M. Feilden (2003) is of the opinion that preservation is an action taken to prevent decay and decay and to implement actions to manage change dynamically. In the context of urban preservation, it is a management action to extend the life of existing tangible heritage such as historic buildings so that they can be used in the future. This idea is synonymous with the view of Yazid Salleh (2010) which states that preservation is a field or activity that is capable of maintaining the heritage value of the site or building of interest that exists to continue to be used in modern times.

The retention of heritage values in a town can provide remuneration in terms of local economy and culture. The historic town as an important element of the local cultural heritage has significance to be maintained and restored. This is because it is important to the historical and socio-cultural development of the local community and the country. In fact, Malaysia has long applied progressive efforts to the preservation of historic town. This can be evidenced by the introduction of the inheritance care law from 1976 until the update took place in 2005.

Malaysia, as a country rich in historical developments, has long undertaken historical urban preservation efforts. Urban locations such as Kuala Lumpur, Georgetown, Melaka and Kota Tinggi are among the early locations of local townships that have been applied preservation efforts (Yazid Salleh, 2010). Since the 1960s, urban preservation efforts around Peninsular Malaysia such as Kota Johor Lama, Johor and Kota Netherlands, Pangkor Island have been an important sticking point in the early steps of local urban preservation. The successful preservation of historic town in Malaysia is also supported by the aspect of location mapping and heritage zones that have been clarified through the District Local Plan and the Special Area Plan planned by the authorities in their respective localities. As a result of such developments, it can be seen that the location of the old towns such as Kuala Lumpur, Georgetown, Taiping and Melaka has received more secure preservation efforts, as well as being a popular cultural tourist hotspot.

To this day, however, it can be assumed that the effectiveness of local old-town preservation measures is still questionable, especially looking at the mapping of historic town in a broader context. Good preservation efforts are often undertaken on large-sized historical urban locations such as Georgetown, Taiping Kuala Lumpur, etc. However, the location of small historical towns such as Chukai Town is less given the same emphasis. Then caused such a morphological element of the town to be disrupted.

In carrying out preservation actions, the mapping aspect is the most important component in guaranteeing effectiveness. Mapping is the first step in carrying out any preservation efforts. It is very important to study as through complete mapping, details such as location, age and number of buildings and monuments available in a town can be clarified. It is also important to clarify the developments that have taken place in the historical town. B.N. Prabowo, *et al*, (2020) has clarified the importance of mapping in looking at the development and care of physical heritage in a historic town. The representation of such heritage value details will show the importance of heritage in a more focused manner, as well as being able to attract stakeholders to pay more attention to an area. L.W.C. Lai, *et al*, (2017) has demonstrated the usefulness of mapping as a representation tool capable of highlighting the importance of heritage and indirectly guaranteeing its preservation. According to C. Udeaja*, et al*, (2020), complete mapping can facilitate the identification, planning and management of heritage preservation in the town. Therefore, it is clear that mapping is essential as the foundation stone for the preservation of a more secure and planned historic town.

Incomplete mapping can hamper any effective and lasting historic urban preservation efforts. It is this kind of challenge that has disrupted the preservation journey of Malaysia's small-sized historic town. Chukai town is a small-sized historical town that has been identified as facing such problems. Thus, this study was carried out to look at the development of mapping that has been carried out and its implications for preservation work in Chukai Town.

2. Literature Reviews

Urban preservation is an important action to maintain the heritage image available to a single urban area, especially in discussing the historic urban context. This image is highlighted through the construction of old buildings, monuments and the entire environment that has been built for a long time. N. Cohen (2001) has asserted that preservation over the town is a cultural necessity. This is said to be because the development of the town through modern development has put pressure on the historical and socio-cultural values that are aesthetically and uniquely existing and flourishing in a town. Such pressure if not given special attention will have adverse effects such as neglect, damage and dispossession to the survival of historical values on a town. Therefore, there is a need for an appropriate preservation measure to preserve the original morphology.

Old or historic town preservation efforts have gained the attention of many researchers around the world. This is due to the desire to preserve the value of cultural heritage in their respective localities. The world organization has also focused on this effort and has even given recommendations on the best approach in implementing the best approach to preservation of the old town. UNESCO has come up with the idea of taking the *Historic Urban Landscape* approach in implementing preservation. This is because this approach is seen as appropriate for the majority of old and historic towns, regardless of the size of the area. This approach emphasizes the need for mapping as a critical initial step in ensuring preservation. As an old town with issues in the aspect of mapping, this approach is seen as appropriate to apply. Especially in the context of seeing the relationship between the lompong mapping and the deterioration of the preservation of heritage value in the area.

Historic Urban Lanscape (HUL) is a comprehensive conservation and preservation approach to historical town that was recognized and adopted by UNESCO in 2011 (UNESCO). This approach strives to provide improvements to the sustainability of planning and design that impacts the existing built environment, heritage, cultural diversity, socio-economic and environmental factors related to community values (UNESCO). Hoda Zeayter, *et al*, (2018) explained that through this idea, there are two prominent features which are (i) the broader territorial and landscape context and (ii) the cladding and interconnection of cultural and natural values over time.

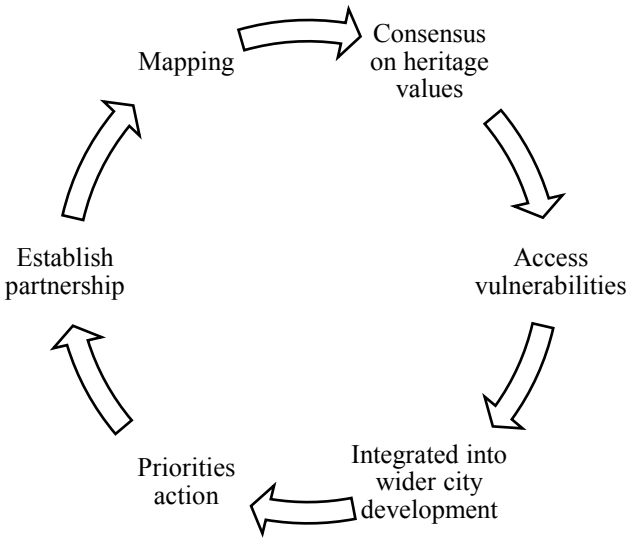
Through the HUL approach, one element that attracts attention is the emphasis given to the mapping function of the study areas that are reviewed and analyzed characteristically. In fact, mapping is also seen as a means of identifying the location, condition and function of the entire study area during surveys and investigations for preservation purposes. Through the HUL implementation guidelines, it has been specifically emphasized that comprehensive monitoring and mapping is the first critical step in the implementation of this approach (UNESCO, 2016). There are various mapping methods often involved in studies that apply the HUL approach including manual and digital methods such as documentation research, survey techniques, the use of *Geographic Information Systems* (GIS) and many more (Hoda Zeayter, *et al*, 2018). Mapping tools such as captivity, 3D painting, and photography are among the synonyms used. Figure 1 details the analysis of topics, techniques, methods and tools used in HUL.

Figure 1: Analysis Topics, Techniques, Methods and Tools Applied in a Historic Urban Lanscape Area (Doratli, et al, 2001; Hoda Zeayter, *et al*, 2018)

Complex layering of urban settlements					
Physical context study	Analysis topics			Techniques and methods	Tools
The site's morphology (Analysis of Natural Environment)	Topographical features Soil Landscape-vegetation Plantation-Flora/Fauna Water Climatic Features			Surveying Techniques	Maps Tables Charts Diagrams
Analysis of the Built Environment (the Historic centre and the contemporary part of the city)	Physical Analysis	Location analysis		Documentary research	Maps
		Historic analysis		Documentary research	Data collected from books, maps, documents
		Urban pattern analysis	Form of development	Morphological analysis (Conzen Methods)	Maps 3D drawings
			Solid-void relations	Figure-ground analysis	Maps
			Street pattern, urban spaces	Linkage theory or/ Geographic Information Systems (GIS)	Street silhouettes 3D scaled sketch drawings Photograph
			Elements of the area (paths, nodes, edges, landmarks and districts)	Lynch analysis	Maps photographs 3D scaled sketch drawings
			The gap sites and vacant plots of land	Lost space analysis	Maps Photographs
		Architectural evaluation		Site surveying	With sketch and measured drawings and photographing; information gathered on tables for all buildings
		Technical infrastructure		Documentary research	Maps and reports
	Functional Analysis	Accessibility/ permeability/ traffic circulation		Traffic and transport. survey	Maps and reports
		Functional distribution		Land use survey/ GIS	Maps
Infrastructures	Technical infrastructure (above and below the ground)			Documentary research	Maps and reports
Open spaces and gardens	Historical and functional evaluation of open spaces (part of urban pattern analysis)			Site surveying/ GIS	Maps photographs
Perceptions and visual relationships	Architectural evaluation			Site surveying	Maps photographs

Erkan (2018) has also highlighted the importance of mapping as a support for the initial process of historic urban preservation. Without good mapping data, more comprehensive preservation work cannot be carried out effectively. This is also emphasized by B.N. Prabowo, *et al*, (2019) in looking at the development and physical changes of the historic town of Semarang Old Town. Analysis of documentation through mapping that existed from the beginning of 1695 to 2019 has been observed to look at the chronology of development and changes in the town more comprehensively. This proves that mapping has succeeded in explaining the development of Semarang Old Town. Once again emerged as an important medium has been in any preservation effort. Therefore, any effort towards the preservation of historical sites needs to focus on mapping data to see the changes and developments that occur.

Figure 2: HUL Action Plan
(Erkan, 2018)



The developments that took place in the town led to a change in the morphology of the town. Indirectly there are changes in the fabric of urban layering. Such changes need to be reviewed and recorded through regular mapping as an effort to preserve the town's cultural heritage. The HUL approach places great emphasis on mapping as a tool to identify the heritage treasures associated. This is as emphasized in the definition of HUL which states the use of topographic maps to find out the heritage value of the town in more detail. Especially involving the built-up historic built environment in the urban layer. This proves that HUL is indeed implemented to preserve the existing cultural heritage of a town. Therefore, the identification of this heritage value through mapping is emphasized in HUL, in line with the principles of the HUL approach (Erkan, 2018) and the implementation of HUL (UNESCO, 2016).

As stressed in Malaysia, there is a preservation effort similar to the HUL approach in the location of the big old town. However, the same emphasis is not placed on the small-sized old town, as is the case with Chukai which is seen as having problems in terms of mapping data especially related to built heritage. To this day, the mapping work is not carried out well until there is a grouping in obtaining mapping data with complete details. Indirectly, it can be concluded that there was neglect of the preservation work of the old town of Chukai at an early stage. This situation is capable of invading heritage rights on historical buildings, so much so that some buildings have been disposed of. In line with Mohd Qaween Mootar (2019) is of the opinion that such documenting problems are inhibiting preservation work. HUL emphasizes the importance of mapping in identifying the heritage values of the historical town. This is as explained in previous studies that emphasise mapping for the initial steps in the preservation efforts of more sustainable old towns.

3. Methodology

This study used a qualitative approach involving 2 methods of data collection i.e., document analysis and semi-structured interviews in achieving the study goals. The analysis of the documents in this study refers to the analysis of 2 mapping data found on the old town of Chukai. Preliminary studies have found that there is a mapping showing detailed details of the heritage of the construction in Chukai released in 1995. Through this mapping, details such as address, type of building, construction style and number of buildings have been set out in quite detail. However, there was no follow-up on the mapping the following year. The Town Planning Department, Kemaman Branch however has carried out a new mapping showing the name of the road and the latest building lot in Chukai. However, in terms of details of the old building data, it is not specified in the mapping.

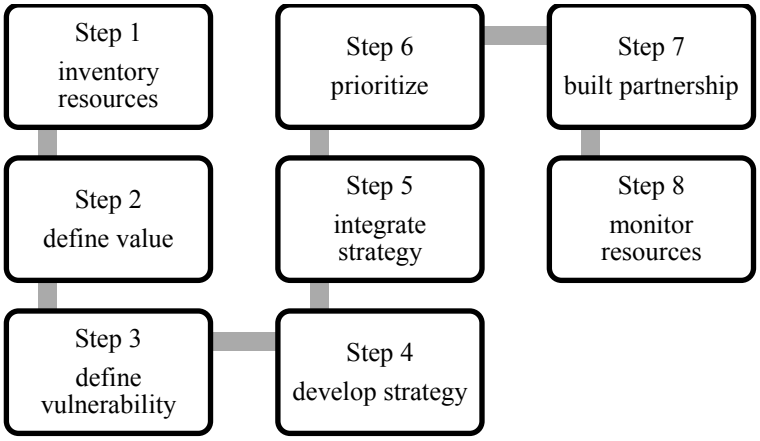
Data collection methods involving semi-structured interviews were also carried out to obtain information on preservation efforts that had been carried out on Chukai. This includes to learn more about the implementation of heritage mapping of the constructions found around the urban area. The interview was conducted on a representative from three interests to be involved in the implementation of the preservation of the old town of Chukai. These three parties have their own authority based on the role that can be played in the context of local administration. This is because these parties function as planning bodies and are also able to act as implementing bodies on urban preservation matters. These three parties consist of (i) Town Planning Department, Kemaman Branch, (ii) Plan Malaysia, Terengganu Branch and (iii) Kemaman Museum. Table 1 describes the analysis methods of the study data after the collection of data through documents and interviews has been conducted.

Table 1: Data Analysis Methods

K. Data Citation	Data Source/Sample	Data Analysis Methods
Document Analysis	• Mapping of Pre-War Buildings in Chukai Town • Recent Mapping	I. Compare the two mappings to get an up-to-date picture of the location of historic buildings more accurately. II. Pay attention to the changes that occur such as the change of street name, building name, etc.
Semi-structured Interview	• 1 representative of Town Planning Department, Kemaman Branch • 1 representative of Plan Malaysia@Terengganu employees • 1 representative of Kemaman Museum officer	I. Identifying preservation efforts that have been carried out by the authorities on historical buildings. II. Refine the mapping and preservation framework carried out.

As a result of the findings of this data, an assessment of the preservation measures taken by the stakeholders in Chukai was carried out. This assessment is also based on practical guidance from the HUL approach. As a comprehensive old-town preservation approach, HUL has issued measures to implement appropriate preservation. This approach is a universal approach (universal) as it has also been implemented in large and small old towns in some of the world's old town. This shows the credibility of this approach as an effective guide. HUL's approach through its guidebook has released an analytical policy tool based on heritage taxonomy (UNESCO, 2016) used as a value indicator to implement the comparison of preservation implementations that have been carried out in Chukai. There are 8 steps based on this process as shown in the diagram below.

Figure 3: The Implementation Process of the HUL Approach (UNESCO, 2016)



3.1 Selection Study and Justification Area

The study was conducted in Chukai Town, Terengganu, a small-sized old town located next to the Kemaman River. Its location which is located close to the Kemaman River gives the area great importance in terms of the local economy. This area has also once emerged as an economic hotspot that has gained rapid development since the British colonial era. As a result of preliminary studies, it has been found that the main

problem with the development of cultural heritage preservation through historic buildings in Chukai Town is the absence of periodic mapping of complete historic buildings. This statement is due to the large number of historic buildings since its inception in 1992/1993 (Syed Zainol Abidin Idid, 1995).

The mapping carried out during the year can be considered quite complete as it includes details such as address, building volume, building type and architectural style in quite detail. A total of 28 old buildings of various types such as residential houses, shop houses, houses of worship and offices, were listed through the mapping. The locations of these old buildings are all located at Jalan Pasar, Jalan Sulaiman and Jalan Masjid (now Jalan Sulaiman and Jalan Pasar have been merged into Jalan Sulaimani). These buildings are very important in terms of heritage value as most of them have achieved heritage building status according to the National Heritage Department (JWN). JWN has issued guidelines on the age of buildings to achieve heritage building status, which must at least reach the age of 50, in addition to having to have a historically prominent interest (Act 645). The average old building expressed by mapping is 90 years old and above. Indirectly, the entitlement of all these buildings is viewed as a local heritage value.

Figure 4: Satellite Map of the Area Around Chukai Town
(*Google Maps*)

4. Results and Discussion

The findings of the study obtained 2 maps showing the appearance of Chukai Town. It has been found that there is an early-stage preservation work in terms of mapping that has been carried out on Chukai Town. Mainly involves the identification of the details of the historical buildings that are in the area. The first mapping was carried out in 1995 which also involved the Malaysian Heritage Trust (Syed Zainol Abidin Idid). The second mapping was carried out by the local authority (PBT) which is the Town Planning Department, Kemaman Branch.

In 1995 (Syed Zainol Abidin Idid), a study on the mapping of heritage treasures, especially on heritage buildings, was carried out which also involved the Chukai area. This mapping is seen as quite complete due to the important details highlighted such as volume, type of building and so on. As a result of the mapping, there were 28 pre-war buildings recorded and classified as heritage buildings in Chukai. In a total of 28 of these buildings, 22 of them are shophouses. While the rest are buildings that serve as offices, houses of worship, factories and residential houses. Table 2 explains the details of each building involved covering the type, name, location, architectural style and number of heritage buildings available.

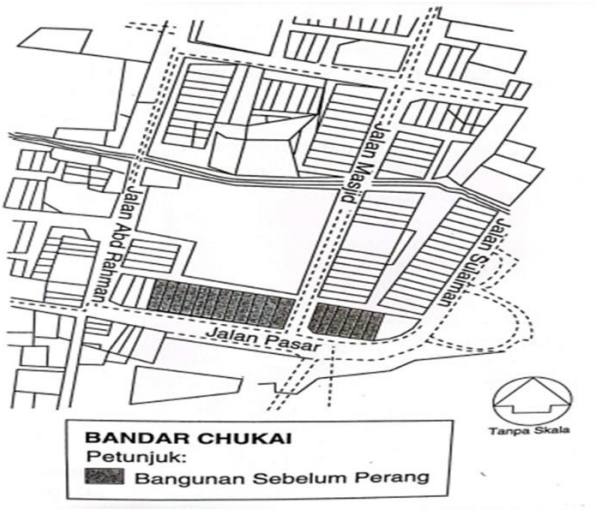
The average of the buildings listed in Table 2 is already almost hundreds of years old. For example, the Malayan Banking building was built in the 1920s (Terengganu State Museum, 2022). The building once served as an iron ore office during the British colonial era in Malaya. Now the building has been transformed into the Kemaman Museum. Apart from that, a row of shophouse buildings in Jalan Pasar have also been

built for a long time. The buildings were built around 1939, making it 84 years old. This is based on the building year carvings found at the top of the shophouse building.

Table 2: Distribution and Art Styles of Historic Buildings in Chukai Town
(Syed Zainol Abidin Idid, 1995)

Building Type	Building Name	Building Location	Architectural Style	Sum
Pre-War Tavern House	Not stated	Market Street	*Eclectic Style*	13
		Solomon's Way	*Eclectic Style*	9
Public Buildings	Malayan Banking Bhd.	Solomon's Way	Art Deco	1
House of Worship	Jamek Mosque	Mosque Street	Classic Malay Mosque	1
Refinery / Company	Siew Distillary	47 Burn Road	Early Colonial	1
Public Buildings	Former Customs Office	Solomon's Way	Early Colonial	1
Residential House	Not Stated	191 Chinese Village	Early Modern	1
Residential House	Not Stated	K52 Jalan Kampung Cina	Early Colonial	1

Figure 5: Sketch of Pre-War Buildings in Chukai Town
(Syed Zainol Abidin Idid, 1995)



This study also included a sketch map showing the location of the shophouses involved as shown in Figure 5. The sketch involves a recording of the shophouse building around Market Street. However, there is a downside in such a sketch as it only highlights a small part of the heritage building and does not highlight the other buildings as a whole. Although it is a small matter because the complete details have been listed, it is clearer and easier to understand if the sketch also involves other heritage buildings as well.

Nevertheless, with the implementation of such a pilot study, it can be seen that the implementer has managed to identify well the heritage buildings in Chukai. This shows that this area has historically prominent value and has the potential and is appropriate for further preservation action.

The latest map through Figure 6 has been given by the Town Planning Department, Kemaman Branch as a local authority with the authority to map and plan the development of Chukai Town. This mapping was initially implemented to identify building lots, land use, urban appearance and other details to implement development planning on the area. This statement is based on the findings from an interview on a representative of the local authority. This map illustrates the building lot plans available around Jalan Sulaimani, Jalan Masjid and Jalan Abdul Rahman, as the focus of the details of the location of the buildings listed in Table 2. However, there is significant input to be obtained from this mapping. Inputs such as street name changes are what have been identified in this mapping. The name Jalan Pasar is no longer used now because it only wants to use the name Jalan Sulaimani for the whole road. As self-disclosed by the local authorities during the interview. The difference in the street name can be seen in Figure 5 and Figure 6.

Figure 6: Building Lot Plan covering Jalan Sulaimani, Jalan Masjid and Jalan Abdul Rahman
(Plan given by Town Planning Department, Kemaman Branch)

The results of the research on both maps and analysis of semi-structured interview findings have found several important issues that can be raised. These issues are specifically affecting the historic buildings in Chukai Town. This has also caused the heritage morphology of Chukai Town to be disrupted and changed. Indirectly has a negative impact on the development of the preservation of this town. The issues are (i) the abandonment of heritage building mapping based on the latest map, (ii) changes to the morphology of urban heritage after 27 years and (iii) non comprehensive preservation efforts by stakeholders.

4.1 Neglection of Heritage Building Mapping Based on Current Maps

The comparison, which was made on the two maps, found that there was a neglect towards the mapping of heritage buildings in Chukai Town especially towards the latest mapping. The mapping in 1995 clearly highlighted the list of heritage buildings in the Chukai area. The research is to identify and implement the list with complete details, indicating that there is a local heritage value in Chukai that needs to be restored. However, this is not emphasized by the local authorities through the latest map provided.

The local authorities did not implement and did not continue the mapping of the heritage buildings that had been carried out. Thus, there is no continuity of mapping on the 28 buildings involved until today. Recent mapping has proven this statement. The mapping was not able to highlight or highlight the details of the

heritage building, as implemented in 1995. This is because it is not such focused. Mapping is more functional to find out what the urban area looks like in general including Jalan Sulaimani, Jalan Abdul Rahman and Jalan Masjid, for local development action.

Based on the findings from the interview, the Local Authority does not have data on the details of the heritage building as presented in Table 2. In fact, the local authorities also do not track the current whereabouts and conditions of some of the buildings involved. This is due to the absence of data that can be accessed by the parties concerned. Buildings such as Siew Distillery and residential houses with the address 47, Jalan Bakar and K52, Jalan Kampung Cina are among the unknown buildings to the local authorities. Such a situation is due to the direct impact of the neglect of mapping by stakeholders.

4.2 Changes to the urban heritage morphology after 27 years

The results of the two mappings have found that there is a difference in the length of time between the two mappings. The first mapping was released in 1995, while the second mapping was obtained in 2022 (based on the acceptance from the local authorities). The difference in time periods of 27 years has shown some drastic changes, especially to the appearance or morphology of the existing heritage in Chukai Town. Based on the rough observation of the map given by the local authorities, it has been found that some of the heritage buildings listed in Table 2 no longer exist today. Or in other words may have lapsed.

Among the heritage buildings in question are Siew Distillery and residential houses with the address 47, Jalan Bakar and K52, Jalan Kampung Cina. As explained, the local authorities are not aware of the whereabouts of the three buildings. Even if you look at the map given, it can be assumed that the buildings are no longer there. This is because in the map given by the authorities, it is not stated on the location of the lots of these buildings. This not only provides difficulties in identifying the location and current condition of the building, but also disrupts the local heritage values. By reducing the number of heritage buildings available in Chukai Town, when compared to the mapping in 1995.

In addition, a more significant and prominent building in terms of functions and heritage values which was the former Customs Office have also been disposed of for local development planning purposes. The disposal of the site was done because the local authority wanted to create a green zone in Chukai Town. As a result, the site has now been developed into a promenade park under the name of Taman Persiaran Bandar Chukai. According to this party, the building has been disposed of because it feels that the building is no longer desirable to maintain. In addition to feeling that other developments can be applied to the site.

4.3 Non comprehensive preservation efforts by stakeholders

The results of the semi-structured interview conducted on the three parties responsible for the preservation affairs of Chukai Town, it has been found that the parties are less focused on urban preservation work. The evidence is that, according to the analysis of urban preservation implementation measures based on HUL guidelines (UNESCO, 2016), these stakeholders generally do not carry out preservation work well. Apart from not achieving the proper preservation process criteria.

Table 3: Analysis of actions taken by informants based on HUL implementation steps (UNESCO, 2016)

Process/Steps According to HUL Implementation	Actions That Have Been Taken By Informants (Yes/No)		
	Planning Department, Kemaman Branch	**Plan Malaysia@Terengganu**	**Kemaman Museum**
Step 1 – inventory resources	Yes	Yes	Yes
Step 2 – define value	No	No	No
Step 3 – define vulnerability	No	No	No
Step 4 – develop strategy	No	No	No
Step 5 – integrate strategy	No	No	No
Step 6 – prioritize	No	No	No
Step 7 – built partnership	Yes	Yes	Yes
Step 8 – monitor resources	No	No	No

The analysis (based on Table 3) found that all three stakeholders generally responded similarly to the preservation development of Chukai Town. The results of the interview found that there are two preservation measures in progress in Chukai Town, namely Step 1 (inventory source) and Step 7 (built partnership). Inventory refers to a detailed list of components found in a place (Hizani Izzati Rijat@Hijat, 2018). Within the scope of this study discussion, the inventory refers to the list of local heritage buildings. Therefore, Step 1 is to identify several areas and buildings that have significant heritage value.

Stakeholders such as the local authorities and the museum are aware that there are a number of buildings with significant historical background. For example, Kemaman Museum and Former Customs Office which has emerged since the colonial era. Apart from that, the party also knows that a row of shop houses in Jalan Pasar and Jalan Sulaiman were built during the same era. Then shows the building is important in terms of its history and age. However, due to the lack of data available, the party has only a brief knowledge of the heritage buildings around Chukai.

It should be noted that the Kemaman Museum has received the cooperation and preservation assistance from outside parties to develop and maintain the identity and function of the building. Indirectly, the seventh preservation measure has been carried out in accordance with HUL's guidelines, which is a built-up partnership. The building used to function as an iron ore office, subsequently changed its function by being developed to become a bank, Malayan Banking. However, in 2008 the building was purchased by the Terengganu State Government and handed over to the Terengganu State Museum in 2009 (Terengganu State Museum, 2022). Preservation work was carried out in the same year by two companies appointed by the Kemaman District Public Works Department.

The findings from the interview have also confirmed this. The Town Planning Department has explained that there is a land acquisition on the Kemaman Museum building site. It is one of the preservation measures

through the adaptive use of the building. The intervention from the Terengganu state government on the preservation effort shows that there is a concerted collaboration and built partnership to assist in the preservation of heritage buildings in Chukai. Indirectly confirm the implementation of Step 7 HUL on the area.

5. Conclusion

Urban preservation is an important action to preserve the existing built heritage in an urban area. The heritage values of the town, such as historic buildings, need to get preservation action to maintain the structure and lower the potential for serious damage. Mapping as an early step in preservation is very important to identify and highlight the town's architectural heritage. Complete mapping data can be used to implement any preservation efforts more effectively. The implications of the absence of this data cause the preservation work to not do well. In addition to being able to invite other problems such as disrupting the heritage image and morphology of the town. The case in Chukai Town is evidence that the abandonment of mapping data is capable of having a detrimental effect on the preservation work of historic town.

The mapping of historic buildings in Chukai Town is not well carried out. In terms of mapping implementation, it has no continuity, especially with regard to the mapping of historic buildings. Only the old mapping has highlighted the details of the existing heritage in full. While the new mapping is not given attention to this. Indirectly, the latest data on the existence and condition of the historical buildings in the area could not be obtained. The authorities also do not perform their roles properly. This is due to the fact that preservation action is not carried out thoroughly. Only 2 out of 10 urban preservations have been implemented. Thus, proving a disregard for the value of local heritage.

It can be concluded that the authorities did not pay serious attention to the preservation work of small-sized historical town such as Chukai Town. This situation also gives the impression that it is likely that the same situation is also in the shackle of most towns like this. As a country with a long historical background, Malaysia should do its best to preserve the uniqueness of its existing heritage. The built heritage should be well identified and restored. Only with such actions can the uniqueness of heritage and local history in each locality be maintained.

6. Acknowledgement

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Balancing The Development and Heritage Using the HeritageImpact Assessment: Case Study of Melaka Coast

Yasmin Amirah[1], Amir Husaini[2] and Asyaari Muhamad[3]

[1, 2, 3] Institute of the Malay World and Civilization (ATMA), The National University of Malaysia, 43600 Bangi, Selangor, Malaysia

[2] Corresponding author: arhusaini97@gmail.com

Abstract. Under the principle of sustainable development, in meeting the needs of the present, the ability of future generations to meet their own needs must never be compromised. Hence, balancing between urban development and the conservation of cultural heritage is a must and should always be observed. Criticism towards development especially in the coastal areas is expected to take place, especially after the strategic development planning of Melakaku Maju Jaya 2035 was introduced by the Melaka Government to boost the state's economy and further increase its competitiveness. The project development involved approximately 25000 acres in Central Melaka through the Melaka-Waterfront Economic Zone project. One of the main issuesof this project is the existence of the JWN's Protected Maritime Zone within the state's coastal area which makes any further modern development in the area becoming more sensitive, and a lot of aspects need to be considered. Through UNESCO's 17 Sustainable Development Goals which promote sustainable economic growth and communities, this article is explaining how Heritage Impact Assessment (HIA) which was formed through the ICOMOS guidelines can be used to balance both heritage and development aspects in Melaka coastal region and subsequently, these discussions will also provide HIA's recommendations and mitigations that need to be implemented to maintain well-balanced heritage management.

1. Introduction

Central Melaka, as a historic World Heritage Site, has put more emphasis on maintaining its centuries-old historical structures while still steering towards moderate economic development. The Melaka Muzium Corporation or PERZIM is the agency responsible for preserving and maintaining every heritage infrastructure in its terrestrial area. However, the task of preservation of the hidden underwater cultural heritage in the state of Melaka falls within the National Heritage Department's jurisdiction by Section 61: Underwater Cultural Heritage (Act 645).

1.1. Melaka-Waterfront Economic Zone (M-WEZ)

Strategic development planning of Melakaku Maju Jaya 2035 (PSMJ 2035) was introduced by the State Government of Melaka in the plan to boost the state's economy and further increase its competitiveness in attracting foreign investors. There are a total of 8 flagships were introduced intothis strategic plan from 2021 until 2035 as shown in Figure 1 (UPEN Melaka). One of the flagships within the PSMJ 2035 development plan is the Melaka-Waterfront Economic Zone (M-WEZ) which was proposed as an integrated development plan which reclaimed coastal area development of approximately 25000 acres across the shoreline in the Central Melaka district. This plan focuses on tourism-based development, including an international tourism center, smart city planning, industrial revolution 4.0, marine logistics center, and others as shown in Figure 2 below. This project holds the state economy through maritime-related activities in Melaka waters, emphasizing digital infrastructureand utilities.

Figure 1. Flagships in PSMJ 2035, with the main issue regarding the article discussions is the M-WEZ (yellow-top).

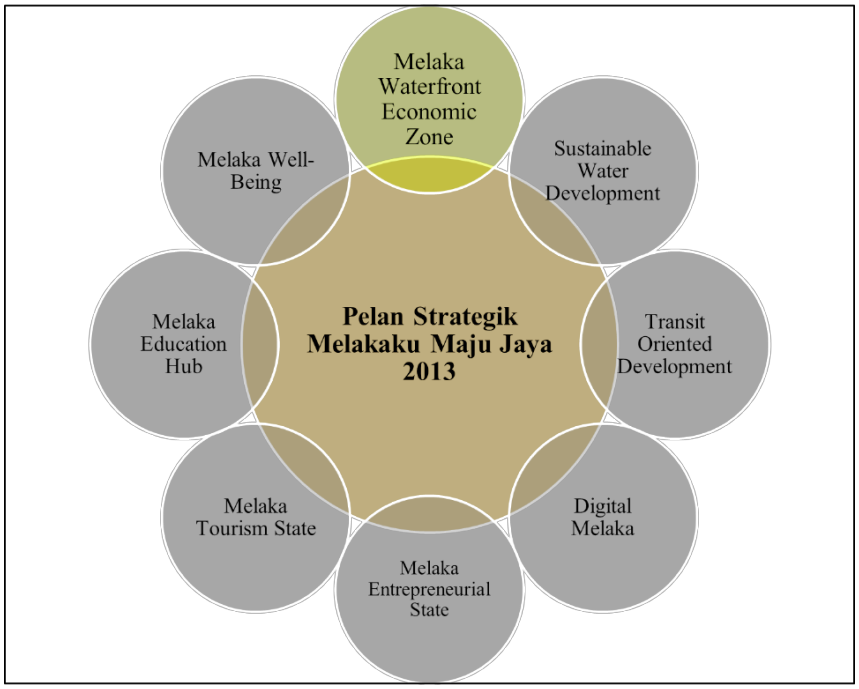
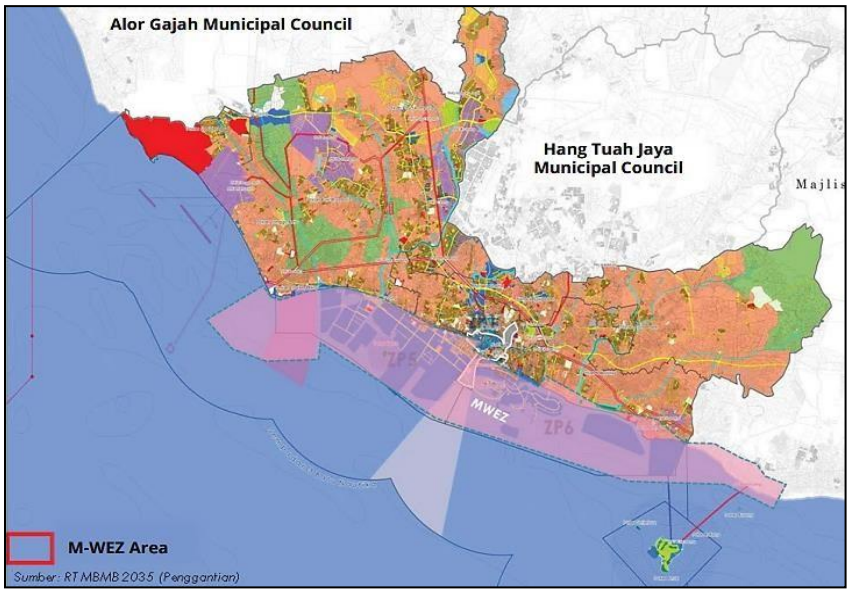


Figure 2. M-WEZ blueprint in PSMJ 2035.

Melaka had a development boom in the past years as the result of the implementation M-WEZ coastal development plan. However, this plan encountered several issues and sensitive matters as the development project requires agreement and confirmation from the federal authorities. This created debate among the state policymakers especially between the Malaccan Economic Planning Unit(UPEN-Melaka) and the National Heritage Department (JWN). Delicate matters such as Melaka's heritage and history, particularly in the maritime area that encompasses potential underwater cultural heritage that is not yet to be found along the state's coastal area, was one issue requiring another solution from both

federal and state governments. It is a pressing matter between the development planning and the heritage agency, where both are crucial to the state's economic welfare. Conflictsthat involved space and land, the idea that comes with how to utilize the space, and pragmaticstrategies on how to use the old buildings and locations are expected to occur and are all lost in these situations where zero holistic and sustainable development can be presented (Roders, 2017). While thedevelopers are keener towards the commercial values in the city's coastline area as Bandar Melaka hasbeen designated as one of the UNESCO World Heritage Sites in 2008, the heritage authorities might have another idea to reject any permanent damage that can threaten the World Heritage values. In this case, the proposed M-WEZ development area (shown in Figure 3) has directly sparked a contention between UPEN Melaka and JWN, in which the proposed area has overlapped with the existing JWN's Protected Zone as shown in Figure 4.

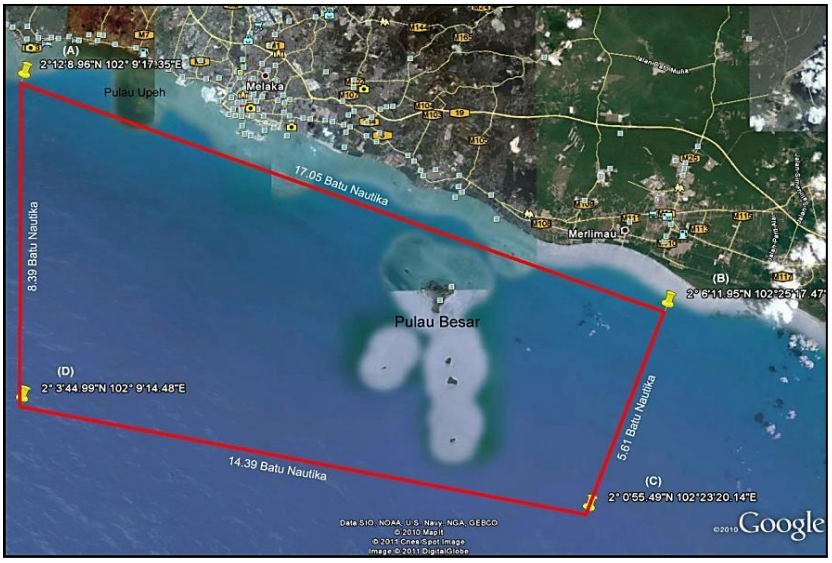
Figure 3. The precise location of the Melaka-Waterfront Economic Zone, Central Melaka.



1.2 Protected Zone of the National Heritage Department (JWN)

Besides the issue of historical aspects, there are other reasons why the sea reclamation project of M-WEZ became a debate between the two agencies. It was because of the existence of the protected zone gazetted by the National Heritage Department (JWN) since 2007. According to JWN (2013), the area along the shoreline from Merlimau to the south towards Tanjung Beruas in the north was the JWN's protected zone. Figure 4 below shows the zones made by JWN back in 2007. Due to the factor of the M-WEZ project overlay with the Protected Zone, discussions between the UPEN Melaka and JWN resulted in disagreements are expected as both parties have their standpoints. The development project from M-WEZ is likely to pose threats to the preservation of the underwater cultural heritage and the maritime history that Melaka holds, JWN has ordered an impact assessment on the heritage to be done to determine the next step of the discussion.

Figure 4. JWN's Protected Zone in spanning from Merlimau in the South to Tanjung Beruas in the North of Central Melaka.



1.3 The Contention Between Heritage and Modern Development in Central Melaka

Figure 5. The overlapping area of the M-WEZ reclamation plan (red tint) into the JWN's Protected Zone.

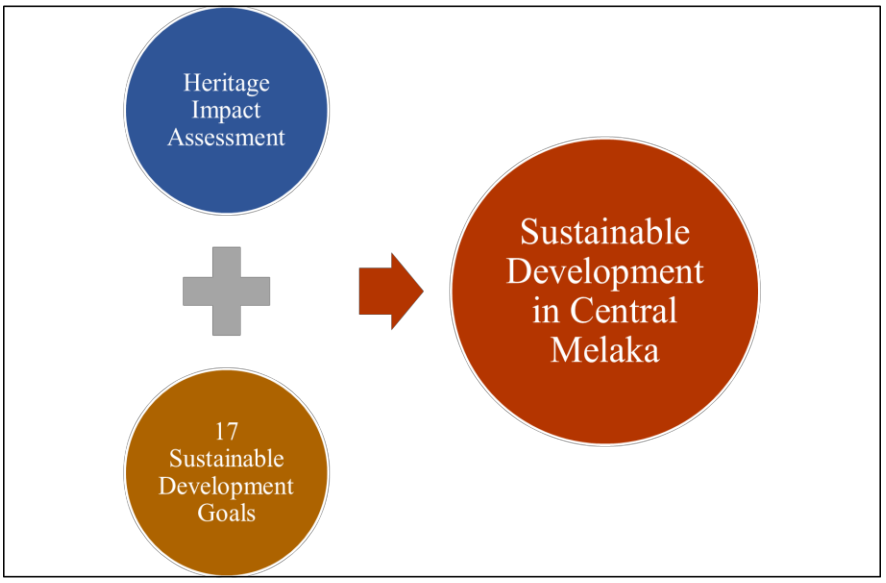
Due to the projected M-WEZ area's zone, disagreements between the JWN and UPEN-MELAKA are expected to result from this event. As shown in Figure 5 above, there is direct cotention between the preservation of cultural heritage and the progress of physical development in Melaka. These two aspects are seen to often go hand in hand as they both emphasize different cores. On the one hand, heritage preservation efforts are based on the importance of preserving historical remains, while modern development is based on infrastructure development (Husaini 2023). Clashes like this occur for various reasons, among them land competition factors, different views on how to use space, or failure to recognize the potential reuse of old buildings or locations where all these situations can lead to sustainable development goals being neglected (Rogers 2017). His view is also supported by Amat

(2019) who asserts that most developers are more interested in pursuing commercial projects in the coastal area of Melaka City as a result of its declaration as a World Heritage Site in 2008.

Therefore, this polemic not only shows a clash from the core aspects, but also contributes to the overlap of policies of each agency that has its own interests. JWN has mandated the implementation of a Heritage Impact Study Assessment (HIA) in advance for any development project to be developed in the coastal area of Central Melaka to reduce the negative effects of modern development.

1.2. Heritage Impact Assessments (HIA) and Sustainable Development Goals (17 SDGs)

Figure 6. HIA and SDGs as a method and guidelines to achieve sustainable development in Central Melaka.



In recent years, Central Melaka as the main economic hub for the state of Melaka has become more urbanized. The declaration of Bandaraya Melaka as UNESCO's World Heritage Site in 2008 alongside Georgetown of Penang has only become the catalyst in attracting more lucrative investmentsfrom both domestic and foreign investments which finally saw the implementation of a mega coastal development plan, the M-WEZ which is about to take place soon. As mentioned above, the overlapping area between the M-WEZ and the Protected Zone has directly stirred a dispute betweenthe Melaka-UPEN and JWN, with both sides upholding their agenda. Heritage was long absent from mainstream sustainable development despite its crucial importance to societies and the wide acknowledgment of its great potential to contribute to social, economic, and environmental goals (UNESCO, 2023).

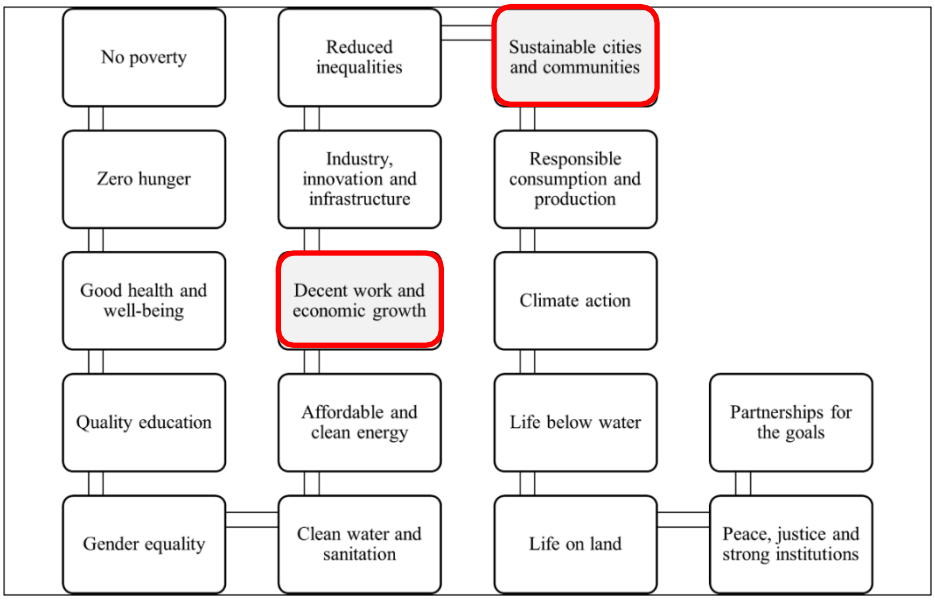
Due to the risk of losing heritage over the threats brought by this urban development, Heritage Impact Assessment (HIA) studies have been imposed as mandatory by JWN to preserve the existing underwater cultural heritage, both seen and unseen beneath the depth of the sea surface. HIA has become a necessity in building sustainable development for the heritage aspect in one country. It has been well established that HIA has become a rather popular method for resolving disputes and enhancing World Heritage (WH) conservation by sustainable development principles (Ashrafi et.al, 2022). A heritage impact assessment was supposed to be derived from the predecessor, the environmental impact assessment concept, and has been used as a key tool for heritage managers and planners. According to ICOMOS (2011), heritage impact assessments were developed within the context of environmental impact assessments since environmental impact assessments were lacking and in poor condition in treating the requirements of cultural World Heritage properties, especially regarding the Outstanding Universal Values (OUV). Rogers et.al (2017) mention that analyzing the impact of heritage values is necessary as they were often lost in development and have been used at anunsustainable rate. Heritage impact assessments offer the methodology to protect the integrity of heritage resources; which is to negotiate a

sustainable balance between the changes, progression, and conservation in a way that can maintain both the authenticity of the threatened heritage values, preserving the significance, meaning and the function towards the community; with the mitigation of negative effects from the development progress and changes, enhancing the community well-being.

The heritage impact study in Melaka usually gives focus on two segments: land and coastal areas. The land comprises locations full of historical architecture; the structure of worship places, settlements, and administrative buildings that have already been gazetted as heritage sites. All the sitesmentioned have their criteria to hold Outstanding Universal Values (OUV) and aged over 100-year- old, examples are Melaka Sultanate Palace, the A Famosa Fort, Tengkera Mosque, Kampung Keling Mosque, St. Paul Church, Christ Church, Stadhuys building (Muhamad 2001). Heritage according to National Heritage Act 2005 means "any National Heritage, heritage site, heritage object, or underwater cultural heritage listed in the Register," (National Heritage Act 2005: 12). Meanwhile National Heritage definitions "any heritage site, heritage object, underwater cultural heritage or any living person declared as a National Heritage under section 67 (National Heritage Act 2005: 16).

The second segment, the coastal area, also includes the estuary of Melaka River, where theremnants of old ports, shipwreck sites, and tens of thousands of items dating from the 15th to 19th century. The artifacts vary from the Melaka Sultanate period to the Portuguese, the Dutch, and thenthe British are among the discoveries. All the artifacts are connected to the maritime cultures of shipwrecks sites. Coins, ceramics, cannons, metals, and beads are among the antiques found in the maritime area. According to the previous survey reports in the Melaka waters maritime area, 30 to 40 shipwreck images were suspected (Jabatan Warisan Negara 2007). However, due to the limitations back then, continuity from that project was stopped and not completed.

Figure 7. 17 SDGs introduced by UNESCO, with numbers 8 and 11 (red) related directly with balancing the heritage and modern development in Central Melaka.

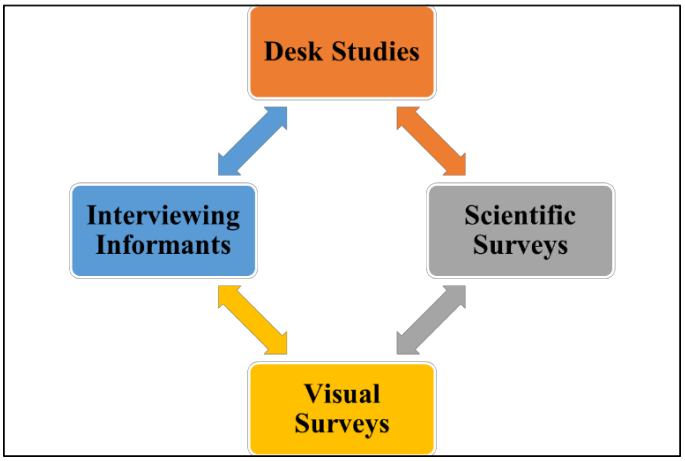


The 2030 SDGs were adopted by all United Nations Member States in 2015 which provides a blueprint to achieve peace and prosperity (United Nations Department of Economic and Social Affairs). The member states agreed to work together to preserve the oceans and forests alongside strategizing economic growth and other focus. Among all the 17 SDGs, numbers 8 and 11 (see highlighted ***Figure 7***) are 'promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all' and 'make cities and human settlements inclusive, safe, resilient and sustainable', are the ones that have close relation with coastal and sustainable tourism. The World Tourism Organization defines sustainable tourism as tourism that takes full account of its current and future economic, social, and environmental impacts, addressing the needs of visitors, the industry, the

environment, and host communities. Trying to align with the objectives of SDGs number 8 and 11, means through the development of the coastal areas in Melaka, would create an opportunity and improve decent work for the local communities. The development in coastal areas also calls for enhanced support for sustainable tourism activities and relevant capacity-building to contribute to the achievement of sustainable development. By the time of 2035 as PSMJ vision, Melaka is on its way to becoming a state with implemented policies to promote sustainable tourism that creates jobs and promotes local culture and products.

2. Methodology

Figure 8. HIA Data Gathering Method.



2.1. Desk Studies

Usually, a desk study or literature review will be conducted as the first step before the assessment can begin. By using this method, a lot of information can be gathered and gained such as previous reports about any conservation or even impact assessment projects, the laws that are relevant to be used regarding the project, articles written in journals or online websites, and books about the subject or location of the project area. All those information can usually be cross-checked to get authentic ones. In this heritage impact assessment, several topics were chosen as the focus of the desk study review, firstly, a review of the laws, and historical and past studies on the same location of this project.

The first focus of the desk study, which is the writings on the laws, the history, and past studies about the locations of projects includes the National Heritage Act 2005, reports on the survey work by JWN along the Melaka coast, the international laws especially on the Guidance on Heritage Impact Assessments for Cultural World Heritage Properties of 2001 y ICOMOS, and few other books by local authors regarding the historical aspect on Melaka history, was used. This desk study was conducted to find any correlation with the next method which is interviewing informants. Reports from previous archaeological excavations and HIA reports by ATMA Report (2020 and 2022) along with Flecker (2005) and JWN (2007), were referred. Based on these methods, it has been found that Melaka since the early 11th century was used as an important route by international traders (Muhamad 2018). Halimi(2021) also mentioned that the Melaka River was used as the main port for the dominance of the Melaka Sultanate in trading and shipping activities in the 15th century. Mills and Cheah (1997) stated that among those activities, tax collection systems also have been established for the East, West, Indian, and Arabs traders that come to Melaka port to trade. In 1990, there have been found by commercial salvage company ships that have been used in battle, filled with weapons, such ascannons, concludes as evidence of wars that were involved by the conquerors on the Melaka coast (Transea Sdn. Bhd 1995 and Nordin 2021). Orillaneda (2016) also mentioned in his writing that Melaka was considered as the prime polity in the 15th century in maritime trading, yet scarcely have any materials in underwater archaeology.

As mentioned, the report on a survey conducted in the early 21st century in Melaka, by Flecker in 2005 and JWN in 2007, has found a large sum of potential shipwreck sites nearby Pulau Upeh, Melaka.

Other than those report, other heritage impact assessments were conducted in 2020 and 2022 and revealed some artifacts, found by the local fishermen although it was not too important and give a huge impact on Melaka's history. Based on the desk study mentioned here, it was concluded that there were several findings of historical values regarding Melaka, through surveys and excavation reports. Therefore, any proposed development project needs to undergo a careful examination through heritage impact assessments among other assessments. It is still a huge concern that some artifacts and ancient antiques might come to the surface in the future due to development projects in future. Thus, a thorough examination process needs to be done in the first place to ensure no heritage values may be lost. So, it must be made mandatory for any future development project, especially ones that are located within or near the potential area of underwater heritage sites, to undergo the HIA process first (Muhamad & Husaini 2022).

2.2. Interviewing Informants

The second method applied in the assessment is through interviews. This is used to gather oral data, which cannot be found in any literature or written sources. This method also can be used as a cross-checked source for the literature review as mentioned before this. The informants often targeted the local people, mostly fishermen that constantly engage with ships and sea activities. This is due to the fact they used fishing nets, and sometimes the net might encounter possible sites or even the nets entangled with the artifacts. The interviews reveal certain details regarding artifacts found by the informants nearby the project site. While researchers conducted the interviews, some photos of the artifacts were taken, and measurements of the artifacts were recorded. Certain researchers that are familiar with the artifacts, might be able to analyze on-site the origin of the artifacts and estimation of the age of the artifacts. This step is important to make a comparison with the evidence or information found in the literature. A few informants that have been going to the sea for a long time, can give their rough estimation of possibilities to find any artifacts or even wreck sites that they have heard of from their elders. Based on this method, Table 1 shows the estimation of the possibilities of finding artifactsaround the Melaka coast. In Figure 9 below, the yellow-coloured region represents the highest percentage of possibilities to find artifacts located along Klebang, followed by the red region in Pulau Panjang which possesses the second highest percentage. Figure 9 below shows several of the artifacts that have been found and collected by the informants, some of them are still in good condition. According to the informants, they have sold the artifacts (see Figure 10) mostly to the privatecollectors that usually deal with them that offer a good price for the artifacts.

Figure 9. Map illustration of Central Melaka coast showing the groups of possibilities in finding artifacts, according to the informants.

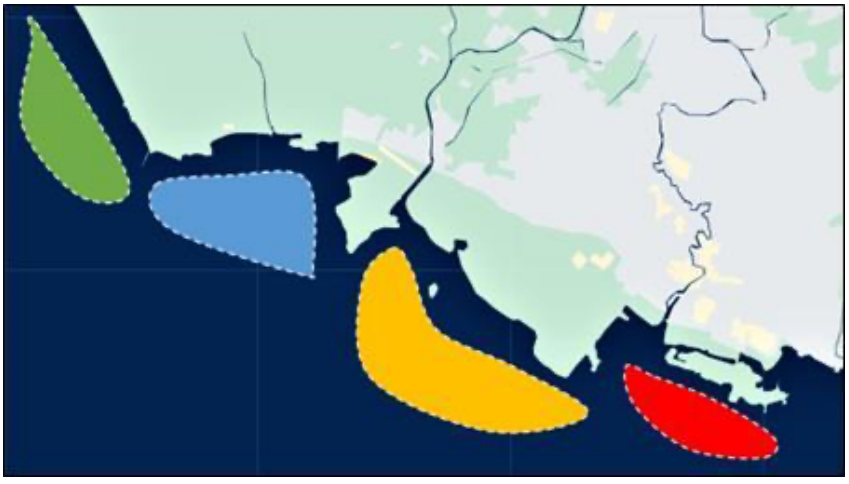


Table 1. Group areas and percentage of possibilities in finding artifacts.

Area	Percentage of Artifacts Findings (%)
Pantai Puteri (Green)	0-10
Lereh (Blue)	10-30
Klebang (Yellow)	30-90
Pulau Panjang (Red)	40-60

Figure 10. A few collections of ceramics were found by informants.

2.3 Scientific Survey

In heritage impact assessment documentation, using technology and scientific tools can help the researchers, even though the researchers should not be solely dependent on the tools. According to ICOMOS (2011), good heritage impact assessment documentation does not require a Geographic Information System (GIS), although it has been proven to be a helpful and powerful tool if used correctly. Good documentation will always follow the guidelines and systematically carry out.

In the case of heritage impact assessment on the Melaka coast, the three scientific survey methods that have been used are the Multibeam Echo-Sounder or the MBES which is a sea-floor surface scanning), Sub-Bottom Profiling, the SBP for sea sediment penetration, and the Magnetometer survey for the magnetic response. These tools helped greatly in detecting underwater objects and have proven to cut short the time used in surveying, and they are great in providing images that might present value during the assessment is carried out. However, this technology does have flaws within their system where they cannot provide great detailing in the findings. That is why the scientific survey is complemented by the visual survey.

2.3.1 Multibeam Echo-Sounder (MBES)

This scientific survey is shown in Figure 11 and Figure 12 below. This tool is used to detect any object located on the seabed. According to ATMA (2022), this tool can detect the existence of objectsbetween 1 square meter. It is however still needing the help of a visual survey. This tool comes to function when it comes to the bottom of the seabed and transmits back the data to the computer abovethrough the wave signal (see Figure 12 below). This method however cannot determine physically what is the object detected on the seabed until the object is brought up to be determined later.

Figure 11. NORBIT MBES with backscatter data and preparation of the receiver device, mounted to the side of the boat before the survey started.

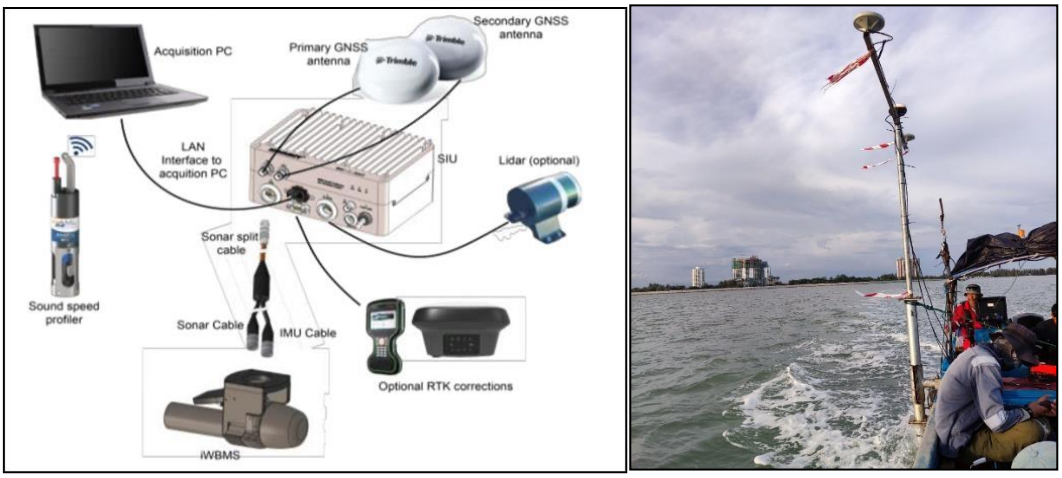
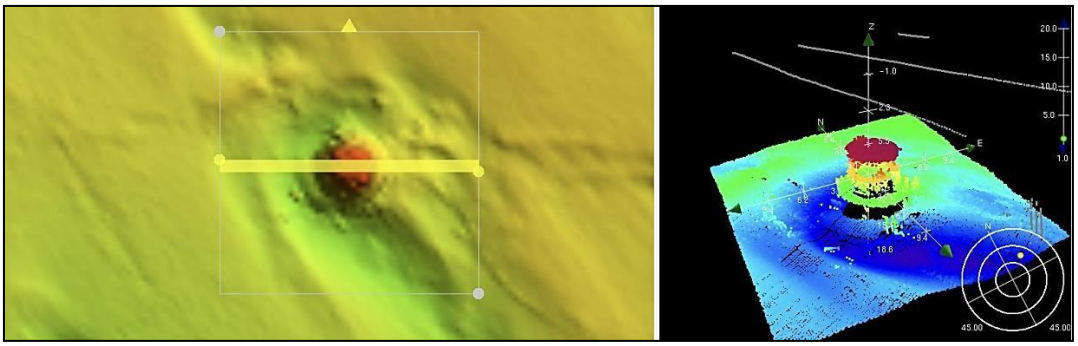


Figure 12. Example of MBES reading produced by the equipment, showing an underwater structure in the study site.

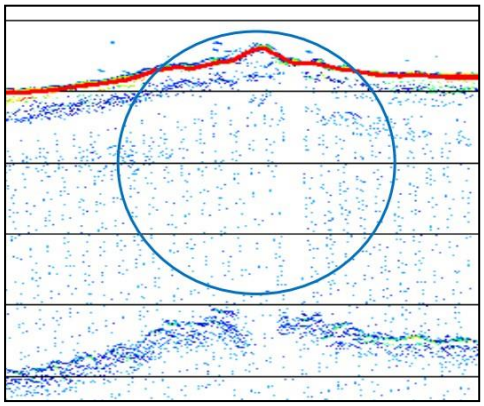


2.3.2 Sub-Bottom Profiling

After using the MBES, the second technology used is the SBP using the Pinger system as shown below in Figure 13 and Figure 14. This technology works by detecting any object that is submerged beneath the ocean floor as shown in Figure 14 below. SBP manage to penetrate and detect embedded object such as wrecks, artifacts, and other objects as deep as 10 meters into the seabed. Due to the reason that the condition of the Melaka coast being muddy, this method was essential for the maritime heritage impact assessment (ATMA Report, 2020). This piece of tool can help researchers to see through into the seabed that might offer important underwater data that cannot be detected by MBESor even by the visual survey.

Figure 13. Preparation of SBP INNOMAR 2000 mounted to the side of the boat.

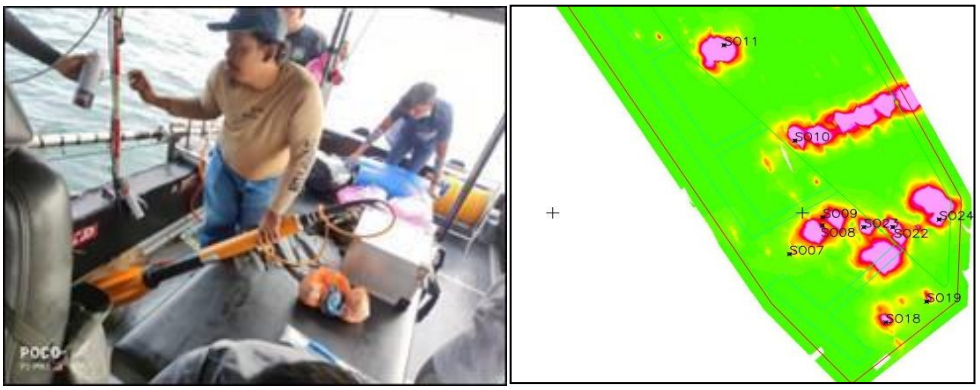
Figure 14. Example of SBP reading showing the penetration of the seabed during one of the studies.



2.3.3 Magnometer Survey

The last piece of equipment in the scientific survey used is the magnetometer which detected any ping of the magnetic response of anything on the seabed. The magnetic response later was translated into reading to the computer system above through a cable. See Figure 15 below for an example of the magnetic reading.

Figure 15. Preparation of Magnetometer SEA SPY 2 device to be towed at the back of the boat (left) and the readings produced show a magnetic response in one of the HIA studies.



2.2 Visual Survey

After the scientific methods, and if there are potential findings (collected through scientific data) underwater that need to be confirmed via visual survey, this method will be implemented using two choices. The visual survey can be implemented by scuba diving or by using Remotely Operated Vehicle (ROV) drone. Both will be determined on a case basis. This is due to the reasoning that a scientific survey cannot confirm the exact date of the findings; for instance, the exact shape of the object, thus needing the visual survey to take place. Figure 16 and Figure 17 below depict the example of scuba diving and ROV being implemented in the heritage impact assessment in 2022. The point of using a visual survey is to examine closely the remnants of ancient structures or artifacts under the water. According to ATMA Report (2022), the use of ROV instead of scuba diving can reduce the costs in terms of the diver's safety, especially at a location that has a strong current. With unpredictable conditions of the sea, especially with the visibility of the sea, this method is risky for both the divers and the ROV.

Figure 16. SCUBA divers in potential locations of findings at the sites.

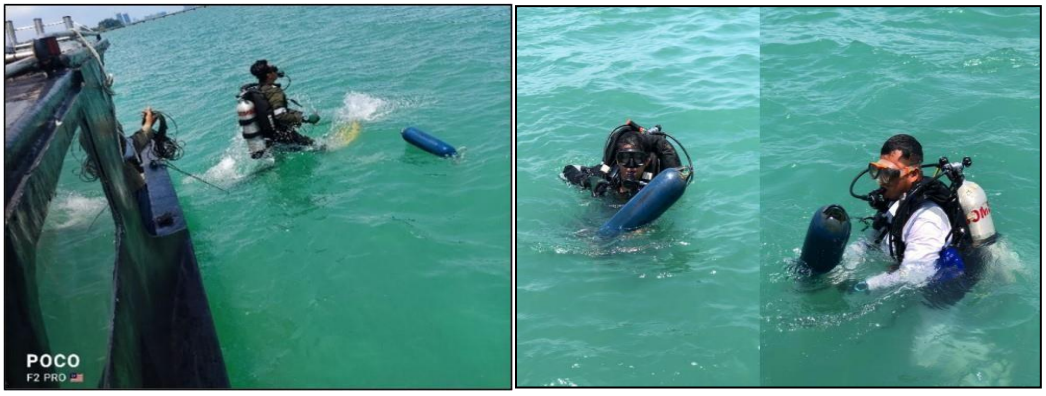


Figure 17. The Gladius Mini ROV is used to obtain visual images.

3. Results and Discussion

3.1. Past HIA results in Central Melaka water

According to the heritage impact assessment study, the methodology that has been used projected several results that can help to support the development proposal by the state UPEN Melaka. Using ICOMOS (2011) guidelines as a tool to balance both heritage and development, this maritime heritage impact assessment shows that by balancing and managing the critical issue in the proposed development project, the community, and state may gain benefit from the project and thus, booming the state's economy and creating a fair trade of decent work for everybody has been promoted by the SDG number 8. While the economy in Melaka can be preserved and sustained through coastal tourism, heritage management can be upheld and enhanced. The preparation of any heritage impact assessment report must include an assessment for each OUV attributes as simple as a minimalistic table and demonstrate how the results for each and collective heritage attribute have been obtained (ICOMOS 2011). According to Ashrafi

et.al (2022), the terms used such as 'identifying, predicting, and evaluating' give major objectives of the impact assessments. By using these terms, it shows especially important and what is often considered the technical part of the impact assessment procedure. Direct impacts from the development are those that arise as a primary consequence which can result in the changes of physical loss of part, or all, of an attribute or change to its setting such as the surroundings in which a place is experienced, its local context, and how it embraces the present and past relationships to the adjacent landscapes (ICOMOS 2011). The coastal environment of Melaka Straits' artifacts or findings including qualitative and quantitative evaluation are shown below in Table2.

Table 2. Heritage Impact Assessments in the maritime area on the Melaka coast.

Methods / Attributes	Literatur ereview	Informant sinterview	Scientifi csurvey	Scuba diving
30-40 shipwreck sites	/			
Qing period porcelain plate		/		
18th-century porcelain bowl		/		
Qing period clay plate		/		
Ming period jar		/		

As the above Table 2 shows, almost 30-40 images of shipwreck sites were recorded during asurvey in 2007 taken by JWN, however. According to the report, no continuous research has been done, for an undisclosed reason.

3.2. Impact assessment, recommendation, and mitigation measures

Aspects that need to be considered before implying any impact assessment, recommendation, and mitigation measures, include the local conditions. Especially the local conditions of the remnants of artifacts, ecofacts, monuments, or building structure that symbolizes the excellence of the universal heritage that is called Outstanding Universal Values (OUV). For instance, if the area that is being developed, does not carry any impact on the heritage value of OUV, we still need to consider the impact on local heritage value. Proper assessments need to be carried out before the recommendation or mitigations can be done. It is important to identify the scale or severity of any changes or effects on the attribute, as this is the combination that defines the significance of the impact, otherwise called 'significance of effect' (ICOMOS 2011). The assessment, proposal, and mitigation step in the coastal development area should consider the factor of site excellence and local heritage, based on below criteria stated below:

1) Impact on the historical heritage
2) Impact on the tourism industry
3) Impact on heritage sites
4) Impact on the environment

Historical heritage mentioned above is included the aspects of historical value, such as relics of underwater cultural heritage resources, shipwrecks, and archaeological artifacts. The tourism industry criteria are based on historical and heritage site resources. The heritage sites include the shipwrecks sites, and underwater archaeological sites – building structures, artifacts, and Eco facts. Using this criteria system, the heritage value is assessed with relation to statutory designations, whether it is international or national, the priorities or recommendations are set out in national research agendas, and the ascribed values. For this assessment to be carried out, a professional judgment is involved (ICOMOS 2011). This system uses the grading scale of 'very important' to 'no interest'. It is an evaluation of the findings in historical, heritage, and archaeological effects based on the criteria system. Table 3 below depicts the assessment of the system.

Table 3. The assessment of the value for the attributes.

Value	Impact			
	Value in Heritage/archaeology	Tourism industry	Heritage / Archaeological sites	Effect on environment
Very important	30-40 shipwreck sites			
Important				
Mediocre				
Low	Qing and Ming period potteries			
No interest	Iron chain and rotten cable			

Table 3 above is an assessment based on the findings during the survey in the maritime location conducted by the authors. Each scale shows the level of importance of the findings in the different fields. As shown above, the Archaeology and Heritage field, the findings, or the images scanned during the survey show the existence of shipwrecks under the water.

Figure 18. The effectiveness of the Heritage Impact Assessment study framework and the relationship between five additional evaluation factors.

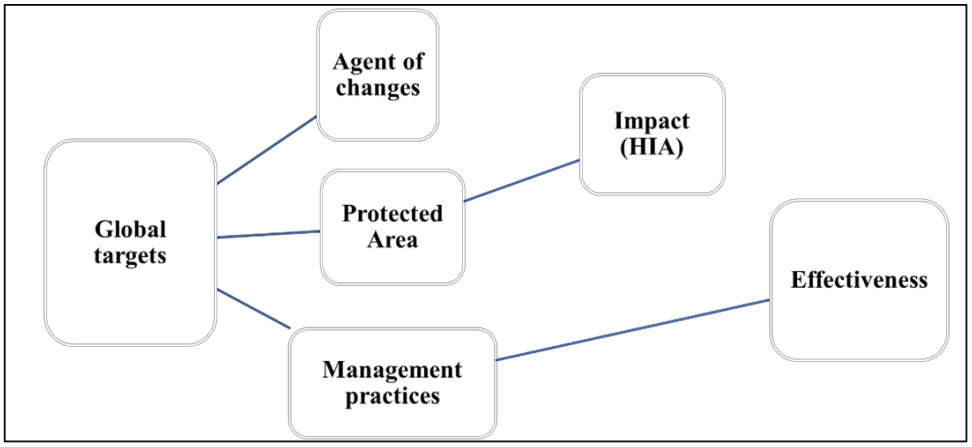


Figure 18 above shows the suggested framework to help determine the effectiveness of management practices which includes the heritage impact assessment practices. The framework acts asguidance to evaluate the assessment and explore the relationship between the five main sub- assessments. Among them are the protected urban areas, agents of change, and management practices. Assessment of the impact of agents of change, as well as the effectiveness of management practices applied, in the protected urban areas, requires input from three previous assessments. The assessment of a protected area is also known as an assessment of cultural importance and is often contained in a Statement of Interest (Statements of Outstanding Universal Value for World Heritage property). All these factors are used to determine the cultural significance covering cultural heritage properties, as well as to monitor the state of their preservation promptly. Assessment of agents of change relates to known and potential factors found to influence protected areas and is often considered a threat to or cause of deterioration of cultural heritage property conservation conditions. The evaluation of management practices focuses on the effectiveness of procedures, especially on the stakeholders involved in their actions and conditions.

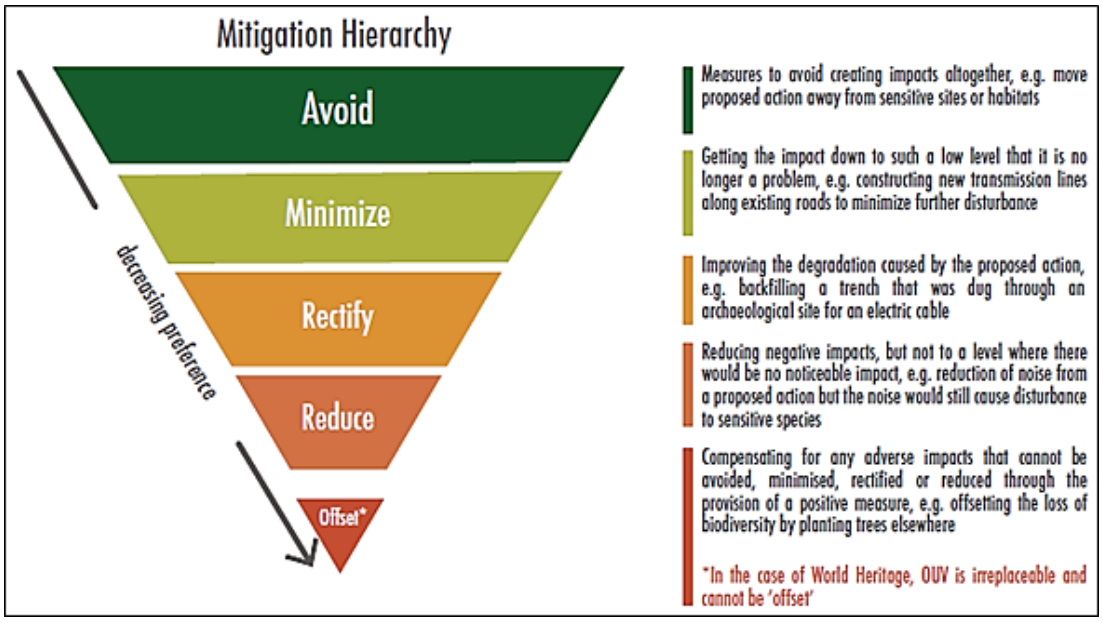
The heritage impact assessment study, as described, considers these assessments to determine the impact of agents on change to protected areas designed as cultural heritage, whereas effectiveness evaluation refers to the contribution of selected management practices, including the heritage impact assessment, to achieve targeted objectives in protected areas and agents of changes (Roders et.al 2013).

Henceforth, the M-WEZ development plan has the potential to generate significant returns for the Melaka state government, based on how the inflow of foreign investment, as well as for the tourism industry, especially in the coastal location. However, there are still a few important issues that need to

be considered, which as the recognition of the state of Melaka as a World Heritage City, given by UNESCO in 2008 (Amat 2019) and the JWN Protected Zone that overlap with the M-WEZ designated location. Therefore, sensitivity to any discovery of any underwater cultural heritage or artifacts related to the cultural heritage of underwater resources, namely shipwrecks, structures, and artifacts that contain or are relevant to local historical values, needs to be saved, recorded, and preserved first. Marine development work should be halted immediately and temporarily if there is any discovery on the mentioned findings above. For this matter, the developer should seek advice and recommendation from JWN to take the next step whether to conduct a comprehensive underwater archaeological study in the affected area. When needed, a specialist consultant with historical, archaeological, and environmental expertise should become involved in the comprehensive study.

Right after the impact assessment methods have been carried out in the project area, the data then be analyzed and turned into information for mitigation measures. This measure will be applied when needed to reduce the effect on the World Heritage properties, especially on the properties with OUV, as an essential requirement for preservation and management. As a result, the mitigation strategies can be built up to prevent, reduce, or offset the significant negative impact of the proposal or project on any World Heritages site (Ashrafi et.al 2022) shown in Figure 19 below.

Figure 19. The mitigation measures by UNESCO (2022).



Melaka coastline, especially, would have a high possibility of containing certain significant heritage findings, and it is advised that any development follow the heritage impact assessment regulations, including the mitigation measures set up by the authorities. Developers, however, are advised to always take precautionary measures even if there is no sign of heritage artifacts first presentwhile ongoing the development. But, if there is a sign or the developers found anything significant to the local heritage, they are needed to inform the authorities and stop for temporarily the progress. The initiative to bear the cost of salvage and excavation with the presence of an archaeologist. All the findings then must be reported immediately to the Melaka Museum Corporation (PERZIM) and JWN. This measure is stated in National Heritage Act 2005 Part IX: Underwater Cultural Heritage (National Heritage Act 645 2005). The article mentions that:

1. Any person who finds an underwater cultural heritage on the Malaysian coast shall, as soon as practicable, give notice of the discovery to the Commissioner or port officer.
2. The port officer upon receipt of the notice shall as soon as practicable notify, and if possible hand over the underwater cultural heritage to, the Commissioner.
3. The Commissioner may, when satisfied that the underwater cultural heritage has a significant cultural heritage, cause it to be listed in the register.
4. Any person who fails to give notice under subsection (1) commits an offense.

3.3. Impact of environment waste, monitoring, and Audit

As mentioned earlier, since heritage impact assessments are originally derived from environmental impact assessments, the study itself would need to include the environmental guidelines. In case they are any significant findings in the proposed location that require attention, in terms of environmental aspects, the same measures need to be applied. The mitigate ion measure would need to comply with the assessment of environmental waste, monitoring, and audit. In the case of the Melaka coastline, there are no requirements for any recommendation of environmental monitoring and auditrequirements. There are no significant findings while conducting the survey can be found.

Conclusion

The establishment of the heritage impact assessment study is a significant step forward regarding the conservation and protection of the cultural World Heritage values concerning sustainable development objectives. In terms of M-WEZ development, the strategic plan is the key point in boosting the economy of the state of Melaka. However, the conservation and preservation of the state's underwater cultural heritage must also be taken into account by implementing the assessment study. This study is an efficient methodology, as it employs a systematic examination of the full range of potential events and outcomes, combining an overview with detail.

As heritage impact assessment is not just for preserving Melaka state's heritage, it can also be used to provide benefits that enhance sustainable development planning in the future. The study is becoming increasingly crucial to make sure that any proposed development will not infringe on any area of archaeological and heritage interest of Melaka state and will reduce the direct or indirectimpact on any underwater archaeological site along with the site of any marine development project.

However, it is emphasized here that, if there are any findings discovered either intentionally or unintentionally during the project, the developer must report the findings to the authorities in advance before proceeding with the development work. It is the hope of the authors that Malaysia can be more advanced in the maritime archaeology field, both in theoretical studies and in practical terms, and can share their findings with other ASEAN countries, as we mostly share history and heritage.

Based on the development of M-WEZ in the Melaka coastal area, the study conducted is in linewith the requirements of JWN before any project can be started. The location of the site that overlaps with the gazetted area of the Protected Zone became a conflict, as the development of urbanization cannot be held for a long time as it involves too many stakeholders. This conflict has been resolved as the outcome of the survey provides that there are no artifacts or underwater cultural heritage that canbe found after three surveys have been conducted. If there are any suspicious objects found when the development progress, the developer has been advised to notify the authorities and take the mitigation measures into account.

According to sustainable development goals number 8 and 11, which are to 'promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all' and 'make cities and human settlements inclusive, safe, resilient and sustainable', this heritage impact assessment study along the coastline of Melaka, was proved to be a help to achieve those vision in 2035 soon. As a start, the study helps the state government to examine the Melaka Coast for any heritage-related findings before any development process gets started. This heritage impact assessmentwould be one of several ways in achieving sustainable coastal tourism in Melaka and able to keep the preservation of heritage standards and booming the economy of Melaka state.

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Cooperation between artists and cultural organisations in achieving the Sustainable Development Goals

Katarzyna Plebańczyk[1], Marzena Barańska[2]
[1, 2] Institute of Culture, Faculty of Management and Social Communication Jagiellonian University Krakow, Poland

[4] katarzyna.plebanczyk@uj.edu.pl

Abstract. Cooperation between artists and cultural organizations is generally analyzed from the perspective of achieving common artistic goals. However, throughout the history of culture, there have been numerous examples where actions taken extend beyond the artistic realm, becoming a voice in public discussions on important issues. Currently observed instrumental treatment of culture and its specific utilization in public management to achieve public policy goals, including SDGs, necessitates cooperation in various non-artistic areas, or joint actions in the context of building desired images. Simultaneously, we can observe pressures exerted by the environment on both cultural organizations (to build socially responsible brands) and artists (to be active in public life). The presented research results indicate the existence of complex relationships between artists and cultural organizations, resulting from the necessity to pursue diverse organizational goals, and the outcomes raise new questions and issues for further discussion.

1. Introduction

"Culture has intrinsic value as an expression of humanity, democracy and civic engagement that can be crucial in striving for sustainable development" (EP, 2021), and cultural activities are today one of the places where the achievement of the Sustainable Development Goals is being measured. Viewed in this context, it is found in almost all SDGs. As a result, it represents a direct goal for cultural policy, but also for the management of cultural organisations.
Due to the changing environmental conditions and the pressure to achieve the SDGs, cultural organisations are starting to adapt their activities more and more to them, while trying to maintain artistic objectives. Cultural sectors entities (especially those working in the performing and visual arts), are entering into collaborations with artists for this purpose. Artists are generally known to the public (they represent with their person the results of the projects undertaken), and in doing so build up their own image and that of the organisation they are associated with , which can bring both benefits and losses to both parties.

2. Literature Reviews

2.1. Culture and sustainable development strategies

Sustainable development has become one of the key objectives of modern public policy and planning worldwide. Defined as 'development that meets the needs of the present without jeopardising the ability of future generations to meet their own needs' (WCED, 1987, p. 43), it has gained prominence by focusing on three areas: economic growth, environmental protection and social development (WCED, 1987). The approach itself received numerous criticisms, e.g. Lele (1991) pointed out the need for environmental sustainability, economic efficiency and social justice, Jacobs (1999) criticised the vagueness of the definition, and Sachs (1999) or Sneddon, Howarth, & Norgaard (2006) noted the excessive focus on economic growth at the expense of environmental and social aspects. The concept, over a period of almost 40 years, has been subjected not only to criticism, but also to expansion into all areas of societal functioning. This is shown, for example, by attempts to link the concept of SD with human rights (Sen, 2005), economic growth with social equality and environmental protection (World Bank, 2001), climate change, social and economic inequalities, or natural resource conservation pressures (Sachs et al., 2019; Foley et al., 2015).

- Culture, initially overlooked in development discussions, has gained importance over time. Understanding its role in this context is key to shaping effective public policies and strategies for sustainability at different levels, from local to global. The topic has been taken up both in scientific discourse and in global public discussion. The UNESCO report (UNESCO, 1996) focused around the main areas in which culture has an impact on sustainable development, recognising that:

- Culture is key to identity and heritage. The report emphasised that culture is the foundation of national and local identity and heritage, and that preserving cultural diversity is important for community development and heritage conservation.
- Culture is a source of creativity and innovation. The report pointed to the importance of culture as a source of innovation, creativity and creativity that can contribute to socio-economic development.
- Culture is an important factor in economic development. The economic (but also social) potential of cultural and creative industries such as arts, crafts, media, design or cultural tourism is highlighted.
- Culture is a factor of social integration. It can serve as a bridge between different social groups, building mutual understanding, tolerance and influencing social cohesion. Culture influences globalisation. The report addresses the mutual impact of globalisation on culture and culture on globalisation processes.

The thesis of culture's key role in building more sustainable societies resonated quite strongly in the report, thus becoming the basis for further discourse. Hawkes (2001) argued that culture is inextricably linked to each of the three pillars and should be the fourth in order to achieve truly sustainable development. Culture builds the identity of societies, shaping their values and norms, and influences development decision-making processes, thereby shaping perspectives on the economy, social relations and the environment. Hawkes' work emphasises that sustainable development requires a cultural transformation that encourages a change in lifestyles, consumption and attitudes towards the environment. For this reason, it should be included in sustainable development agendas (Hawkes, 2001). To achieve it, it is necessary to recognise and respect cultural diversity (UNESCO, 2001) or to promote intercultural dialogue, which can lead to more responsible and sustainable approaches to consumption and changing lifestyles. Cultural values play an important role in defining the identity and goals of societies, influence perceptions of political action as acceptable and in line with the values of a community, and are important for creating bonds and a sense of community (Holden 2006). In the context of achieving sustainable development goals, they can influence what goals a community sets for itself in terms of environmental protection, resource use or the formation of social relationships, and cultural activities can be used to combat overexploitation of natural resources or the causes and effects of climate change (Nurse, 2006). Considering culture as an integral part of sustainable development means recognising its importance in the economy, society and the environment (Throsby, 2008). Sustainability, as a cultural value of many communities, can become a point of reference and a key element of legitimacy for government. Failure to integrate this value into policy can lead to a loss of public trust in authority (Holden, 2006). The UNESCO Declaration (2013), emphasises that public policies need to reflect and enhance the diversity of initiatives at local and national initiatives, and encourages the integration of culture into strategies for growth and social development. Culture can therefore play three key roles: a) culture can be an integral part of sustainable development, influencing development goals and values; b) culture can be used as a tool to support and promote sustainable development; c) the process of cultural development itself is an integral part of sustainable development (Dessein et al., 2015).

Today, it is considered as a key element in international and regional strategies. The adoption of Agenda 21 at the Rio Conference in 1992 (UNCED, 1992), the 17 Sustainable Development Goals by the UN General Assembly in 2015 (UN, 2015), or the focus on specific measurement indicators (Sachs, 2015), highlight the dynamics of change. UNESCO and the European Union support culture as a tool for solving contemporary social and economic problems, promoting cultural diversity, a facilitator of international dialogue (UNESCO 1996, 2013; EC 2007; EC 2018) or a tool for achieving the SDGs by introducing local development and innovation strategies (UNESCO, 2016). It can also be a strong economic engine, generating jobs and contributing to economic growth. At the same time, the cultural sector can be an

important source of knowledge and solutions for sustainable development, contributing to building a more inclusive and sustainable society (Throsby, 2008).

2.2 Governance of cultural organisations and the implementation of the SDGs

The 2030 Agenda has given countries responsibility for the implementation of the SDGs at national, regional and global levels and has presented them with more specific challenges (UN, 2015). Thus, countries that were already integrating the achievement of the Millenium Goals into their development strategies were given a more detailed approach that programmed new roles for culture and tasks for conducting activities in the field of culture (Plebańczyk, 2020). Cultural organisations play a key role in the implementation of the SDGs by linking them, e.g with innovation, cultural diversity, social inclusion and education (Borrup, 2019). The governance of cultural organisations is closely linked to the implementation of state development strategy and - indirectly (if the organisations are not public), or directly (if they are), with regional strategies, and the organisations' management strategies become crucial to strengthen the role of these organisations in achieving the SDGs.

Management strategies in cultural organisations have to balance the often conflicting commercial, artistic and environmentally-imposed goals, especially public policy (Bilton, 2017; Plebańczyk, 2022). Art, which is an expression of creative freedom, is often constrained by the need to make money or to conform to social and political expectations, and 'is never solely a matter of individual expression, but is also always placed in a wider socio-economic context' (Becker, 1982, p. 1). According to Hesmondhalgh (2007), arts and cultural organisations should engage in long-term strategies that integrate culture and the arts with the principles of sustainability and corporate social responsibility. A similar position is presented by Throsby (2008), who argues that cultural institutions should create value not only economically, but also socially, culturally and environmentally. Management strategies, require cultural managers to go beyond traditional management patterns, engage with different stakeholders and promote sustainability at multiple levels (Belfiore, 2002). They may focus on external objectives such as. promoting sustainable consumption and production (SDG 12), by encouraging creativity and innovation that minimises environmental impacts (Styhre, 2019); promoting peace, justice and strong institutions (SDG 16), by creatively articulating and exploring social issues (Novy, Leubolt, 2005); or ensuring inclusive and equitable quality of education (SDG 4) through educational programmes for young people, especially those who are marginalised or underserved (Belfiore, 2002). Achieving the SDGs can also be part of a strategy to target management processes in organisations, such as financial management, which allows for the creation of sustainable jobs (SDG 8) in the cultural sector (Throsby, 2010), the pursuit of gender equality in management (SDG 5), in the face of widespread knowledge of the dominance of cultural work by women, but who are not always represented in leadership positions (Oakley, 2013). In the future, cultural organisations will face funding and viability challenges in the face of increasing competition and changing economic conditions (Kotler, 2008). They will also need to make even greater efforts to integrate the SDGs into their strategies and activities. For, as noted in the previous section, culture is nowadays increasingly seen as a tool to achieve public policy goals.

Although cultural institutions do not seek profit in the way traditionally understood by business, their social value is invaluable and their activities are based on principles of sustainability that are fully compatible with Corporate Social Responsibility (CSR). The management of cultural organisations and CSR are areas that appear at first glance to be separate. However, the need to integrate CSR elements into the management strategies of cultural organisations is increasingly emphasised (Matarasso, 1997; Bilton, 2010). Indeed, the CSR approach focuses on three main areas: economic, social and environmental responsibility (Carroll, Shabana, 2010; Porter, Kramer, 2006; Visser, Matten, Pohl, Tolhurst, 2010). Cultural organisations play a key role in community building and a sustainable future, and have the opportunity to take a leadership role in CSR due to their unique position in society. At the same time, integrating the SDGs into the management process of cultural organisations will allow for better coordination of sustainability efforts, as the SDGs are according to the UN, a universal plan for people, planet and peace (UN, 2015).

2.3 Cooperation of cultural organisations with artists

Managing a cultural organisation is a unique field that combines elements of art, management and public policy (Kangas, 2002). Organisations, in order to achieve their strategic objectives, rely on human resource management, including harnessing the creativity and talents of employees and collaborators.

The development of cultural institutions is closely linked to the growing importance of artists. Their talents, skills and creativity are crucial to the success of a cultural institution, influencing audience attraction, image building and the achievement of the institution's mission and goals.
Cooperation between artists and cultural organisations affects the image of both parties. An artist, in the common understanding, is a popular person with an established image, a fan base, a position in the cultural market and in society. On the one hand, cultural managers manage the talents of artists, creating the conditions for their work and development; on the other hand, artists, recognised in society, work simultaneously for their image and for the image of the organisation with which they are associated (Kelloway et al., 2010). However, not only is artistic creativity unpredictable and subject to various external factors (Smith 2015), the artist himself may have different priorities and vision for his work and persona than the cultural organisation. At the same time, in a world where social media plays an increasing role in everyday life, artists are increasingly under pressure to engage with the public (Marwick, Boyd, 2011). They are expected to be socially responsible, not only through their work, but also through their public actions and attitudes (Markusen 2006, Christensen, Cheney, 2015), to inspire change on an individual and collective level (Gablik, 1991). This can be a source of conflict for artists, who usually prefer independence and creative freedom. The pressure on artists to be active in public life has many consequences, both positive and negative. Positive consequences can include increased public awareness, mobilisation for social change and increased public engagement (Guèvremont, Grohmann, 2017). Negative consequences, on the other hand, can include a restriction of artistic freedom, the risk of controversy and social tensions, and even potential damage to the artist's career (Dubois, 2012).
In the practice of managing cultural organisations, more and more attention is being paid to the key role of artists as a strategic resource. Indeed, the competitiveness of an organisation depends on its unique resources (Porter, 1990), and the creativity and skills of artists are among the most important determinants of the uniqueness of a cultural organisation. This is an area where the objectives of artists and those of cultural organisations may differ, leading to potential conflicts, but most importantly the artist can become an ambassador of the cultural institution. Due to their popularity and influence on the audience (Kotler and Scheff, 1997), which often builds positive associations between the artist and the cultural organisation, the effect of a positive image of the institution emerges (Falk 2009). These collaborations can also generate innovative artistic projects that attract media and public attention (McCarthy and Jinnett, 2001). The artist brings to the organisation his or her unique skills, knowledge and experience, which results into innovation (Shalley, Zhou, & Oldham, 2004), but is at the same time an uncertain and risky resource, due to its subjective nature and difficulty in evaluation (Throsby, 2001). As a result, managing uncertainty becomes a key challenge for organisations integrating artistic resources (Milliken, 1987).

3. Methodology

The authors' research on the management of artistic careers from the perspective of artists and the management of cultural organisations in the Polish market (carried out in 2020-2022, during the covid-19 pandemic and where 350 questionnaires were collected and 100 interviews were conducted with representatives of cultural organisations and artists), identified many additional issues, transformed into further research problems. Among them, one was considered interesting concerning the cooperation between cultural organisations and artists, who are increasingly often associated with a cultural organisation only for the purpose of realising an event (artistic project), remaining independent persons working more or less consciously for their own image (personal branding). Preliminary diagnoses have been made of themes, recurring in almost all statements, with reference to the achievement of the SDG goals by countries. In Poland, this means the implementation of the EU strategy and other international agreements ratified by the Polish state (including with the UN). Among the main themes relating to the cooperation of organisations and artists, there were first and foremost:

- Assigning new roles for culture in public policy and, in effect, its peculiar 'use' to achieve non-artistic goals;
- Public discussion on currently fashionable (promoted) elements of the sustainable development strategy (e.g. climate issues, ecology);
- Pressure from the public administration to achieve indicators related to the implementation of the country's sustainable development strategy (especially influencing social change);

- Pressure from the organisation's environment to build a socially responsible brand (transferred from the Corporate Social Responsibility business);
- The peer pressure on publicly recognisable artists to be active in public life, to be socially responsible or to take a side.

The above themes formed the basis for the formulation of new research questions, written as below:

- What roles do cultural organisations and artists play in public life today?
- What is the practice of managing a cultural organisation in the face of environmental pressure, e.g. achieving the SDGs accounted for by the organisers (public administration) in the context of cooperation with independent and well-known artists?
- Is there a contradiction between achieving the goals and indicators set by the SDGs and achieving artistic goals in the management of a cultural organisation? How do they balance each other out??
- How do cultural organisations collaborate with artists in achieving common goals? What are the limits of compromise?
- How do artists and organisations collaborate in building independent but similar images of being socially responsible?

In order to obtain a greater saturation of data and to be more representative, a qualitative study was conducted. To analyse the research material, a triangulation of data obtained among different interviewees (artists, cultural managers and artists' managers), collected between 2020 and 2023 from different sources and in different locations (large and smaller towns in Poland) was used. Research techniques included:

a) Secondary qualitative data analysis - from the 100 (raw and previously archived), interviews from the artist career management survey, thematic issues were extracted (based on pre-programmed keywords) - were described above as a basis for the new research questions, but selected statements from respondents were also used in the presentation of the results;
b) Analysis of data from 15 semi-structured interviews with individuals representing cultural organisations, cultural managers and artists' managers (purposive sampling), collected between December 2022 and March 2023. The interviewees were intended to be representatives of performing and visual organisations, selected for the nature of their activities and direct contact with artists. A non-random sampling (snowballing) method was used to select interviewees by recruiting participants from other participants.

The undertaken research was exploratory in nature, hence its relatively small scale. It should be noted, however, that cultural circles are very reluctant to take part in research, and conducting surveys or interviews here encounters considerable difficulties. The results, presented in the following section, are therefore limited in their scope. The netographic research being carried out at the same time (limited only to an analysis of cooperation on image-building of artists and cultural organisations, and therefore not directly used in this text), does, however, show considerable potential for extending the undertaken themes in a broader study in the future.

4. Results and discussion

4.1. The complexity of the organisation-artist relationship

Building relationships between the organisation and artists to achieve the organisation's goals is an important area that often brings challenges and difficulties. Cultural organisations and artists have different goals, as highlighted by a statement from the director of a philharmonic in a large EO city: "Organisations have to meet targets set by public policy, artists work towards personal branding. The common element is public approval of the goals pursued" (EO). In this context, AO - a dissemination coordinator at a public museum in a medium-sized city - complements the above statement by saying: "In an arts organisation it is important to be flexible and open to the changes that occur in society and culture. Only in this way we can effectively achieve the organisation's goals" (AO). A statement by RD, the director of a public theatre in a medium-sized city, complements the above by mentioning innovation processes as follows: "We need to be open to new ideas and approaches, as this is the only way to achieve our organisational goals. Artistic creativity and fresh insights can bring us valuable innovations"(RD). In doing so, it is worth noting that cultural managers also show a relatively high sensitivity to the needs and expectations of artists, e.g. the director of the AG contemporary art gallery emphasises the importance of dialogue and mutual respect, saying: "In the relationship with artists, it is important to listen to their needs

and expectations and to respect their contribution to the organisation"(AG). Informed collaboration and dialogue between artists and cultural organisations produces results. BS - the director of an authorial theatre in a big city emphasises this, saying: "I have always seen the development of ideas through how many people have been inspired by the success of our activities, how it has given many people the courage and belief that certain things can be done" (BS).
Collaboration requires sensitivity, mutual understanding and respect in order for the relationship between organization and artist to be effective. As BS pointed out: 'The artist and the organisation must be able to work together and trust each other. Mutual understanding and communication are key to success" (BS). In general, the need to understand the relationship taking place exists on both sides, although greater attentiveness is seen here on the part of managers, who have an additional awareness of the importance of the impact of the artist's image on the organisation and the environment. Interviewees emphasised that there is a need to recognise and appreciate the role of the artist as a creator and innovator, e.g. RD states that 'artistic success can inspire the whole organisation, spurring others on to greater achievements and bold actions' (RD). This issue was also emphasised by AK - coordinator of artistic work in a theatre in a large city, saying: "Artists are key contributors to the development of the organisation. Their creativity, originality and innovative approaches are of great importance in achieving the organisation's goals"(AK).
One of the elements of relationship building is the cultural organisation's sense of responsibility for the transparency and clarity of the agreements governing cooperation, in which the interests of both parties are secured, managing the artist's image in accordance with his or her preferences and professed values. Managers of cultural organisations usually take the view that it is their task to "create the right conditions for creative work" (RD) and "maintain creative autonomy in the face of social or political pressures" (KG - director of a large theatre in a large city), which more or less directly contributes to building positive image cooperation. The collaboration benefits both parties. The coordinator of artistic work and head of marketing at the TLA theatre said explicitly that 'working with artists allows an organisation to increase its attractiveness and prestige, and for artists it can be an opportunity to expand their audience' (TLA).
The relationship between the organisation and the artist is proving to be an important aspect of managing a cultural organisation. Mutual understanding, collaboration and support are key to achieving the organisation's goals. The statements cited indicate the need to recognise the role of the artist as an innovator and creator, to provide appropriate working conditions, to take into account the autonomy of the artist and to value collaboration and partnership. Finally, RD said: "We need to work together to achieve our artistic and strategic goals. And to meet society's expectations" (RD).

4.2 Artists and cultural organisations in public life

4.2.1. Social responsibility

In many artists' statements, there is a view that nowadays the measure of an artist's position on the market is not his or her artistic activity, but popularity, recognisability, the number of likes on social media, the number of albums sold or signed autographs. There is also a growing expectation that celebrities will take a public statements in social or political discussions. Awareness of social responsibility and the power to influence other people's views is generally high, but it is also often the case that artists act under the influence of emotion, without thinking about the consequences for either their own image or the cultural organisation. In interviews with managers, such a theme came up repeatedly. They also noted that this public activity "carries the risk of being classified, pilloried, ostracised in communities that express different views and results in decisions about potential collaboration with the artist" (AWW artists' manager). Despite this, interviewees emphasised that an artist does not always have to follow public policy and can have their own opinions on social or political issues, which they have the right to express publicly.
Many artists are aware of the public recognition, the baggage of social responsibility and use their position to engage with others. A statement by one female performance artist confirms this: "As artists we have some kind of social responsibility and opportunity to act for the benefit of other people. And we take advantage of it" (AZ). Active on social media artists communicate their views (more or less consciously influencing personal branding) through their own profiles or channels, achieving enormous reach.
The task of a cultural manager is to understand the role that cultural organisations and artists play in public and social life. The interviews show a high awareness among managers that these organisations have the potential to create social change, promote values and provide unique experiences. A cultural manager should be aware of this impact and strive to fulfil the social mission through their actions. As

AWW's artist manager said: "The organisation is the creator of that space where culture happens, but at the same time what happens outside of it is also its domain" (AWW). The director of an urban theatre in a large TL city, meanwhile, emphasises the positive effects of working with artists for the organisation, saying: "I see a lot of positives in the fact that we employ actors who are recognised in the public, not only as a result of their artistic activity" (TL).

4.2.2. Sense of agency and the limits of compromise

A sense of agency refers to the belief in our ability to influence the world around us. Both artists and cultural organisations often have this sense. As already mentioned, artists use their skills and creativity to take action to affect social change, they speak out on political issues. Cultural manager KP put it in the following terms: "They have a passion for doing something" (KP). Cultural organisations also strive to make a difference and influence reality, and as the AWW artists' manager pointed out: "It's that sense of empowerment that is key for me in this work, to just feel that we have the ability and the power to make a difference" (AWW). However, as interviewees emphasised, in order to achieve the desired results, it is essential to establish boundaries of compromise, often between the need to achieve the different goals of the organisation and the artists, or to constantly seek a balance between the goals and interests of the different parties involved in the process of seeking change. Cultural organisations have to manage the interests of both artists and cultural institutions efficiently, as the cultural manager AG notes - "to find the boundaries of compromise between artists, institutions and audience expectations" (AG). At the same time, in doing so they implement activities that are in line with public expectations and guided by public policy. As the director of the author's BS theatre noted, 'there is a need to find a compromise between different parties in the process of changing attitudes' (BS). Looking at the topic from a different perspective, JP - who works at the Polish Institute abroad and is in charge of promoting Polish culture - has the task of building the image of the country desired by public policy. Thus, on the one hand, she is responsible for selecting an appropriate offer; on the other hand, she points out in her statements the need to adapt it to the given environment. JP states: "You have to know what kind of audience comes to their institution for their performances. You have to trace very carefully what they have done before, what they are interested in, what their audience likes" (JP). When the aim is to satisfy sometimes conflicting expectations, such work is quite a challenge.

An important component of a sense of agency is the ability to adapt and learn from experience. Making changes and striving for progress often requires experimentation, risk-taking and reflection on the results. As KP's culture manager noted, there is a need to be open to experimentation and a willingness to learn from one's mistakes: "Doing things your own way and expressing yourself in a project, but also being prepared for the fact to be wrong and that will have to be changed. You have to be ready for it" (KP). In the context of changing social attitudes, artists, cultural organisations and cultural managers want to achieve concrete results. The boundary of compromise is a significant challenge, especially in organisations with many people working together on successive projects. As TLA, coordinator of artistic work and marketing manager at the theatre, notes in this regard, "it turns out that someone performs in a project, but at some point they realise that worldview-wise it might be placed in some context that is difficult for them" (TLA). As the AO museum's dissemination coordinator emphasised, 'compromise is a form of resolving conflict or reaching an agreement, but the boundary of compromise means that there are certain limits that cannot be crossed' (AO). Taking steps towards change requires artists and cultural organisations to be aware of the need to compromise, to be able to negotiate and collaborate, and to be able to maintain their own identity and creative expression. In doing so, it should be emphasised, following, for example, the artistic manager of the ZJ, that the boundary of compromise does not mean giving up one's own beliefs, values or goals, "it is rather a challenge that requires us to be flexible, empathetic and able to find a common language in the process of change. It is important to seek a balance between different perspectives and interests, with respect for diversity" (ZJ).

Yet another element in the discussion about agency and the limits of compromise is the context of artistic freedom, which applies equally to artists and cultural organisations. Both sides observe the pressure from the public administration, but also from the public, to take the desired attitudes towards current political or social problems, both in artistic and personal terms. Here, artist manager AWW emphasises the importance of artistic freedom for artists and their work. This freedom allows them to express their own ideas, messages and values in an authentic and independent way. Another manager - ZJ - states: "This artistic freedom we have is very important so that we can experiment, so that we can open up a theme"

(ZJ). The director of Contemporary Art Gallery AG believes that a cultural manager should be aware of and respect artistic freedom, providing artists with space to develop and experiment, he says: "What fascinated me was how to put it all together so that we can quickly and well help artists not to worry about anything other than artistic matters only" (AG).

4.3 Collaboration between artists and cultural organisations in achieving the SDGs

The pressure to be socially responsible, transferred from business (the concept of Corporate Social Responsibility), the settlement of tasks in the context of the implementation of public management strategies (in the countries of the European Union, the strategy of sustainable development) and the achievement of the required indicators, often place cultural organisations in a difficult position of choice. This is because, on the one hand they have to meet the objectives set by public policy, based on meticulous strategy, analysis and planning and bearing in mind the three key pillars: the environment, the community and the economy, and on the other hand, artistic objectives which, as the BS theatre director said, "are often abstract and subjective. It is not always possible to combine them" (BS). Another director, RD adds that 'management is based on strategy, logic and efficiency, whereas art is based on imagination, intuition and spontaneity' (RD), and contemporary art gallery director AG says that 'art is inherently subjective, creative and sometimes even unpredictable' (AG). However, it seems that the tension between these two areas can lead to new creative solutions. Among these, interviewees emphasised the perceived need for collaboration and dialogue, rather than competition with each other, culture manager ZL said: "By working together, artists can be more successful and support each other in their activities. Artistic collaboration allows for the exchange of experiences and skills, which leads to more innovative and inspiring projects" (ZL) and which can be complemented by the statement of the museum's dissemination coordinator AO: "In today's society, values such as solidarity, accessibility and image sharing and acting for the benefit of others play an important role" (AO). Such collaboration contributes to the creation of more inclusive and accessible spaces, as the AWW artists' manager mentioned in the statement quoted earlier. AO, the museum's dissemination coordinator, put it in terms of accessibility, saying: "Both cultural institutions and artists strive to make their work accessible to the widest possible audience" (AO). In doing so, accessibility is not only limited to physical barriers, but also to issues such as the intelligibility of the message or the diversity of the content presented. As the director of the WZ museum emphasises in this regard: "I am talking about the dialogue that the museum has with its audience and which introduces an element of some kind of education, i.e. that we nevertheless know something a little better, for example about an artist" (WZ).

Both cultural organisations and artists play a key role in taking action (including education) with both audiences and the wider community. AWW's artist manager commented that all activities in culture can have a common goal: "To teach means to explain, to raise awareness of how culture manifests itself, how it affects us in terms of reflection, but also to show relationships, relations between people, to build tolerance" (AWW). All involved have the opportunity to use their position and influence in society to address important social topics such as environmental issues, cultural diversity or the fight against poverty. Collaboration between artists and cultural organisations contributes to a better understanding of the needs of audiences and the creation of more effective and attractive cultural activities. It enables the creation of projects with a greater social impact, engaging and inspiring a wider audience, and the use of artists' images to support charities or social initiatives demonstrates solidarity with those in need and care for the environment around us. An example of this is the involvement of museums in promoting pro-environmental activities, e.g. waste segregation or nature conservation education, as mentioned by the museum's publicity coordinator AO in the interview, and culture manager ZL commented: "Public dialogue plays an important role in issues related to ecology and sustainability" (ZL).

Collaboration between organisations and artists plays a key role in promoting a change in social attitudes. Artists often use their talents and creativity to express their views and inspiration. In such cases, collaborating with an organisation can help to reach a wider audience and amplify the message. However, in the context of advocating for socially sensitive issues, there is some tension and difficulty in finding compromise or accepting consensual solutions. AO - the museum's dissemination coordinator - has a need to stand up for what is important, while at the same time she feels that her organisation, for equal reasons, is not doing so. To quote AO: "We know why it is not happening. And we also know what we could possibly gain if it is not happening. But we lack more permission to sometimes advocate for something that is important" (AO).

It is worth emphasising that such activities require the involvement of all parties, i.e. artists, cultural organisations and audiences alike. However, through solidarity, cooperation and social responsibility, culture and the arts can play a key role in achieving the Sustainable Development Goals, creating more accessible cultural spaces and inspiring the public to take an active role for the benefit of others and the environment.

4.3.1. Cooperation in branding

Co-operation in building the desired image is a complex relationship between the organisation and the artists, which includes employment, co-operation, or promotion of cultural activities. In a formal way, it applies only for the duration of the contract, but it is of great importance beyond that and affects the reputation of both the brand - the cultural institution - and the artist (personal branding). Managers generally understand that the image of artists and the organisation are intertwined, and that the need for dialogue between the two entities creates challenges and difficulties, but also opens the door to potential benefits for both parties. The organisation's desired image of artists can contribute to its prestige, even if the direct collaboration has ended. Interviewees, especially directors of performance organisations, agree that 'if an artist feels badly within any institution, the situation reflects badly on the institution'(TL). On the other hand, it should also be borne in mind that the image of an organisation can also have an impact on how an artist is perceived. If an organisation has a good reputation and is associated with high quality and professionalism, the artist associated with it may benefit, such as greater interest and visibility in the media. However, there is also a risk that cultural institutions are not always supportive of new artistic ideas and approaches, which may limit the artist's opportunities for development and negatively affect the artist's image.

The coordinator of artistic work and head of marketing at the TLA theatre points to the existence of contracts governing the use of the artist's image for promotional purposes. According to current legislation, these contracts define the scope of use of the artist's image depending on the specific project. However, artists are not always willing to share their image with the organisations with which they undertake cooperation, and they usually then make sure that such a provision is included in the contract they conclude. There were very divergent opinions among the interviewees as to why this is the case. Sometimes, participation in a project is only treated as an opportunity to earn money, while the project itself is not considered prestigious enough by the artist (as the SR and AW artists emphasised in their interviews) or incompatible with their world view. One of MK cultural managers puts it as follows: "Sometimes it turns out that someone performs in an endeavour, but at some point they realise that worldview-wise it might be placed in some context that is difficult for them. And then there are stipulations that say, for example, in connection with a given event there will be no political speeches, there will be no worldview declarations and so on and so forth, that it will only be an artistic event" (MK). The interviewees avoided clear answers to questions about the public activity of the artists with whom they collaborate. The artists interviewed claimed that the organisations do not influence their freedom of expression, although on the other hand they admitted to signing contracts in which these rules were described. A far-reaching trust in this regard was indicated, especially in the case of artists in an employment relationship with a cultural organisation. On the other hand, however, the interviews showed that organisations tend to control the image of the artist, especially if the artist is associated with it or its project. As the director of an urban theatre in a large TL city notes: 'there are many positive aspects of employing recognisable actors, but the actions of artists cannot always be controlled' (TL). An organisation can only influence those activities that relate directly to its activity, such as the choice of artistic content, marketing strategy and the way works are presented. However, interviewees emphasised, such as the RD theatre director, that: "Institutions do not always have full control over the artist's image, as the artist has their own creative autonomy and can express their beliefs and values, which are not always in line with the organisation's vision"(RD). Therefore, in many of the opinions expressed, cultural managers should be able to establish and maintain a good relationship with artists, support their work and help them with their projects. In a context where institutions do not have full control over the image of artists, there is a need to accept the diversity and autonomy of artists, and organisations should consider approaches that allow artists to express themselves and their beliefs, while ensuring that they are in line with the values and reputation of the institution. As the director of the author's BS Theatre notes, 'We don't want to be an institution that controls artists. We want to be an institution that helps them, that supports artists, that works with them, that creates a space in which they can act" (BS).

RD, - the director of a public theatre in a medium-sized city, emphasised the need to work together in building the desired image of both the institution and the artists, not only in the sense of creative freedom and artistic autonomy, but also in the context of their social activism. There are times when an artist's activities in the public sphere require the intervention of an organisation because they affect its undesirable image, RD noted: "There is a practice in theatre that the institution - the board, the director, the producers - try to control the artist in some way (RD). On the other hand, she expressed the need for a wider discussion, saying: "It is interesting and necessary to talk about how the individual actions of artists, their social or political activism, transfer to the image of the institution" (RD). The director of the author's BS theatre additionally noted that "institutions do not always have full control over an artist's image, and trying to control it can affect the image of the institution itself, not necessarily positively" (BS). The statement by KP's cultural manager suggests that full control of the institution over the organisation's image in this context may be utopian, as the artist is an independent creator whose work and public activity, can affect the image of the institution, both positively and negatively.

Some of the contributions of the interviewees focused on the role of the media in shaping the image of artists and their influence on cultural organisations. Museum director WZ points out that the media often use scandals and controversies involving artists to generate sensationalism and increase their audience. Artistic manager ZJ stresses that the media is an important tool in promoting artists, but it can also have a negative impact on their reputation and image, especially when information is manipulated. Image management can contribute to achieving the goals of cultural organisations, increasing their social impact and building strong relationships with artists and the community. Collaborating with artists with different perspectives and experiences can benefit the organisation in terms of greater diversity of content, attracting different audiences or building a positive image of the organisation as a place open to diversity, inclusion and speaking out on socially sensitive issues. The director of the author's BS Theatre believes that it is important for cultural organisations to involve artists in decision-making processes and give them the opportunity to express their views and ideas. In this way, the artist can feel involved and responsible for the activities created This leads into better quality and efficiency of the organisation's activities. In addition, the coordinator of artistic work and marketing manager at TLA theatre points to the importance of collaboration, support and artistic networking, which can enhance image and achieve greater social impact. TLA states: "We need to strengthen each other, because when we are in a strong network, we are also more able to achieve change." In doing so, it is also important to involve the local community and a wide audience in arts activities, which can "contribute to increased awareness and acceptance of cultural organisations" (TL).

Managing the image of artists and cultural organisations is therefore a complex process that requires awareness, dialogue, collaboration and consideration of the social context and the activities of the media. Organisations should support artists in their work while respecting their creative autonomy. The artist, in turn, should be aware of the organisation's context and respect its goals and values. Collaboration and dialogue are key to building a positive relationship that will benefit both the organisation and the artists, and the development of art and culture as a whole. It should also be noted that the issue of an undesirable image that affects the reputation of the brand and, as a result, the creation of a need for collaboration with the brand, both in the context of artists and cultural organisations, is a difficult topic and always requires personal decision-making. RD, the theatre director, emphasised that "in the modern world and polarised societies, there is always a risk that there will be some undesirable opinions or a media vilification, so every collaboration carries a risk" (RD). When undertaking a project, on the other hand, it is the responsibility of the organisation to ensure the best possible working conditions and to take responsibility for its decisions.

5. Conclusions

The analysis of the presented material indicates the existence of complex relationships between artists and cultural organizations, resulting from the need to achieve organizational goals and establish effective cooperation. Research results raise new questions and problems for further discussion.

The results of the analysis indicate several important conclusions:

1. Both artists and cultural organizations are aware of the need for cooperation to achieve success.
    - Conscious cooperation between organizations and artists benefits both parties. The result is increased attractiveness, prestige, expansion of the audience, greater visibility in the public space, and increased trust.

- Cooperation, in its basic form, concerns artistic activities. Artistic success can inspire the entire organization, and artistic creativity and innovative approaches are essential for achieving organizational goals, including sustainable development goals that are part of public policy.

2. Managing the image of the artist and the cultural organization is a significant element of cooperation.
   - Cultural organizations and artists have different goals: organizations must achieve objectives set by public policy, while artists work towards personal branding. A common element is social approval for the pursued goals.
   - Cultural managers are aware of the influence of the artist's image on the organization:
     - Public institutions, such as theaters, operas, and cultural event organizers, often involve actors and performers to achieve a certain level of artistic quality. Their media actions result from marketing strategies aimed at achieving intended effects through collaboration with various entities.
     - Image is a personal asset that requires consent for its use. Portraying a person's figure, or face, along with additional elements related to their profession, can bring benefits to a public institution. Therefore, organizations are more willing to engage individuals with a good reputation who represent specific views and opinions.
     - Lack of agreement on cooperation between cultural institutions and artists can result from various reasons, such as statements on social and political issues, undesirable social attitudes, etc. Decisions to terminate cooperation can also be motivated by a lack of support for the authority or programmatic line of the organization.
     - Imposing cooperation frameworks, including limitations on freedom of speech, expression of opinions, and views, is becoming increasingly common. Organizations tend to control the artist's image, particularly when a cooperation agreement is in place. However, the organization can influence those actions directly related to its activities, such as the choice of artistic content, marketing strategy, and presentation of works.
     - Organizational managers usually believe that their task is to create suitable conditions for artistic work, which contributes, to a greater or lesser extent, to building positive image cooperation.
     - Artists are not always aware of the impact of their personal and artistic image on the image of the organization they collaborate with. They often act impulsively, expressing themselves publicly on socially sensitive topics without realizing that they are also influencing personal branding, which, in turn, builds the branding of the organizations they collaborate with.
     - The organization's image can influence the perception of the artist. The choices made by artists regarding cooperation usually relate to the possibility of artistic development within a particular organization, but the issue of its image is equally important, as it arises from the adopted strategy.
3. Artists as public figures:
   - Artists as a social voice:
     - Artists have a unique opportunity to speak up and express opinions on various social topics. They use their position to engage in public or political affairs, allowing them to influence society and the community.
     - Artists do not always have to align with public policy and have the right to express their own opinions. There is a need to respect artistic autonomy, even if artists' opinions conflict with public policy.
   - Social responsibility of the artist: Artists have the ability to act for the benefit of others. They can engage in activities that have an impact on the community and initiate social initiatives. This means that their actions are not limited to creating works but also have a social dimension.
   - Artists are sometimes in conflict - social pressure regarding their involvement in public life may contradict their personal beliefs, resulting in the construction of personal branding as a false construct.

4. Artists and the achievement of goals set by public policy organizations:
    - Creating social change:
        - Artistic activities have the power to create unique communities united around artistic actions. Artists and cultural organizations have the potential to create social change, promote values, and provide unique cultural experiences. Through their actions, creativity, and engagement in social issues, they can influence the shaping of public space and society as a whole.
    - Building effective organization-artist relationships requires a flexible approach and going beyond established patterns. Cultural organizations need to be open to new ideas and approaches because artistic creativity and fresh perspectives can bring valuable innovations. Collaboration between organizations and artists is based on mutual understanding, dialogue, and respect. Long-term cooperation brings positive results for the parties in shaping mutual relationships but can have negative consequences in the external environment that does not support certain views, ideas, or attitudes, which devalues artistic achievement.
    - Artistic autonomy is crucial for maintaining authenticity and creativity. Control over the artist can restrict their creative possibilities, so it is important to provide space for artistic action and freedom in realizing their art.
    - Resistance to public policy: Artists and organizations have individual images and opinions on various topics. Artists do not always have to follow public policy and may have their own opinions on certain social issues. There is a need to respect artistic autonomy and allow artists to express individual opinions, even if they conflict with public policy. In practice, these rights are not always respected.
    - Balancing autonomy and image both artists and cultural organizations need to strike a balance between their artistic autonomy and their social image. Artists and organizations have individual images and opinions on various topics but should act in a way that contributes to building prosocial attitudes.

The relationship between the organization and the artist is complex, requiring a flexible approach and consideration of the artist's creative autonomy. Cooperation, mutual understanding, and respect are crucial for achieving artistic and organizational success. However, there are many topics that generate controversy and should be further explored. Among the most frequently mentioned in the presented research, the following have been diagnosed:

- The need for discussion on the mutual creation of the artist's and cultural organization's image - this is an issue that is poorly represented in scientific research and in management practice.
- The need to consider how organizations view image control and how they react to situations that may affect the image of artists and organizations. Cultural organizations lack tools - both legal and management-related - in this regard.
- The need for dialogue on the boundaries of artistic freedom and the autonomy of artists and organizations in the face of pressure to achieve public policy goals (including those related to the implementation of sustainable development strategies).

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Design of digital entrepreneurial model of traditional Chinese fragrance culture -- pursuing cultural sustainability based on scientific and technological innovation

Author: 徐冰清 ；谢琳琳

Xu Bingqing*, Xie linlin*

*School of Journalism and Communication, Anhui Normal University

Abstract

With the proposal of cultural sustainability concepts and scientific progress in recent years, cultural and creative industries have become a new driving force for regional economies. Digital technology brings multiple opportunities for the innovation of traditional culture. Digital creative industry is an emerging business format resulting from the integration of emerging digital technology and cultural and creative industries. The inheritance and development of fragrance culture has a long history in China. Under the fragrance economy wind, the world fragrance industry has seen a big explosion in recent years. Fragrance has gradually integrated into the daily life of new generation consumers and become an important medium for expressing personal style. In today's social media communication environment, the pursuit of young consumers for lifestyle and the assistance of digital technology in life mode have increased the new demand for the functionality and value of fragrance products. The use of modern digital technology to digitalize, materialize and deconstruct digital fragrance with Chinese cultural concepts will subvert the way of creating fragrance products. This comprehensive innovation of interactive design combining traditional fragrance culture and modern digital technology has innovative value for the study of cultural sustainability. This article aims to fully explore the functions and values of fragrance culture in the current digital media environment, tap the sustainable core in the traditional fragrance cultural heritage, and explore the digital entrepreneurial model of fragrance culture in depth, so as to promote the sustainable development of traditional culture represented by fragrance.

Keywords: Digital Creative,Cultural Sustainability, Fragrance Culture

1. Introduction

Development is an eternal theme of human society, especially after World War II, when the development issue became the core problem that all countries in the world needed to solve. Therefore, discussions about development issues have become the focus of theoretical research in all countries. In 1992, the World Environment and Development Conference, guided by the principle of "sustainable development", formulated and passed important documents such as the "Agenda 21" and the "Rio Declaration". Since then, "sustainable development" has become a strategy and a common action that human beings must take to survive and develop. People's understanding of cultural sustainability has also begun to take shape.

Cultural sustainability is generally defined as a community's ability to maintain cultural identity and the capacity to guide cultural values transformation. Since the 1995 UNESCO report "Our Creative Diversity" acknowledged the relationship between culture and sustainable development, the concept of cultural sustainability has been increasingly recognized, researched, and defined by more and more countries. According to UNESCO's development agreement for international cooperation, cultural sustainability can be a category for responsible development of cultural sectors (such as heritage, creativity, cultural industries, arts, cultural tourism, etc.), or a category advocating for the incorporation of culture into all public policies and processes. Some international research organizations have begun to connect cultural sustainability with dimensions such as environmental responsibility, economic prosperity, social equity, and cultural vitality.

Ⅰ.Research on the significance of Chinese fragrance culture transmission from the perspective of cultural sustainability and cultural creative industry development

(i.) Basic understanding of cultural and creative industries

Cultural and creative industries is a new concept proposed by developed countries in the 1990s, which gradually evolved into a new development concept. This concept believes that the real wealth of contemporary economy is creativity composed of ideas, knowledge, culture, skills, and creativity from human brains, which will derive infinite new products, new services, new markets, new employment opportunities, and new social wealth, and is an important driving force for economic and social development. Some experts even propose that cultural and creative industries will be separated from modern service industry and become a new and higher-level industrial form, namely the so-called "fourth industry". John Howkins, an advocate of British creative economy, defines creative industries in his book The Creative Economy as economic sectors whose products are all protected under intellectual property law. Intellectual property has four categories: patents, copyrights, trademarks, and designs. Howkins believes that each form of intellectual property law has a large industrial sector corresponding to it, and together "these four industries make up the creative industry and creative economy."

We define the cultural and creative industries as: a knowledge-intensive and intellect-led strategic industry that is centered on creativity, powered by culture, supported by technology, and focused on the development and utilization of intellectual property rights.

(ii.)Connotation definition of cultural consumption

Based on various relevant research results, the definition of cultural consumption is complicated, diverse, and inconsistent in terms of perspective. Regarding the attributes of culture, the connotation of cultural consumption should involve three dimensions: first, as the object of public cultural services, cultural consumption refers to micro-level cultural services, including the consumption of cultural content and facilities, as well as the integration of cultural consumption in the fields of education, science, sports, and other public service

consumption. This type of consumption is dominated by the government and aims to meet the basic needs of service objects, and belongs to the behavior of cultural welfare guarantee, where the objects of consumption are unpaid. Second, as the main consumer or object of the cultural market, cultural consumption refers to macro-level paid cultural services, which means that people purchase various cultural products or services with content as the primary consumption object to meet their spiritual needs. This mainly includes the consumption of movies, stage performances, music, newspapers, and many others. These cultural consumption behaviors are mainly reflected in monetary expenditures and are carried out in the form of purchases. Third, as a channel for the industry or product supply, cultural consumption is the primary resource for the cultural industry and public cultural services, the key factor in the entire cultural industry process, and the intrinsic driving force for the development of the cultural industry. It is necessary to take the targeted consumption as the starting point. The speed of the cultural industry is very fast. If you don't focus on the overall development of the industry, it is hard to do a good job in the cultural industry. At the same time, the level of cultural consumption depends on both the consumption capacity and willingness of residents, as well as the supply of cultural products. In fact, the demand for cultural consumption is forming a "reversed coercion," which promotes the rapid development of the cultural industry and related industries and drives the development and prosperity of artistic creation and production.

(iii.) Research on the development process and significance of Chinese fragrance culture

As early as four or five thousand years ago, the ancestors in the Yellow River basin and the Yangtze River basin had already begun to use incense products. With Emperor Wudi of the Han Dynasty as the boundary, the front is the first period, which can be called the initial period. From Emperor Wudi of the Han Dynasty to the Wei and Jin Dynasties, it is a peak of the development of incense culture, which can also be called the leaping period. It was after the Sui and Tang Dynasties. In the Sui and Tang dynasties, the atmosphere of using incense was not only widely popular in the princes and nobles, but also the national government places, folk festivals, the daily life of ordinary people, as the medicine to cure the disease, incense has become an indispensable part of People's Daily life. During the Tang and Song dynasties, various kinds of incense meetings and incense fights were also common and elegant entertainment activities among the literati and officials. In the Song Dynasty, when the development of incense culture was at the peak, the annual expenditure of incense medicine alone was close to one third of the national economic income. The income of the national incense medicine franchise basically supported the national defense expenditure of the whole country. During this period, the thread incense began to be widely used, and formed a mature production technology. By the time of the Qing Dynasty, "incense" has gone deep into daily life, stoves, bottles, boxes of study and incense cases have become the typical display of the study. This clue, you can prove that the incense can purify the environment.

The Neolithic Age was the embryonic period of Chinese incense. The ancient people extracted incense from the spices of plants, and the human love for incense was an innate natural demand. In the Sui and Tang dynasties, the economy was prosperous, the sea transportation was convenient, and Buddhism reached its prosperity. From the royal family and nobles to the common people, the incense atmosphere was quite common, enriching various forms of incense methods. In the Northern Song Dynasty, not only Buddhism, Taoism and Confucianism advocated the use of incense, but incense became a part of the daily life of ordinary people. In the Ming and Qing Dynasties, while inheriting and developing the exquisite incense culture of the Song Dynasty, Chinese incense combined with Neo-Confucianism and Buddhism into "sitting incense" and "teaching incense", thus becoming a subject of jungle meditation and inspection knowledge. At the end of the Qing Dynasty, when the war began, the spiritual life of

scholar-officials and literati tended to be rough and rigid, and incense learning, like pure artistic forms such as poetry, music and dance, gradually declined.

China's "using fragrance" culture has a long history, and the sachets are the carrier of the Chinese nation's love and memory for fragrance. The Chinese cultural elements worth discovering and expressing are naturally very diverse and vivid. In Chinese culture, fragrance not only serves as medicine and gift, but also serves as a carrier of etiquette and emotion.

Ⅱ.New opportunities for the transmission path of Chinese fragrance culture from the perspective of digital fragrance technology development

According to the data of Qianzhan Industry Research Institute, due to the rapid development of smart home, automotive electronics, smart medical care and other industries, in 2020, the market scale of gas sensor-related industries in China has exceeded 60 billion yuan. The market is expected to enter rapid growth over the next five years with continued technology growth and lower costs, with a total valuation of $691 million by 2020 and a compound annual growth rate of 30.4% between 2015 and 2020. By 2020, North America and Europe will be the largest in terms of "market size", with the Asia-Pacific region recognized as the "fastest growing" region.

(i.) Digital fragrance technology development

With the progress of The Times, smell has become an important marketing tool, which has been widely recognized by retailers, manufacturers and advertisers. However, despite the important value of olfaction for economic activity, enterprises generally lack scientific tools for odor recognition, measurement and management. Fortunately, the emergence of the emerging digital olfactory technology has changed that. Digital olfactory technology consists of two branches: one is digital detection and analysis of different odors; the other is digital transmission and reproduction of odors. These technologies could revolutionize a range of industries including perfume, food, the environment and healthcare.

As early as 17 years ago, international companies ahead of digital odor technology. In the 1990s, an American company called DigiScent developed a technology product, ——DigiScent iSmell, that was connected to a computer to emit different smells based on screen images, but it soon disappeared from public view. In 2011, a California software developer launched an odmachine called ScentScape, which can release specific odors as the screen plays. In 2013, researchers at Tokyo Agricultural Technical University in Japan released the smelling screen, which emits the smell from screen displays. In 2014, an American company launched oPhone, and recently launched a Cyrano odor speaker that fills a space with the natural flavor you want.

The International Consumer Electronics Show (CES 2023) is held in Las Vegas. At the show, digital fragrance technology provider OVR announced the launch of the personal wearable fragrance technology —— ION 3. ION works in a simple way by connecting wirelessly to a smartphone, PC or VR, AR headset, combining the main aromas in different ways to create thousands of unique digital native fragrances. This ION 3 provides a solution to the smell problem in virtual space. It connects the sense of smell through digital technology, allowing users to experience the scene, creating a more emotionally attractive and entertaining digital experience, and improving people's virtual life.

Look Labs Launch the first digital perfume, Cyber Eau de Parfum, created by Canadian artist Sean Caruso. In addition to releasing physical perfumes, Look Labs also uses Cyber Eau de Parfum as a limited supply of NFT (non-homogenized token) art, coded using spectral data. The smell of this perfume is extracted using near-infrared spectroscopy and represented in art works in the form of spectral data, " aiming to provide future luxury goods for the next generation of beauty consumers.

(ii.)China digital fragrance technology application case

In April 2015, Hangzhou Meike Information Technology Co., Ltd. officially launched the project of "Smell Kingdom". The main technology of the odor kingdom is digital odor

technology, also known as virtual smell technology, which is the "gene map" of material odor discovery. Through the core innovation technology of the pattern recognition system of signal processing system, network transmission and terminal reproduction of odor information. Independent devices are used to accurately reproduce the various odors produced by the real substances.

Zhongke micro sense, founded in June 2022, is a based on building "artificial olfactory sensor and smell digital technology" integrated application development platform of start-up team, for automotive, consumer electronics, medical, food and other industries, is committed to leading the domestic gas sensor from "single gas perception" to the digital smell. The artificial olfactory sensor produced by Zhongke, combined with the latest MEMS micro-nano processing, big data, wireless communication and artificial intelligence technologies, can gradually replace the biological smell and realize the function of accurate odor discrimination through the effective discrimination of gases in the environment.

It can be seen that the development speed of digital fragrance technology is considerable, and the development of digital fragrance technology is inevitable. Under this opportunity, the refining of Chinese fragrance cultural elements and the integration with new technology is a necessary way to promote cultural sustainability, and also the opportunity for industrial innovation.

Ⅲ. Brief introduction to the design of digital entrepreneurial model of Chinese traditional fragrance culture

The integration of culture and technology is an important way to inherit culture and promote cultural sustainability. This design integrates digital fragrance technology with Chinese fragrance culture. Extracting and refining cultural design elements from traditional Chinese fragrance ball culture and integrating them with digital fragrance technology can make Chinese fragrance culture better spread, provide reference for feature extraction and innovative application of national culture, and provide reference for design activities based on regional culture.

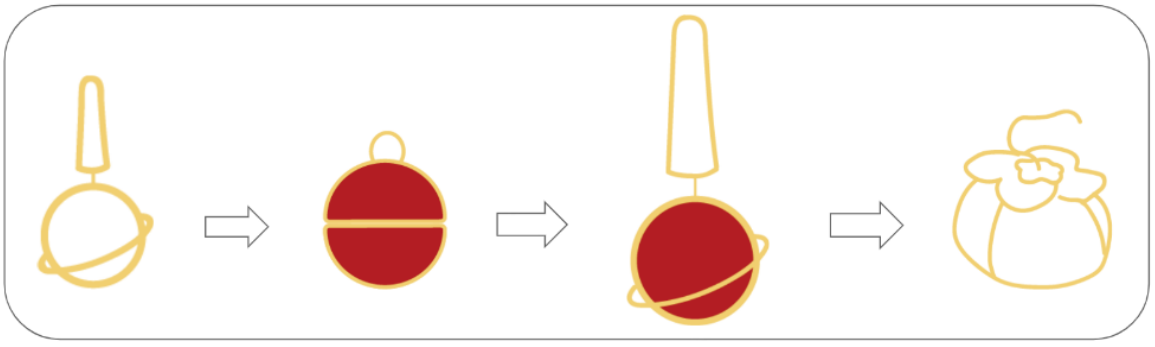
(i.) The genealogy of Chinese traditional sachet ball culture

Sachet has a long history. Since ancient times, China has the tradition of wearing sachet. Sachet culture originated in the Zhou Dynasty and reached its peak in the Han and Tang Dynasties. The shape of the perfume bag is diverse, and the production materials are rich. In the course of its long development history, from the external shape and material to the internal symbol, it gradually changed from simple to complex. In the Tang Dynasty, there appeared the production of exquisite, exquisite craft of perfume bags.

(ii.) Physical electronic perfume bag ball appearance design

The main body of the product is a container in the shape of a perfume bag ball. The surface of the ball uses cultural symbols appearing in classical Chinese stories as design elements and is combined into a cutout pattern. The perfume bag ball is equipped with a fragrance container and electronic fragrance device, in the form of perfume or solid fragrance, the fragrance product with Chinese classical fragrance into the incense ball, and is equipped with a usb interface and rechargeable battery, so as to meet the needs of people to carry.

The upper end of the ball is provided with a connecting port, which is connected with a chain. While restoring the characteristics of the original perfume bag ball, it is convenient for users to disassemble and replace it at will. The material of the chain is metal, cowhide, linen, etc., different materials and colors to meet people's pursuit of fashion and personality. At the same time, the integration of the chain makes the aromatherapy ball can be arbitrarily integrated with the clothing or leather bags of contemporary users, so as to play a lasting fragrance and carry the role.

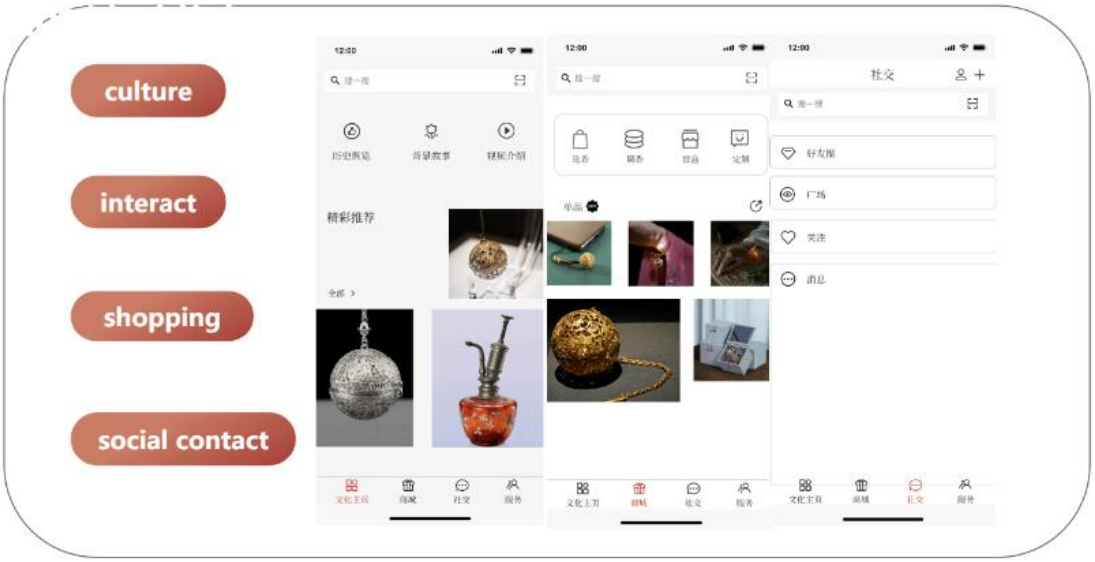


The lower end of the aromatherapy ball is provided with a usb interface for connecting with the charging base. The charging base can be placed anywhere in the bedroom, on the desk or under the front windshield of the car. At this time, the aromatherapy ball can be used as a

household small desktop electronic aromatherapy. So as to further expand the use of aromatherapy balls in real life.

(iii.) Online service design

In Chinese history, perfume sachets or aromatherapy itself had many functional uses, such as being a token of expression between men and women, a carrier to transmit signals, and a ceremonial symbol. In today's era, these functions of mobile electronic aromatherapy balls can still be excavated. Through our official app, users can get a variety of related services, such as customizing or diy fragrance oil products with special meanings in the mall, and can also express themselves and communicate with other users through social channels. So that the use of the perfume bag infinite divergence, become a new trend culture.



Online services interact with offline physical products through the Internet to provide users with cultural cognition services, social services and shopping services. The culture section of the app is responsible for the export of traditional culture, including the display around the perfume bag culture and Chinese "fragrance" culture, but also covers the transmission of the pharmacological value of different "fragrances", as well as the latest international fragrance fashion consultation, to understand the history and backstory of the product. The mall section provides the audience with shopping and understanding of the latest product information, and also sets up a special area for users to play diy mini-games. After diy, the goods can be purchased directly online and mailed to home, and blind box customization services are provided. The social section provides the audience to share their shopping experience, as well as some fragrance making skills and feelings. It also includes other social functions such as making friends.

Ⅳ.the prospect of Chinese traditional fragrance digital products in cultural communication and application

The particularity of the olfactory track determines that consumers can only form the perception of aroma through personal experience. In other words, for traditional fragrance brands, the product is the first element to communicate and impress consumers. Now, the rules are being changed by new players. On the one hand, the epidemic has formed many restrictions on people's offline life, and the public's online consumption habit has further deepened. On the other hand, as the new brand grows in the increasingly developed Internet environment in China, the traditional model has been engraved into the genes of most brands, and the network and social media have become the main channels for brand peddling.

(i.) New fragrance products occupy the fragrance market

Taking China's fragrance market as an example, the compound annual growth rate between 2015 and 2020 reached 14.9%, and the growth rate will be more optimistic in the next five years, and it is expected that by 2025, China's perfume market retail sales will reach 30 billion yuan. The global market will grow at a compound rate of about 7% over the next five years. The main fragrance consumption is Generation Z, which is mainly born after 90, 95 or even 00, and women account for the majority. According to the 2021 online olfactory economy research report: the post-90s, post-95s, and post-00s contribute more than half of the consumption of makeup and perfume, and the young generation market has matured. At the same time, the post-85, post-90 and post-95 generations are the main consumers of the online olfactory market, and the post-00 generation is waking up. The consumption characteristics of "Z" generation: pleasing their own needs, interest in social interaction, appearance level justice, establishment of people, fashion sinking. The "Z" generation is the main consumer group of fragrance, and its consumption characteristics have a crucial impact on the development of fragrance.

With the rise of the "national tide", as well as the cultural identity and cultural confidence of the Chinese people, more and more domestic fragrance brands continue the "spiritual core" of traditional perfume culture in their products. But as the saying goes, "there are many who enter the game, but few who break the game." Although the development space of the domestic fragrance market is broad, the current mainstream market and head occupation are still firmly controlled by foreign first-line brands. It can be seen that it is feasible and necessary to create a domestic fragrance product that has Chinese characteristics and can reflect the contemporary "national tide" thinking, so that "Oriental smell" becomes the new favorite of The Times, and the development of digital fragrance technology has brought opportunities for this goal.

(ii.) The integration of technology enabling and traditional fragrance culture stimulates cultural consumption

Technology empowerment can make cultural consumption have a deeper digital culture mechanism, which is mainly reflected in the following points: First, scene empowerment, promoting the integration of online and offline cultural consumption scenes; Second, form empowerment, deepening cultural activity experience and social connection and integration; Third, content empowerment, strengthening the integration of cultural content creativity and digital technology innovation.

Integrate digital fragrance, Internet, Internet of Things and other technologies with fragrance culture. It has a significant impact on people's perception and use of fragrances, and is undoubtedly innovative and even revolutionary. On this basis, the reconstruction of cultural consumption and technology consumption brings users a new consumption experience, thus stimulating new forms of consumption.

(ⅲ.)Help the olfactory economy and industrial linkage

At present, there is no clear definition of olfactory economy in the market. Broadly speaking, the olfactory economy can include all economic activities that rely on the human sense of smell to promote the completion of consumer behavior. At present, fragrance as an important part of

the olfactory economy, has been widely used in home life, car fragrance, food and many other fields. However, with the arrival of digital fragrances, the olfactory economy can be combined with more industries, such as odor movies in the field of film and television, and movies that increase the olfactory dimension on the basis of the original sight and listening. It is different from 4D and 5D, its smell can not only render the environmental atmosphere, but also promote the development of the film plot, and fundamentally change the existing audio-visual language narrative method of the film. Odor socialization in the social field, expression and emotional transmission in the form of odor, etc. And the economic value behind it is also very considerable.

Ⅴ.Summarize

In recent years, China's digital creative industry has developed rapidly, and digital technology has brought multiple opportunities for the innovation of traditional culture. Digital creative industry is a new form of business produced by the integration of emerging digital technology and cultural creative industry. From the perspective of cultural sustainable development, the issue of inheritance and innovation of fragrance cultural heritage has attracted more and more attention. Under the tuyair of the olfactory economy, the field of domestic fragrance has ushered in a big explosion in the past two years, and fragrance has gradually integrated into the daily life of the new generation of consumers, becoming an important medium for expressing personal style. In today's social media communication environment, the pursuit of lifestyle by the younger generation of consumers and the lifestyle facilitated by digital technology have increased people's new demand for the function and value dissemination of fragrance products. Using modern digital technology means to electronize and materialize fragrance, and deconstruct digital fragrance with Chinese cultural concepts, the participation of digital tools will subvert the way fragrance products are created. This comprehensive and innovative interaction design, which combines traditional fragrance culture and modern digital technology, has innovative value for the study of cultural sustainable communication. From the perspective of sustainable development of Chinese fragrance culture, the function and value of fragrance culture in the current digital media environment are discussed, and the sustainable cultural core of traditional fragrance heritage is explored to better spread Chinese fragrance culture and rejuvenate cultural heritage in digital technology.

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ENVIRONMENTAL INTERACTIONS AS THE PRIMARY DETERMINANT OF THE VIABILITY OF MUSEUMS IN HISTORIC SITE

Amirah Athirah Yaacob[1] & Nor Zalina Harun[2]

[1] Institute of the Malay World and Civilization
[2] Institute of the Malay World and Civilization

[1] P119283@siswa.ukm.edu.my
[2] nzalina@ukm.edu.my

Abstract.
This study begins with the notion that the difficulty of maintaining the sustainability and functionality of local museums can be circumvented by enhancing the quality of the museum environment. However, in the context of this study, the historical element, old city landmarks, and natural environment, as well as their impact on the attention of tourists and the sociocultural community, will be analysed in more depth so that the role of the museum can be strengthened. Even though much research on the sustainability of museums have been undertaken, however these studies have primarily focused on management and marketing. Insufficient and scant research has been conducted on the topic of empowering museums located on historic site. As a preliminary step, a study of four local museums located in heritage sites was done to determine whether their implementation is consistent with the strategy of museums that have successfully been preserved, notably Borobudur and Angkor Wat. To achieve this aim, two main objectives were developed: to identify how museums in heritage sites are empowered from the perspective of the of spatial planning and facilities that support the role of the museum; and ii) to examine the issues and obstacles faced by four local heritage-site museums. Using document analysis techniques and articles on the strategies and sustainability of museums in Borobudur and Angkor Wat, this study highlighted three primary strategies that might potentially be implemented to the four analysed local museums. The study's findings indicate that the three primary strategies are closely tied to complete infrastructure facilities, preservation of the original physical landscape character, and involvement of the local community. In accordance with the third core listed by the National Cultural Policy (DAKEN); cultural heritage must be preserved through preservation and conservation efforts to ensure the high aesthetic value of national treasures; it is anticipated that this study will serve as a reference for addressing the problem of maintaining the physical sustainability of museums as one of important cultural hub.

Keywords: museum in heritage sites, heritage sites, environmental relations, role, and function of museums

1. Introduction

ICOM (International Council of Museums) (2022), defines a museum as an institution that does not make a profit but prefers as a center or permanent institution to provide advisory services to the public as a place that acquires and gains knowledge through the process of research and research by means of spreading and exhibiting, as well as storing and preserving historical and cultural heritage treasures for a country, and also emphasizing the purpose of research through education and exhibitions that can be used and enjoyed while also serving as evidence of humans and their environment.

According to the Department of Museum Malaysia, the estimated total number of museums throughout Malaysia is about 150, classified into federal museums, state museums, institutional or departmental museums, and private museums. Each museum that is built has its own objective of establishment by focusing on the strength of the collection, which has a very high historical value. The type and quality of a museum can also usually be seen through its collection, where essence is the most important thing in its field. The history museum is one of the most famous museums not only in Malaysia but also all over the world. A historical museum is a museum that houses a very diverse collection, such as documents and artifacts in various forms, as well as historical collections related to history. There are various types of history museums, including historic houses, which are buildings with high historical value; historic sites, which become museums; and open-air museums, also known as open-air museums.

However, based on initial observations, the function of museums in historic sites is seen as less prominent than that of other museums. Therefore, in the context of this study, the historical element, old city landmarks, and natural environment, as well as their impact on the attention of tourists and the sociocultural community, will be analyzed in more depth so that the role of the museum can be strengthened. Even though much research on the sustainability of museums have been undertaken, however these studies have primarily focused on management and marketing. Insufficient and scant research has been conducted on the topic of empowering museums located on historic site. As a preliminary step, a study of four local museums located in heritage sites was done to determine whether their implementation is consistent with the strategy of museums that have successfully been preserved, notably Borobudur and Angkor Wat.

2. Literature Reviews

Articles related to the study were consulted to obtain additional information and help in obtaining study data.

Aspects of the museum

Intan (2018) defines a museum as a permanent institution established for social interest; this institution does not seek profit through its service to the community and is open to the general public. It acquires, preserves, conducts research, communicates, and organizes exhibitions. The researcher focused her study on the factors influencing visitor arrival at the museum only. The study on the factors that influence the arrival of visitors to the Sabah Museum explains that the desire to obtain intellectual knowledge is the main factor for visitors to the museum.

The museum's function in preserving and making national treasures easy to reach and accessible becomes something pointed. The most effective method to preserving this treasure is to store it in a store or an area where the climate is controlled and allow little or no access to it (Laura et al., 2014). This is because the amount of access to materials, in most cases, will lead to a deterioration in quality. The museum sector benefits from the heritage sector, where museum workers should understand business and economic development issues. Museums are seen as non-profit institutions, but the collections in them have a very high value.

Museums also play a role in allowing the public to explore collections for inspiration, learning, and enjoyment. A museum is an institution that collects, protects, and makes artifacts and specimens accessible, acting as a trust for the community. The function of the museum has now been directed to two main aspects of division; the traditional museum, which functions and plays a role in the original purpose for which a museum was created, and the contemporary museum, which is in the modern era (now), where the role and function of the museum have changed according to current changes (Amirul Hafiz, 2017).

According to Paiman Keromo (2005), the function of a museum institution has recently changed to become the focus of visitors, and it is not only a cultural, natural, and scientific custodian institution. The new emphasis is that the relationship between the museum and the visitor is one of interaction. The change in the function of the museum has had an impact on the management of the museum, which is the main pillar of the institution. This is through the recognition of a new role for the museum director in attracting visitors to the museum; at the same time, it is a new challenge for the museum director who works traditionally compared to the director who is contemporary.

Hamimi Omar et al., (2018), conducted a study on the role of the museum as a cultural heritage attraction in Kota Kuala Kedah. This study found that the process of exhibiting, communicating, and conveying to visitors the importance of the site or resource they are visiting is important in ensuring their satisfaction. The results of the study show that the management of the Kota Kuala Kedah Museum should always be prepared to face challenges in the future by adopting a more visitor-friendly approach in addition to continuously carrying out heritage conservation.

Management strategy

The museum also plays a role as a socio-cultural institution, which is a tool for providing awareness and campaigns to the community on current issues related to community life and the environment. Therefore, the museum needs to redesign its identity by focusing on democratic and inclusive principles, making it cultural, ethical, and social, and being able to meet the needs of stakeholders and generate value (Laura et al., 2014). So, to ensure the long-term sustainability of the museum is preserved, a radical change in approach and management is very necessary.

Christian Waltl (2006), through his writing, thinks that a museum without the presence of visitors will become like a lifeless and empty space without function. In order to form a museum that plays an important role in increasing the attendance of its visitors efficiently and effectively, the museum should understand the motivations and needs of different audiences by creating an atmosphere that offers a variety of experiences. The researcher also explained the importance of museum management strategies that can help achieve visitors are not the duty of some positions only; all staff are responsible and play an important role.

Amer (2019) conducted a study on marketing planning as a tool to increase visits to heritage sites and museums. He thinks that heritage sites or museums may realize that, given the rate of visitor participation in heritage-related activities, the management of heritage sites or museums requires special creative marketing activities. He also found that heritage marketing planning, as an important tool to attract those interested in heritage, is a collaboration between heritage sites and communities, exchanging something of value for something they need or want. Furthermore, it aims to satisfy some of the visitors' expectations and motivations and, at the same time, convey knowledge of the heritage for future generations.

In an effort to help the region's museums withstand the demands of change, in addition to being related to the present, heritage sites should be introduced with new functions or activities. If cultural heritage sites are only preserved without the injection of new functions and activities that are responsive to the demands of today's needs, they will gradually be destroyed. Although the heritage site is still functioning for a certain purpose, it may not be able to withstand the challenges of the future. New functions related to the social environment should be introduced in cultural heritage sites, and old functions should also be reconstructed to ensure that vitality is really maintained in cultural heritage sites and their relationship with modern cities and spatial groups.

3. Methodology

This study will use bibliographic methods to find reference materials in related fields. The researcher uses reference sources such as books and journals as additional references to strengthen the content. The resources obtained can be used as a guide to conduct an action study and then prepare a study report. This method is important in order to provide a clear picture of the concepts, principles, methods, processing, and analysis of data that are compatible with the study design. This bibliographic method is related to general information with keywords for a study. The keywords for this study are museum management strategies, museums in heritage sites, museum marketing, and so on. In order to find information related to this study, the researcher as referred to several writings that revolve around studies that are almost the same as the studies done by the previous researcher. This basic reference is very important so that the

researcher's writing does not deviate from the track. This method uses four processes that are done in stages: the content reading process, content selection, content recognition, and content presentation.

The method used in this content analysis method will help produce further research findings. In the context of this study, the content selected and used as reference material is an aspect applied by the museum with the highest number of visitors in the world. The analyzed content is the result of a study of seven famous museums in the world, where the justification for the selection of these museums is based on the number of visitors received throughout the year as well as the support of complete data. The results of the content analysis obtainer are also formulated based on the strengths, uniqueness, and differences of the selected museum and the group of visitors present.

This method is also implemented to see the success factors or strategies that make a museum popular. For this aspect, three world heritage sites have been selected, namely Borobudur, Angkor Wat, and Fort Rotterdam. Factors that are analyzed for this aspect include physical elements such as location and physical character, research and development, preservation and conservation, infrastructure facilities, and programs or activities provided. This study also analyzes four local museums located near the heritage site, namely the Kota Kuala Kedah Museum, the Johor Lama Museum, the Pasir Salak Museum, and the Kota Ngah Ibrahim Museum. The analysis is carried out by looking at the initial planning and development strategy, which is in terms of the history of the opening of the museum, and strategies that can be implemented to strengthen the quality of the historic site where the museum is built. The physical structure or infrastructure facilities are also analyzed to see how the planning and construction are implemented to meet the needs and attract visitors.

4. Results and Discussion

4.1 How museums in heritage sites are empowered from the perspective of the of spatial planning and facilities that support the role of the museum.

In an effort to create a museum that is visited by many visitors, the success factors or strategies that have been proven by several world heritage sites can be used as the best example. For that, the world-famous heritage sites of Borobudur and Angkor Wat have been studied for their success factors in terms of their environment.

4.1.1 Borobudur

Picture 1. Borobudur

In terms of the historical background of this temple, Borobudur is a Buddhist temple located in Borobudur, Magelang, Central Java, Indonesia. The temple that was built is located approximately 100km southwest of Semarang, 86km west of Surakarta, and 40km northwest of Yogyakarta. This stupa-shaped temple (bell) was built by Mahayana Buddhists around the 8th century AD during the reign of the Syailendra Dynasty. Borobudur is the largest Buddhist temple in the world, as well as one of the largest Buddhist monuments in the world. For the selection of the site for the construction of the temple, several factors must be considered rationally. Because it was built with the purpose of being a protected area, the natural environment became an important factor, i.e., it not only needed to be suitable in terms of the technical implementation of the project, but it was also important to be able to face the problems of basic religious needs and metaphysical concepts. Therefore, this Borobudur temple was built in a very strategic geographical area on the island of Java.

Sucithatiningsih (2020), in his study on the strategy for the development of Borobudur, says that this Borobudur temple is the largest monument for Buddhists. The building materials found in the monument were built based on the scriptures of Mahayana Buddhism. This includes the design of the monument, the position of the stupa, the renovation process that took place, the relief sculpture, and the square towers. Not only is it the largest centre of Buddhist worship in the world, but the existence of Borobudur has also been certified by UNESCO as a world heritage site. Through SWOT analysis, several strategies have been carried out by the management of Borobudur in terms of preservation and conservation, including the development of infrastructure to facilitate access there, holding art performances, and optimizing promotions.

In terms of infrastructure facilities, the Borobudur temple area has provided a tour map at the airport. This will make it easier for tourists to visit and can indirectly attract tourists from all over the world. In terms of physical elements (location and physical character), this Borobudur temple is located in an area close to the international airport. This can make it easier for tourists to continue visiting this historic site. The area near this temple also has various other tourist areas that make this place one of the must-see tourist destinations for visitors from all over the country. However, although this area has been developed with various tourism activities, the area around the Borobudur temple still looks green with the greenery of the mountains around it, making it another attraction for visitors to come to this place.

For the selection of the site for the construction of the temple, several factors must be considered rationally. Because it was built with the purpose of being a protected area, the natural environment is an important factor that is not only necessary in terms of the technical implementation of the project, but it is also important to be able to face the problems of basic religious needs and metaphysical concepts. Therefore, this Borobudur temple was built in a very strategic geographical area on the island of Java. This region is known as Dataran Kedu, and it is also known as Javanese Park because of its good fertility. It is a bowl-shaped plain surrounded by mountain ranges on almost all sides. Although the current state of the temple is the result of restoration activities, it still retains more than enough of the original materials found in the reconstruction.

4.1.2 Angkor Wat

Picture 2. Angkor Wat

Angkor Wat was built during the glory days of Angkor, and it represents the peak of temple glory in Cambodia, just like Borobudur represents the peak of temple glory in Indonesia. Therefore, the two temples that were built can be said to have similarities because they both function as main temples. According to Rahadhian (2018), Angkor Wat was built in the 12th century AD, when Angkor began its golden age with the capture of Angkor by a new dynasty, the Surya dynasty. With the leadership of King Suryawarman, the entire society of Angkor organized all their creations into something perfect and harmonious. Therefore, the Khmer civilization developed over three centuries and reached its peak with the construction of Angkor Wat.

This universe model feature is also accompanied by a very complex drainage system built to provide a source of drinking water to the local population as well as irrigate agricultural areas. The drainage system surrounding Angkor Wat is also a symbol that illustrates the concept of the cosmos, a very vast universe that reflects Mount Mahameru, which is where the Hindu gods reside.

4.1.3 Fort Rotterdam

Picture 3. Fort Rotterdam

Fort Rotterdam is located in Baru village, Ujung Pandang subdistrict, or more precisely, on Ujung Pandang Road, Makassar, South Sulawesi. Fort Rotterdam is very accessible as it is located on a road travelled by public transport, with a distance of 500 meters towards the west from Karebosi Field. This fort was built in 1545 by King Gowa IX, named I Manrigau Daeng Bonto Karaeng Lakiung Tumapa'risi' Kallona. Initially, this fort was made of clay, but during the reign of Raja Gowa XIV Sultan Alauddin, this construction was changed to stronger stone obtained from the Karst Mountains in the Maros district. It has an area of 28,595.55 m2 with a total building area of 11,805.85 m2. The highest part of this fort wall is 7 m, and the lowest is 5m, with a wall thickness of 2m. Fort Rotterdam is shaped like a turtle about to crawl into the ocean.

In terms of philosophy, the shape of this fort explains that turtles do not live on land or in the sea, just like the kingdom of Gowa, which is also successful on land or in the sea. The overall picture of the walls of this fort is green moss that begins to cover the walls. The people of Gowa-Makassar also know this fort better by the name Kubu Ujung Pandang. The Gowa-Tallo government finally signed the Bongaya agreement, one of which obliged the Gowa government to hand over this fort to the Dutch. During the Dutch occupation of this fort, the name Kubu Ujung Pandang was changed to Fort Rotterdam. Cornelis Speelman deliberately chose the name Fort Rotterdam to commemorate his birthplace in the Netherlands. This fort was later used by the Dutch as a spice storage centre in the eastern part of Indonesia (Chandra, 2013).

According to Gani's study (2019), the physical development that took place at the Fort Rotterdam cultural heritage site caused an increase in changes in the use of space that are not suitable for the function of the area as a cultural heritage group to control and plan a proper and better arrangement and pay attention to the heritage site culture to function better. The space utilization process at this heritage site is also carried out by zoning first so that there is a core zone that is set to be closed for commercial use, followed by a recreation zone so that the quality, capacity, and resilience of this cultural heritage site can be maintained. This situation shows the need for regulations in setting guidelines and regulations regarding buildings that are not allowed to be developed in conservation areas where heritage sites are created so that areas that can still be used as water catchments can also be open spaces that can be used by the public who visit cultural protection areas, such as Fort Rotterdam.

Through the analysis of these three famous heritage sites, the success factor that makes this heritage site famous is the result of good management through its physical elements, preservation, and restoration, as well as the complete infrastructure facilities provided. The result of this effort is very important so that the protected heritage site can be used not only for the site itself but also for the local community and the general public as well. This success factor should be used as the best example for heritage sites in Malaysia so that their artistic and aesthetic value can also be maintained.

Table 1. The success factor that makes this heritage sites famous

Factor / **Heritage sites**	**Physical elements (location & physical character)**	**Preservation & conservation**	**Facilities**
Borobudur	Location: Built in a geographically central area and fertile land. Physical character:	Conservation of physical aspects of heritage	Borobudur Temple Recreation Park Museum

	Built based on Buddhist scriptures. Tell in levels and based on carvings from the world of Mahayana Buddhism	Handicraft production where each village has its own expertise. A place for community cultural activities	Audiovisual theatre Kiosks and stalls Area for cultural performances Parking lot
Angkor Wat	Location: Built in a marshy area with moist soil. It took 5 centuries to build. Physical character: It consists of several temples, hydraulic structures (basins, embankments, reservoirs, canals) as well as communication routes. Good drainage system Modelling the concept of the universe The main building of the temple was built in a period of 37 years. Excerpts from the Mahabhrata, the Hindu scriptures are engraved on the walls of the temple	Ensure coordination of successive scientific, restoration and conservation related projects Implemented by the Royal Government of Cambodia and its international partners. Ensure consistency of various projects, and define, when necessary, technical, and financial standards Contribute to the overall management of real estate and its sustainable development. Property conservation by APSARA National Authority	Library Gallery Public toilets
Fort Rotterdam	Location: Built on the west coast of Makassar City, South Sulawesi Physical character: The shape of the fort resembles a turtle	Community activities are dominated by local residents such as trade, settlement, and offices.	Art gallery Cultural Preservation Center Church Park

4.2 The issues and obstacles faced by four local heritage-site museums.

4.2.1 Johor Lama Museum, Kota Tinggi

Picture 4. Johor Lama Museum

The Johor Lama Museum is a museum placed under the administration of the Malaysian Museum Department (Southern Region). The construction of this museum began in August 2004 and was fully completed in February 2007. The museum opened to the public in October 2007. The design of the museum building is characterized by the shape of a traditional house, and this museum is the only museum

developed 'in situ' in an area that once sketched an important history in the development of the country's history.

The main function of the establishment of this museum is to provide information and a clearer picture for those who love history to know more deeply the role of Kota Johor Lama, which was once an important centre of government in the Malay kingdom after the era of the fall of the Melaka Sultanate in 1511. Continuation of the glorious legacy of the Kingdom of Malacca Malays continued to have a foothold in the state of Johor and have coloured the local history at that time, especially along the Johor River. The exhibition space in this museum is divided into several segments, starting with the introduction of Kota Johor Lama, and continuing with the archaeological studies that have been carried out in this city area by local and foreign researchers.

Entry fee for the general public to the Johor Lama Museum is free and several other facilities are also provided such as parking, guided tours, and public toilets. In terms of the museum's physical and social preservation strategy, the museum carries out analysis, research, treatment, and preservation of the museum's collection. The museum also carries out damage prevention and artefact restoration work as well as temperature, humidity, lighting, and pest control system monitoring to maintain the value of valuable exhibits. From the perspective of museum officers and staff, the museum organization provides training and advisory services on conservation to its staff and related agencies. For administrative matters, the Malaysian Museum Department is closely involved in the administration and maintenance of this museum.

4.2.2 Kota Kuala Kedah Museum

Picture 5. Kota Kuala Kedah Museum

Kota Kuala Kedah Museum was built in Kota Kuala Kedah or Kuala Bahang which is located on the north bank of the mouth of the Kedah river. A gate has been built on the eastern wall facing Alor Melaka, known as the "Kacapuri Gate". The city of Kuala Kedah was once attacked by Bugis, Acheh, and Siamese. In 1909, when Kedah was officially placed under British control, several government offices were built in this city area, including a lighthouse. Another new gate was built where it still exists to this day. During the Japanese occupation of Malaya, the city was used as a military base until their defeat by the British in 1945. On 31 August 1978, the city was gazette by the Department of Museums and Antiquities as a "Historic Site" in accordance with the provisions of the "Antiquities Act 1976" under Act 165. In November 2000, the Department of Museums and Antiquities carried out conservation work on the east and south walls, including rebuilding the Kacapuri Gate which had collapsed in 1970.

The museum divides its exhibition gallery into six main segments which are introduction, history, function of the City of Kuala Kedah, the British Era, the Japanese Era, and the Post-Independence Era. The Kuala Kedah City Museum displays 60 collections of archaeological artefacts, ceramics, and bricks from the city. An interesting collection on display at this museum is 13 cannonballs and six English-made cannons that are over 100 years old. In addition, there is an artifact called 'Pelita' found during archaeological research and conservation works of the eastern wall near the Kacapuri gate. Entry fee for the general public to the Kuala Kedah City Museum is free and several other facilities are also provided such as toilets, parking, cafes, suraus and even guided tours.

In terms of transportation, the museum is located approximately 11km from Alor Setar where visitors can take a bus to Kuala Kedah from Shahab Perdana or Pekan Rabu or take a taxi from Alor Setar or Terminal Kuala Kedah. For administrative matters, the Malaysian Museum Department is closely involved in the administration and maintenance of this museum. Therefore, some aspects of the museum's

physical and social preservation strategy are also the same as those implemented at the old Johor Museum, i.e., this museum carries out analysis, research, treatment and preservation of the museum's collection. The museum also carries out damage prevention and artefact restoration works as well as temperature, humidity, lighting, and pest control system monitoring to maintain the value of valuable exhibits. The museum organization also provides training and advisory services on conservation to its staff and related agencies.

4.2.3 Pasir Salak Museum

Picture 6. Pasir Salak Museum

The historical complex was established as an important historical memorial of Pasir Salak to appreciate and perpetuate the services and sacrifices of the heroes who persevered in defending the dignity of the nation and the country. This complex was opened by His Majesty the Regent of Perak, King Dr. Nazrin Shah on 26 May 1990 and was fully inaugurated by His Majesty the Sultan of Perak, Sultan Azlan Muhibbuddin Shah on 5 July 2004. The original concept of the establishment of this complex was as a form of historical recording commemorating the importance of the bloody Pasir Salak event which is considered to be the foundation of the system parliamentary democracy in Malaysia.

The series of historical events are exhibited in the History Tunnel using the diorama exhibition technique which is a three-dimensional exhibition. Every important event and episode in the history of the country and its development is arranged and presented according to historical chronology. In addition, this complex is also a center that provides reference sources on the history and culture of the state of Perak. The complex, which was built in stages, was also completed with the construction of monuments and buildings such as Rumah Kutai I, which was built around 1896, Rumah Kutai II, Lela Rentaka Monument, Belotah Stage, Perak Heroes Memorial Monument, Keris Gallery and Perak Chief Ministers History Gallery.

This complex also has a J.W.W Birch memorial built by the British government around 1900 to commemorate Birch's murder in Pasir Salak. Visitors can not only explore the history of the struggle of Malay warriors against British colonialism but can also see the aesthetic beauty of Perak's Malay architecture which is one of the landmarks for this state. The entrance fee charged by the public to enter this complex is RM4.00 for adults and RM2.00 for children (7-12 years old) in addition to several other facilities that are also provided by the complex such as toilets, surau and souvenir shops. Among the parties directly involved in administering and maintaining this museum are the Perak State Museum Board and the Malaysian Museum Department.

4.2.4 Kota Ngah Ibrahim Museum

Picture 7. Kota Ngah Ibrahim Museum

Kota Ngah Ibrahim Museum was built by Che Ngah Ibrahim in 1857. This city was originally an administrative and defence center of Larut District, and the official residence of Che Ngah Ibrahim who was the governor of Larut District at that time. Minister Ngah Ibrahim is recorded as a very rich person and Minister Ngah Ibrahim's biggest income is through tin companies, coffee plantations in Asam Kumbang, Taiping and sugarcane plantations in Kerian. Minister Ngah Ibrahim has his own security force made up of Indian soldiers and led by captain T.C.S Speedy. Minister Ngah Ibrahim has completed this area of his city with infrastructure facilities such as roads and mosques.

The chronology of the planning and development of this museum is as follows; In 1874, Ngah Ibrahim's house was used as the residence of captain Tristam Charles Sawyer Speedy (assistant resident), at the same time it was used as a prison and a court as well. In 1913 to 1922 this house was used as Matang Malay Teachers' College, 1923 to 1942 this house became a Malay school, 1942 to 1945 this house became a Japanese army defense headquarters, 1946 to 1983 this house became a Malay school and Matang National School and in 1983 until 1985 this house opened a few more classes such as additional classes of Matang National School (grades 5 and 6), al-Quran and fardhu ain classes (afternoon), KEMAS class twice a week and once in a while it was used as a meeting place or gathering of the villagers. In 1985 this house was finally taken over by the Department of Museums and Antiquities Malaysia and in 2009 Kota Ngah Ibrahim was gazetted as a Heritage Building under the National Heritage Act 2005.

The museum's collection consists of all kinds of artifacts in relation to the chronology of the establishment of the museum itself. Therefore, the exhibits displayed in this museum are artifacts related to the chronology of the establishment of the building and the use of the building itself starting from Ngah Ibrahim, the British Rule, the Japanese Occupation, the Matang Malay Teacher Training College and the Malay School. The operating hours for Kota Ngah Ibrahim Museum are open every day from 9.00 am to 5.00 pm except on the first Monday of every month and closed on the First and Second Hari Raya Aidil Fitr and Hari Raya Aidil Adha. Admission to the museum is free to the public.

In terms of transportation facilities at this museum, visitors can also visit the Matang Museum located in the Taiping district. Taiping is a district located between the cities of Ipoh and Butterworth. Taiping district is also connected to Selama town and Krian district in Perak. Various public transport facilities are available for visitor access to the Kota Ngah Ibrahim Museum such as taxis, express buses, and the fast Electric Train Service (ETS) to Ipoh and Kuala Lumpur. Visitors from outside the city of Taiping can also visit the Matang Museum with a good, easy, friendly and time-saving public transport network that facilitates the movement of tourists from one place to another. However, this museum also provides other facilities such as a prayer hall, parking lot, mini library, guided tours, research facilities and also book sales which can indirectly attract many more visitors to come to this museum.

The results of the analysis of the four museums show that there are still some constraints even though all of these museums are located in heritage sites which should be one of the catalysts for the public to come and visit. Heritage sites should be best utilized by the museum as done by the management in Borobudur, Angkor Watt, and Fort Rotterdam where their success in attracting visitors from all over the world should be emulated. The management of all these museums are administered and managed under one organization, the Malaysian Museum Department, which requires the involvement of external agencies and the public to also help promote the museum's products. Websites should also be established by each museum to make it easier for visitors to access the museum of their choice directly and make it easier for visitors to visit.

Table 2. The criteria and elements provided by the local heritage site museums.

Criteria / Museum	Physical elements	Facilities	Museum physical and social preservation strategy
Johor Lama Museum	Built on the site of the main area of Kota Johor Lama The building is characterized by traditional Malay house architecture. Construction began in August 2004 and was fully completed in July 2006 Opened to the public in October 2007	Parking lot Guided tours Public toilets	Carrying out analysis, research, treatment, and preservation of museum collections Carry out damage prevention works and repair artifacts. Monitoring of temperature, humidity, lighting, and pest control systems Provide training and advisory services on conservation to staff and related agencies
Kota Kuala Kedah Museum	Built in 1771 Construction was completed in 1780. The design was drawn by Hafiz Sab who at that time held the position of Dato' Maharaja Kadhi. A gate was built on the eastern wall of the "Kadapuri Gate".	Gallery Parking lot	
Pasir Salak Museum	Collecting, researching, preserving, exhibiting and publishing historical exhibits of the struggle for patriotism and nationalism of the people of Perak State museum curator management system	Toilet Gift shop	The series of historical events are exhibited in the History Tunnel using the diorama exhibition technique which is a three-dimensional exhibition. Provide reference sources on the history and culture of the state of Perak. Reference center
Kota Ngah Ibrahim Museum	1874 - Residence of Captain Tristam Charles Sawyer Speedy (Assistant Resident). At the same time, it was used as a Prison and Court. 1913 -1922 - Matang Malay Teachers College. 1923 -1941 - Malay School. 1942 -1945 - Japanese Army Defense Headquarters. 1946 – 1983 - Malay School and Matang National School. 1983 – 1985 - Additional Class of Matang National School 1985 - Taken over by the Department of Museums and Antiquities Malaysia 2009 - Kota Ngah Ibrahim was gazetted as a Heritage Building under the National Heritage Act 2005.	Public transport (Taxis, Express Bus and ETS Electric Train Service) Parking lot Mini library Guided tour Research facilities Book sales	

5. Conclusion

This study is expected to help the Museum Department's efforts to dignify the preservation and conservation of the nation's historical heritage and natural artefacts. In addition, through the research conducted, the care and preservation of heritage can be avoided from being destroyed or changed without planning. Systematic control and management should be systematically planned so that these heritage assets can be well taken care of. In the context of a heritage city that needs to be perfectly preserved, historical facts and the background of its authenticity play an important role for future generations. In conclusion, this study is expected to be used as a reference in dealing with the issue of maintaining the sustainability of museums from a physical point of view, in line with the third core listed by the National Cultural Policy (DAKEN), cultural heritage needs to be preserved through preservation and conservation efforts to ensure the high aesthetic value of treasures country.

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TRACK 7
Social-economic aspects of sustainability

7a. Global inequality and poverty

Abstracts

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A feminist political ecology of household waste management in South African urban township

Dr Mbali Pewa[1], Dr Elsbeth Robson[2], Professor Pauline Deutz[2]

[1]University of South Africa, Johannesburg, South Africa. [2]University of Hull, Hull, United Kingdom

Abstract

In the Global South, women and children spend a significant amount of time engaging with household waste. Development studies literature suggests that persistent feminization of household waste management activities is a product of cultural, social and economic factors that link women close to private domestic spaces. Raising awareness of the intricacies of these gendered disparities and social relations from the intimate space of the home is a way of addressing patriarchal power and female oppression. However, there is a lack of research that investigates the intersection of the multiple oppressions (based on identity) create through interaction with household waste. This paper critically examines the relationships between gender and household waste management in a South African township. Based in mixed methods research, the reported investigation draws on and contributes to feminist political ecology scholarship relating to gendered knowledges and oppression. The analysis unpacks how patriarchal cultural norms, gender, socio-economic status, marital status and proximity to waste are intertwined to (re)produce gendered power relations and unequal exposures to household waste. The way that intersecting identities mediate waste spaces also contribute to our understanding of the role of political economy in shaping individual subjectivities, and increasing the likelihood of discrimination against subordinated identities. Feminist political ecology is thus proven a useful lens to highlight the gendered disparities which are anchored in new forms of neo apartheid discrimination that limit women's mobilities and autonomy in South Africa's urban areas. Drawing on these theoretical developments, we argue that waste spaces and practices are gendered and embedded in local meaning which determine how waste is perceived and subsequently used to control women's behaviour. Such an understanding may help address entrenched gendered oppression through the implementation of policies that recognise the multiple inequalities in household waste management.

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“We need to try harder one more time”: challenges in the transition of work os waste pickers from a dumping ground to a cooperative

Miss Dijana Helena Diniz Costa Vieira, Mister Armindo dos Santos de Sousa Teodósio
Pontifical Catholic University of Minas Gerais, Belo Horizonte, Brazil

MISS DIJANA HELENA DINIZ COSTA VIEIRA

MISTER ARMINDO DOS SANTOS DE SOUSA TEODÓSIO

Abstract

The destruction of the environment to ensure the culture of exacerbated consumption in contemporary societies has led public and private actors to create initiatives to mitigate the impacts caused by man on nature. Among these actions is the closure of open-air dumping grounds. It is a measure that is beneficial to the environment and that directly affects the waste pickers who work in this space. Faced with the vulnerability of this group and the importance of keeping a close eye on them, this work aimed to analyze the challenges of the transition from the work of waste pickers in a dumping ground to a cooperative organization in the Esmeraldas, a municipality of Minas Gerais State in Brazil. We adopted in our research the action-research through not-extractivist and participative methodologies such as social cartography and in-depth semi-structured interviews in a case study with a holistic approach. The data collection methods used were document analysis, participant observation, and participatory mapping. As for the results, there were numerous challenges that the waste-pickers faced in their transition to the shed, such as, for example, the lack of knowledge about how to manage an association, the absence of a selective collection program in the municipality, the resistance of the collectors to work as a team and government barriers to the cooperative run as an organization in the chain of urban waste residuals system. To overcome these challenges, especially those related to technical and administrative issues, the association had the support of external actors such as social movements, civil society organizations, and some local business and religious leaders. This research contributed to the field of Sustainability as it reported the scenario experienced by Brazilian waste pickers after the closure of the dumping ground, detailing how this group has done to strengthen the association and guarantee their source of income; this scenario will be repeated in several Brazilian municipalities, given that there are still a large number of open dumps in operation in the country. Our research tries to bring new highlights over the inequality dimensions of Sustainability issues in countries marked by later development and incomplete access to citizenship as Brazil.

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AN INVESTIGATION OF THE IMPACT OF HOUSEHOLD UPLIFTING PROGRAMME ON HOUSEHOLD CONSUMPTION AND ASSET ACQUISITION IN OYO STATE, NIGERIA: IMPLICATIONS ON SDGs 1

Dr Tolulope Gbadamosi, Mr Akintunde Gbadamosi
University of Ibadan, Ibadan, Nigeria

DR TOLULOPE GBADAMOSI

MR AKINTUNDE GBADAMOSI

Abstract

Previous development intervention programmes have not succeeded due to poor implementation. However, the present government, in its efforts to reduce poverty among the vulnerable groups, recently introduced the Household Uplifting Programme (HUP). Previous studies have addressed needs assessment and the mode of implementation of the programme. While it seems little have been done to determine if the objectives of the programme are being achieved, Therefore, this study was designed to assess if the HUP is improving household consumption and expanding asset acquisition among its beneficiaries in Oyo State, Nigeria, or not. Two research questions were raised and answered in this study. Two validated instruments, the household's consumption pattern questionnaire (r = 0.76) and the household asset acquisition checklist (r = 0.83), were used to collect the data. The data collected was analysed using descriptive statistics of frequency counts and percentages. The findings of the study revealed that the introduction of HUP has significantly improved household consumption among the beneficiaries. The result also showed that, among the beneficiaries of the programme, there was a clear-cut difference between their household asset acquisition before and during the programme. It is therefore concluded that HUP is a potent means of eliminating poverty among households. It is therefore recommended that if there will be an end to poverty in all its forms everywhere, HUP should be extended to all indigent people in Oyo State and should be legislative backing among others.

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Environmental Injustice: An Unsustainable Development

Professor Carlton Waterhouse
Howard University School of Law, Washington, DC, USA

Abstract

Thirty six years ago, the Brundtland Commission published a groundbreaking report entitled Our Common Future. It has not only influenced but has framed much of the environmental discourse around the world since. One of the many fruits of that work is the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs). The agenda and the goals reflect international cooperation and agreements around how to meet the needs of the present without compromising the ability of future generations to meet their own needs—a concise definition of sustainable development provided by the commission. The report and the subsequent goals share a core principle of sustainability—social equity. Our Common Future made clear why equity is essential for sustainability, "A world in which poverty and inequity are endemic will always be prone to ecological and other crises." The historic and contemporary examples of this are legion. Despite that fact, in the United States and around the globe, environmental organizations and institutions pay far too little attention to social inequities in the environmental context. The creation of sustainable--and therefore just--societies is inconsistent with the environmental injustices that marginalized and disadvantaged social groups experience. Through an examination of the inequitable vulnerabilities to climate based harms, pollution exposure, and natural resource extraction in the United States and around the world, this paper argues that reaching the SDGs requires special attention to understanding environmental injustices and the best legal mechanisms to eliminate them. The paper proposes the use of Social Dominance Theory as a valuable tool for examining the persistence of group based inequality and the creation of effective legal mechanisms to end it. As a theory of relations between and among groups, Social Dominance Theory combines social analysis with examinations of human psychology. It stands out among theories examining social inequality because of its success in explaining the processes that produce and maintain prejudice and discrimination at multiple levels. When considered in its totality, the theory insightfully describes how societal myths and ideologies reflected in individual attitudes and beliefs undergird institutional practices that perpetuate group based inequalities across diverse countries, cultures, and contexts. This paper applies the theory as a lens for understanding the prevalence and persistence of environmental injustices in the United States, primarily, but with broader implications for nations across the globe. Successfully reaching global SDG goals for 2030 requires that we better understand the persistence of group based inequality and adjust our approaches accordingly. Today, the threats and harms of climate change, pollution, and exposure to emerging contaminants in useful products fall unequally across and within nations. Ethnicity, religion, class, race, clan, geographic region, and other identity constructs shape individuals' experiences and relationships to environmental benefits and harms. This paper connects group identity with access to a clean and safe environment and the role that law can play in ensuring that all people can fulfil their potential in dignity and equality in a healthy environment.

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Will mankind achieve a just and equitable sharing of benefits of the high seas? Connecting the SDGs to the new "UN Treaty of the high seas."

Dr Stella Emery Santana[1,2,3], Pedro Pulino Melatte[4]
[1]Centro Universitario FAESA, Vitoria, Brazil. [2]UFES - PROFAgua, Vitoria, Brazil. [3]Robert H. McKinney School of Law, IUPUI, Indianapolis, USA. [4]Universidade Federal do Mato Grosso, Cuiaba, Brazil

DR STELLA EMERY SANTANA

PEDRO PULINO MELATTE

Abstract

On March 4th, 2023, the new "Treaty of the high seas" was approved by delegates from almost 200 countries after nearly 20 years of UN-facilitated talks about marine biodiversity of areas beyond national jurisdictions. The main goal of this new multilateral environmental agreement is to ensure the conservation and sustainable use of marine biological diversity. The agreement still needs to be signed and ratified by countries, but it already represents a significant achievement. Since 1982, when the United Nations Convention on the Law of the Sea (UNCLOS) was adopted, there has been the prediction to conserve and develop management tools for the living resources of the "High Seas." Additionally, the same agreement refers to the "Area" as "the seabed and ocean floor and subsoil beyond the limits of national jurisdiction." As a general term, the same agreement defines the concept of marine pollution. Regarding humanity and the seas, the preamble of UNCLOS affirms that through this convention, there will be the realization of a "just and equitable international economic order," considering the "needs of mankind as a whole." In the same direction, it affirms that the "Area" and its resources are considered the common heritage of mankind and, therefore, "the exploration and exploitation of which shall be carried out for the benefit of mankind as a whole, irrespective of the geographical location of States." The question here is how humankind would share this benefit. In practical ways, how can an agreement establish rules that will have just and equitable meanings for all humanity? These questions have crossed a scholar in this field before and during the negotiations of the first "Treaty of the high seas." The agreement of this treaty comes after the COP 15 UN Biodiversity summit that occurred in Montreal, Canada, at the end of 2022. In this meeting, the global goal is to protect 30% of the world's oceans by 2030. This paper aims to analyze the new "Treaty of the High Seas" and its promises to contribute to the "realization of a just and equitable international economic order," taking into consideration the "interests and needs of humankind as a whole and, in particular, the special interests and needs of developing States, whether coastal or landlocked." To analyze the paper's primary goal, it will have an environmental justice approach. This analysis will be guided by SDG 1, no poverty; SDG 9, industry, innovation, and infrastructure; SDG 10, reduced inequalities; SDG 13, climate action and; SDG 14, life below water. In the end, the text of the treaty will provide if the goals described in the previous paragraph were reached or not and if the SDGs listed may or may not be connected to achieving the sharing of benefits for mankind.

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The Toll of Disproportionate Impact: Africatown's Fight for Environmental Equality

Kenadi Mitchell
Howard University School of Law, Washington DC, USA

K E N A D I M I T C H E L L

Abstract

This paper discusses environmental justice concerns in Africatown, Alabama, with a focus on transportation development disparities and the United Nations' Sustainable Development Goal 11. In particular, this paper examines how the Bay Bridge Alternative, chosen by the Alabama Department of Transportation (ALDOT), will disproportionately affect Africatown, which holds the only toll-free alternative for hazardous trucks. Africatown's bridge is currently the only path for hazardous trucks and will subject the community to more pollution, while the rest of Mobile, Alabama will benefit from the $125 million dollar Infrastructure for Rebuilding America (INFRA) discretionary grant. The community was founded by descendants of the last known illegal shipment of slaves to the US and was once home to a thriving Black-owned business district. However, the construction of an interstate highway in the 1960s divided the community and surrounded the remaining homes with factories and chemical plants, leading to Africatown being home to three of the five largest industrial polluters in Mobile County.

This paper analyzes Africatown in relation to the 14th Amendment to the US Constitution and the Title VI Civil Rights Act to discuss the current transportation and urban planning trends in the United States. The paper examines how group identity relates to environmental experiences and what injustices can be linked to land use, zoning practices, and political climate. It highlights the overall inequalities of environmental experiences based on poverty and race.

This paper relies on both primary and secondary sources to examine these inequities from a legal standpoint. Primary sources include the text of the 14th Amendment and Title VI of the Civil Rights Act, as well as relevant case law and legal scholarship. Secondary sources include historical accounts, academic literature, and policy reports that contextualize the legal frameworks in their historical and contemporary contexts.

This paper concludes that ALDOT most likely did not violate the Equal Protection clause of the Fourteenth Amendment because Africatown is unlikely to meet the heavy burden of evidence required to find that ALDOT invidiously discriminated against African American people. However, when examined in conjunction with the constitutional claim, ALDOT's facially neutral action of requiring Africatown to be the only toll-free bridge alternative for hazardous trucks likely does violate Title VI as the action creates a disproportionate, adverse, and disparate impact on African Americans.

This proposal directly addresses SDG-11, specifically SDG Target 11.2, by examining the deep disparities in the distribution of the benefits of pollution control and the environmental decision-making process. The paper underscores the importance of fostering peaceful partnerships between community members and local and federal officials to address such disparities to promote sustainable development. The research on the deeply intertwined relationship between racial inequities and transport development systems in urban planning is highly relevant to the "Halfway through Agenda 2030" Conference, as Africatown serves as a prime example of how transport decisions can significantly impact people's well-being and health.

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Beyond Four Walls: The Story of Housing Inequity Among India's Poor

Ms Rincy Simon

Centre for Economic and Social Studies, Hyderabad, India

Abstract

The rapid rise in the population and income in the past decade has increased the demand for housing all over the world, especially in developing countries (OECD Economic Surveys: India 2019). A house is not only a medium of shelter but possesses much significance in the overall well-being of an individual and household. In the current scenario around one billion people who live in slums globally have low-quality housing and poor living conditions (UN, 2020). On average, across the OECD, low-income households spend the biggest share of their household budget on housing, much more so than middle- and upper-income households (OECD, 2020). The low-income households are unable to pay the rising cost of housing in the urban area and often settle in illegal settlements or slums which do not have adequate housing services. Even if they manage to construct a house by using all their economic resources, they are left with no income for their livelihood which pushes them into a vicious circle of poverty. For low-income families, housing is not a product is it a process. It is a means of getting up the ladder of economic freedom (UNESCAP, 2008).

In this context, this paper explores the problems related to Indian housing with the help of secondary data from the NSS surveys (76th round and 69th round). Both rounds address the key issues of India's housing situation. The NSS provides more thorough information on housing and its impact on factors including education, health, and across gender. To analyse the unit-level data and comprehend the living conditions of the richest and poorest citizens of the nation, the population will be divided into quartiles based on their consumer expenditure and appropriate methodologies will be used for the analysis (Radhakrishna et al. 2007). All the other variables will be controlled by specifying appropriate regression tools. There are numerous approaches in economics for analysing housing conditions from more than a physical structure, as the study needed the use of both subjective and objective variables for the examination of the relationship between housing and well-being.

The main findings of the article will be a trajectory of change in India's housing through time. India's fast urbanization is the root cause of the housing shortage in the nation. The housing crisis will have a particularly negative impact on the underprivileged in Urban India. Housing poverty in India is often underestimated because of the variation in the definition by the census of India and international standards (Patel, Shah, and Beauregard 2020). If we apply international standards to the Indian data, the number of individuals with inadequate housing will be significantly higher. The article also attempts to compare housing in India to a global standard. With the study of housing, the article will also provide important details on other basic needs including water, sanitation, and other housing outcome indicators.

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Environmental Justice in Houston; How Houston has failed the Manchester/Harrisburg neighborhood

Environmental Justice in Houstn Wesley Davis
Howard University School of Law, District of Columbia, USA

Abstract

Environmental justice is an important topic because it is a fundamental human right, and every person should be able to live in a safe environment. Without Environmental justice, certain groups of people would become the victims of the ambition of others. Low-income and minority communities have a long history of being disproportionately burdened with many environmental hazards. Specific characteristics of a community determine whether those communities will house these environmental hazards, and the two most significant reasons are race and income. Manchester/Harrisburg is a community located in Houston's East Side, disproportionately burdened with pollution-creating sources. As Houston has become known as the "Energy Capital of the World," it has forgotten this neighborhood in its efforts to grow the Houston Ship Channel. With a population of 90% Hispanic and 40% below the poverty rate, this community sits in one of the most air-polluted areas in America. This paper explores a more fitting definition of environmental justice that sufficiently understands its ties to the civil rights movement and explains why this community is an environmental justice Community. To answer this question, I compare this community's environmental harms to other communities in Houston, where the population is less diverse and more affluent. The data used in the paper comes from the EPA, TCEQ, and other local groups operating in the Houston area. After examining the data, I concluded that Harrisburg/Manchester is an environmental justice community. After determining that the community is indeed an environmental justice community, I propose possible solutions that the community can take to help alleviate the environmental risks the community faces. I look at ways the community can get involved, including participation in permitting hearings and connecting with their representatives. I look at ways the community can get involved in the enforcement of air pollution regulations that the facilities must abide by. Finally, I analyzed the possible state, local, and federal legal remedies. From an Environmental justice perspective, this paper emphasizes the need for both state and federal environmental bodies to consider the cumulative impacts of exposure to various environmental harms that have direct and indirect effects on the environment that affect health and well-being.

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Building Social Capital: An Effective Method for Combatting Discriminatory Zoning and Environmental Degradation in Urban Minority Communities

Autumn Hooker
Howard University, Washington, USA

AUTUMN HOOKER

Abstract

The United Nations Sustainable Development Goals provide a helpful framework for achieving healthy, sustainable communities globally, with specific applicability to the United States urban, low-income, and minority communities. Urban communities experience disproportionate levels of environmental degradation as a result of discriminatory zoning practices. These communities often shoulder vast amounts of toxic waste pollution which is detrimental to both the environment and the health of the community. These communities must garner social capital to reverse decades of environmental degradation that has resulted in severe poor community health. There is no one size fits all way to build social capital, it will depend on the unique needs of each community.

Social capital refers to the relationships among community members that confers benefits to the community, usually in the form of a public good. These social connections are garnered through civic engagement, trust, and shared social norms. The development of social capital will likely facilitate other forms of community development, such as, economic, human, and political capital. Social capital often connects people and resources resulting in community problem-solving. In fact, communities with high degrees of social capital are able to overcome barriers of social injustice, like racism, poverty, and environmental injustices, which enhance productive community development

Using Washington, D.C. as a case study, this paper will analyze Community Benefit Agreements and Land Trusts as two of the many ways to create social, political, and economic capital. The Southwest region of D.C. has experienced two major renovation projects. The first, "Urban Renewal," spanned from the 1950s-1970s. It initially brought economic success. The second "Revitalization" project, now known as "The Wharf," holds a similar nostalgia. Although the project was successful in creating new, luxury apartment buildings, townhomes, and condominiums, it [HAE1] drove low-income and minority residents out of their long-standing, established communities. The Renewal project was unsuccessful at creating and establishing a lasting community, resulting in another costly round of revitalization. Without building social capital through these mechanisms, society will continue to build unsustainable communities that threaten the health of future generations.

Full Papers

AN INVESTIGATION OF THE IMPACT OF HOUSEHOLD UPLIFTING PROGRAMME ON HOUSEHOLD CONSUMPTION AND ASSET ACQUISITION IN OYO STATE, NIGERIA: IMPLICATIONS ON SDG 1

TOLULOPE VICTORIA GBADAMOSI PhD[1], AKINTUNDESAMSON GBADAMOSI[2]

Department of Arts and Social Sciences Education[1]

Centre for Sustainable Development[2]
University of Ibadan, Ibadan, Nigeria
Corresponding author: tv.gbadamosi@ui.edu.ng, samtiv1975@gmail.com

Abstract

Nigeria government, in its efforts to reduce poverty among the vulnerable groups, recently introduced the Household Uplifting Programme (HUP). While it seems little have been done to determine if the objectives of the programme are being achieved, Therefore, this study was designed to assess if the HUP is improving household consumption and expanding asset acquisition among its beneficiaries in Oyo State, Nigeria. Two research questions were answered in this study. Two validated instruments, the Household's Consumption Pattern Questionnaire (r = 0.76) and Household Asset Acquisition Checklist (r = 0.83), were used to collect the data. The data collected was analysed using descriptive statistics of frequency counts and percentages. The findings of the study revealed that the introduction of HUP has significantly improved household consumption among the beneficiaries; there was a clear-cut difference between their household asset acquisition before and during the programme. It is therefore concluded that HUP is a potent means of eliminating poverty among households. It is therefore recommended that if there will be an end to poverty in all its forms everywhere as stated in SDG 1, HUP should be extended to all indigent people in Oyo State and there should be legislative backing among others.

Wordcount: 199

Keywords: Poverty alleviation; Policy; Sustainable Development Goals

1. Introduction

Over the years, poverty has become one of the major factors being debated as a limitation to every nation's development in terms of social, environment, and economy. The most effective way to describe, comprehend, and eradicate poverty has consumed both academic study and development-related public policy. This is a testament to the fact that poverty has long been a global issue of concern, impacting both the developed and developing worlds in varying degrees of severity (absolute or relative). However, it is more predominant in the developing countries because it takes the form of an impossible-to-end vicious cycle.

The prevalence of absolute poverty in developing economics and relative poverty in developed economics necessitated the adoption of the first Sustainable Development Goals, by the United Nation at it general assembly in 2015. The sole objective of the first goal is to end poverty in all its forms. This goal has encouraged countries, including Nigeria, to develop policies and programmes targeted at achieving the goal of ending poverty. Nigeria, been a developing state has been plagued by poverty for many years; it dates back to the late 1980s. National poverty peaked in 2010 at 69.00%, up from a low of 66.90% in 1996. It had increased from 28.10% in 1980 to 66.90% in 1996. With a Human Development Index (HDI) of 0.532, Nigeria ranked 157th out of 187 nations included in the Human Development Report, showing poor income, education, and life expectancy (United Nations Development Programme,UNDP, 2020).

According to Grijalva-Eternod, Jelle Mohamed, Waller Osman, and Hussein Barasa, (2023), there are three main points of view that predominate in the literature on the definitions and causes of poverty. According to the first perspective, poverty is defined as a lack of tangible possessions, which can typically be measured in monetary terms. The second perspective sees poverty as having multiple dimensions, including not having an adequate means of subsistence and assets, not being able to meet the requirements for nutrition, health, economic well-being, and social interaction, among other things. According to the third point of view, poverty is a phenomenon that is hard to pin down with objectivity. Kate, Robert, Ignacio, Marta, Brynde., and Alice Cahill. (2022) shared this latter perspective, considering poverty to have subjective aspects with both physical and psychological dimensions that predispose its victims to hunger, violence and crime, insecurity, discrimination, victimisation, political repression, and other issues.

It is generally accepted that a variety of factors can contribute to poverty and that these factors reinforce one another, creating a vicious cycle. Some factors that contribute to poverty include a lack of access to markets for the items and services that the poor could sell, a lack of income, a lack of empowerment, and a lack of material and social assets like land, equipment, and supportive networks (Felix and Osu, 2014; Adio and Gbadamosi, 2023). The following were also explored by Taiwo and Agwu (2016) as contributing causes to the prevalence of poverty in Nigeria: lack of physical assets, lack of employment prospects, and loss of natural resources (causing environmental degradation) Rural and urban regions are deteriorating as a result of a lack of access to aid for the weak and disenfranchised, a

non-participatory approach to programme design and implementation, and a poor maintenance culture of existing institutions. Although various governments have attempted to address the above-mentioned issue of poverty, the methods and programmes' effects have not been particularly noticeable because poverty is still a problem in the nation.

2. Literature Reviews

Previous Government Programmes to address Poverty in Nigeria

The development and implementation of numerous poverty alleviation programmes by various past regimes had resulted from efforts to reduce the effects of poverty if not completely eradicate poverty and raise the standard of living of the populace . Among the programmes are: the federal military government, under the command of General Olusegun Obasanjo, launched Operation Feed the Nation (OFN) in 1979. It concentrated on raising food production in order to make food more accessible, reduce poverty, and assure adequate nutrition. Likewise, Alhaji Shehu Shagari administration launched the "Green Revolution" in April 1980 purposely to promote agricultural production.

In 1984, General Muhammadu Buhari led the War Against Indiscipline (WAI), which sought to enhance national cohesion, advance economic independence, and teach moral, ethical, and cultural discipline. General Badamasi Babangida established the People's Bank of Nigeria (PBN) which promotes business owners without imposing strict conditions in the form of collateral. Moreover, this administration established Community Banks, the Directorate of Food Roads and Rural Infrastructure (DIFFRI), which built feeder roads to open up rural areas and provided access to basic services to boost the economy of the nation., the Nigerian Agricultural Land Development Authority (NALDA) was also established to reduce subsistence agriculture and promote commercial agriculture, the National Directorate of Employment (NDE), Family Economic Advancement Programme (FEAP), Better Life for Rural Women, Family Support Programme (FSP) and the National Poverty Eradication Programme (NAPEP) (Abbas, 2016).

Current Efforts to Address Poverty in Nigeria by Government

Social protection programmes, which include social assistance, social insurance, cash transfers, and labour market regulations, were created with the purpose of assisting low-income households with their income and consumption needs. With the overall goal of lessening the economic and social vulnerability of poor, vulnerable, and marginalised groups, the Social Protection Programme is a public and private initiative that provides income or consumption transfers to the poor, protects the vulnerable against livelihood risks, and improves the social status and rights of the marginalised (Hussaini, 2014). It specifically refers to a series of measures to lessen people's vulnerability across social insurance (providing protection against risk and adversity throughout life), social assistance (providing payments and in-kind transfers to support and enable the poor), and inclusion initiatives that improve the marginalised population's capacity to access social insurance and assistance (European Communities cited by Odishika and Adedeji, 2015; Gbadamosi, 2019).

To reduce poverty by 2030, which is the first Sustainable Development Goal (SDG), the Nigeria Government created a number of National Social Investment Programmes (N-SIP) in 2016. The programmes' objectives include eliminating poverty and enhancing the living conditions of vulnerable populations such young people without jobs, women, and children. Moreover, other established programmes include N-power, the Government Enterprise Empowerment Programme (GEEP), Home Grown School Feeding, the National Cash Transfer Programme (NCTP), also known as the Household Uplifting Programme (HUP), which is the subject of this study.

One of the four social investment programmes supported by the Federal Government of Nigeria is the Household Uplifting Programme. It was designed to address important social issues in the nation as part of the Federal Government of Nigeria's broader growth and social inclusion initiatives (Shadare, 2020; Gbadamosi, 2020). It is a part of the National Social Safety Nets Programme (NASSP), which the World Bank supports and aims to give selected poor and vulnerable Nigerian households cash assistance. The plan is focused on addressing capacity gaps and a lack of investment in human capital, particularly among our most vulnerable populations.Basic Cash Transfer, Top-Up (depending on State-selected conditions), and Livelihood Support are the three parts of the HUP (Ona, 2020).

The government of Nigeria and its development partners are actively implementing cash transfers to address the nation's high rates of poverty and vulnerability. In recent years, social protection policies and programmes have evolved in Nigeria (John-Akamelu, Osegbue, Onuzulike-Chukwuemeka, and Obi-Nwosu, 2022). The theoretical justification for cash transfers is based on the income impact theory, which claims that changes in consumption are dependent on income, suggesting that people will typically spend more if their income rises and may spend less if income decreases.

Studies on Conditional Cash Transfers (CCTs) and Household Consumption

In a study done to evaluate the effects of Brazil's Bolsa Familia Conditional Cash Transfer programme on children aged 6 to 17 years, De Brauw, Gilligan, Hoddinott, and Roy (2015) discovered that the programme considerably raised children's consumption (by 8 percentage points) and had substantial consequences on both younger and older females in rural regions, but with a focus on girls between the ages of 15 and 17. Moreover, Parker and Vogl (2018) employed panel regression analysis in an empirical study to examine the connection between poverty alleviation and the welfare of vulnerable people in the United States of America. They discovered that there is a strong association between the two.

Studies on CCTs and Household Assets

Conditional Cash Transfers, according to Cahyadi, Hanna, Olken, Prima, Satriawan, and Syamsulhakim (2020), boost investments in human capital while also generating revenue. On the other hand, Seyram and Evans (2015) investigated conditional cash transfer's effectiveness and its impact on

vulnerable people in Nigeria. However, conditional cash transfers may not be sufficient to reduce poverty and health inequities in the midst of subpar healthcare facilities, according to research by Gracia and Attanasio, 2017).

Social Return of Investment (SROI) Theory

This study was anchored on the Social Return of Investment theory which has been developed by The SROI Network (De Brauw, Gilligan, Hoddinott and Roy, 2015). SROI is a method of measuring socio-economic and environmental impact that combines cost-benefit analysis, stakeholder engagement, financial representation, and project improvement.

Problem Statement

Over the decades, most development intervention programmes introduced by previous Nigeria governments have not succeeded due to many reasons, among which is poor implementation. Still, the present government in her efforts to reduce poverty among the vulnerable groups has recently introduced some social protection programmes such as N-power, school children feeding as well as Household Uplifting Programme (HUP). The HUP has been implemented in Oyo State since 2016. The programme has been widely accepted by the targeted population. However, in line with the objectives of the programme, it seems there is no empirical data to show that the objectives of the programme have been achieved or not. Previous studies focused on other intervening programmes such as N-power, Youth empowerment Programmes, Government Enterprise Empowerment Programme (GEEP), Home Grown School Feeding, National Cash Transfer Programme (NCTP) and so on with little attention on Household Uplifting Programme (HUP). Therefore, this study is design to assess the extent to which the HUP is improving household consumption and expanding assets acquisition of its participants in Oyo State, Nigeria.

Research Questions

The following research questions were raised and answered in this study.

1. In what ways has HUP improved Household consumption among the beneficiaries?
2. In what ways has HUP expanded the assets acquisition of the beneficiaries?

3. **Methodology**

The research design of the mixed-methods of Sequential QUA+qual type was used in this study. This approach involves conducting quantitative research followed by qualitative research to gain deeper understanding.

The study was conducted in Oyo State, Nigeria. It occupies a region of 28,454 square kilometers in Southwest Nigeria. It is bordered on the South by Ogun State, the North by Kwara, the West by the Republic of Benin, and the East by Osun State. According to the 2006 census, Oyo State's population was 5,591,589, and it is divided into 33 local government areas. People trade and settle in the state primarily in metropolitan regions, both from within the nation and from abroad.The primary line of work for most

people in Oyo State is agriculture. Crops including maize, yams, cassava, millet, rice, plantains, cocoa, palm fruit, cashew, etc. may all be grown in the state because to the favorable environment. Clay and kaolin are widely available in the state. Ibadan, Oyo, Iseyin, Ogbomoso, Saki, and Okeho are some of the other notable towns and cities in Oyo State.

Respondents for this study were selected using a multi-stage sampling procedure. It was in five stages. The population of the study was Oyo State's thirty-three (33) Local Government Areas that received Conditional Cash Transfer programme. These include:

Stage 1: Three (3) of the beneficiary Local Governments were randomly selected. One from each senatorial district (Oyo South, Oyo Central and Oyo North respectively. This represents almost 10% of benefitting Local Government Area.

Stage 2: A list of beneficiaries in the three local governments was obtained and 10% in each of the 3 local governments were randomly selected vis-a-vis Ibadan North East Local Government (71 beneficiaries), Oyo West Local Government (35 beneficiaries) and Saki East Local Government (74 beneficiaries)

Stage 3: A total of 180 beneficiaries were used for the study. Further to this, 6 saving group leaders were interviewed for qualitative data.

The Household's Consumption Pattern Questionnaire (r = 0.76) and Household Asset Acquisition Checklist (r = 0.83), and CCT Interview Guide were used to gather primary data from (Cash Transfer Facilitators, CTFs and Desk Officers, DOs) and community leaders assess HUP on the beneficiaries. The researcher distributed copies of the questionnaire to the respondents with the aid of trained enumerators who read out the questions on the questionnaire in Yoruba Language and collected on the spot.

Data were gathered and analyzed using descriptive statistical methods (frequencies, percentage distribution, mean, and standard deviation) to determine the correlations. Using inferential statistical methods like the t-test, hypotheses were tested. At a significance level of 0.05, every analysis was conducted. Qualitative data was thematically presented.

Specific Personal Characteristics

Age: The respondent's actual age in years, which is at the interval level, was measured on a continuous scale.

Marital Status: Were classified as single (1), married (2), widowed (3), divorced (4), others (specify) as 5, and unmarried (5). Respondents selected the option that applies to them and measured at nominal level.

Educational level: No formal education (0), Primary Education (1), Secondary Education (2), and Tertiary Education (3) were the respondents' levels of education as measured on an ordinal scale.

Income: Interval measurements of the respondent's income were made in naira. The respondents were prompted to provide their real monthly income in naira.

Occupation: Based on a nominal scale, this was measured as Farming (1), Artisan (2), Trade (3), and Other (Specify) as 4.

Household Characteristics

Household size: This was measured by obtaining a specific number of persons (male and female) in the household.

Gender of the household caregiver: This was measured at a nominal level as either Male (1) or Female (2)

Family Type: Respondents were asked to indicate their family type as Nuclear, Single-parent, Extended, and Grandparent with scores of 1, 2, 3 and 4 respectively

4. Results and Discussion

4.1.1 Demographic characteristics of the respondents

Table 1: Demographic Distribution of Respondents

Variables	Categories	Frequency	Percentage (%)
Marital status	Single	7	3.9%
	Married	126	70.0%
	Widowed	35	19.4%
	Divorced	12	6.7%
Level of Education	No formal	84	46.7%
	Primary	61	33.9%
	Secondary	32	17.8%
	Tertiary	3	1.7%
Occupation	Farming	35	19.4%
	Trading	118	65.6%
	Artisans	27	15.0%
Family Type	Monogamy	74	41.1%
	Polygamy	59	32.8%
	Single household	47	26.1%
Gender of household caregiver	Male	32	17.8%
	Female	148	82.2%
Total		**180**	**100.0%**

Source: Field Survey (2022)

Table 1 further shows that the study was dominated by married individual with 126(70.0%) respondents. In addition, 35(19.4%) were widowed, 12(6.7%) were divorced while the remaining 7(3.9%) were single. Also, about 84(46.7%) of them had no formal education, 61(33.9%) had primary education, 32(17.8%) had secondary education while the remaining 3(1.7%) had tertiary education.

In terms of the respondents' occupation, majority of them; 118 (65.6%) were traders, followed by 35(19.4%) who were farmers while the remaining 27(15.0%) were artisans. Table 1 further shows that the family types of the respondents showed that the study was largely dominated by monogamy with 74(41.1%) respondents, 59(32.8%) were polygamists while the remaining 4s7(26.1%) were single households. Information about the gender of the household caregiver revealed that the study was dominated by female respondents with 148(82.2%) while remaining 32(17.8%) were male.

4.1.2 HUP Beneficiaries Household Consumption

Research Questions 1: . In what ways has HUP improved Household consumption among the beneficiaries?

Table 2: HUP Beneficiaries Household Consumption

Items		Yes		No	
		F	%	F	%
1.	Has your participation in HUP enables you to prepared choice meal for your household members?	148	82.2	32	17.8
2.	Has your participation in HUP enables you and your household to eat at least 3 times daily?	128	71.1	52	28.9
3.	Has the intervention improve on eating balance diet?	151	83.9	29	16.1
4.	Has your new consumption pattern affected your health status positively?	140	77.8	40	22.2
	N=180				

Source: Field Survey (2022)

Results in Table 2 showed that majority of beneficiaries of HUP have benefited tremendously from the programme. Results from the items constructed to measure how well the beneficiaries have benefited from the programme revealed that at least, 128(71.1%) attested to the underlying benefits of the program. 151(83.9) reiterated that through the program, they have been able to keep up in eating balanced diet. 148(82.2%) attested to the fact that their households have witnessed some improvements in terms of how they cook for the family members as against 32(17.8%) that indicated no influence of HUP on preparing meal for their households; 140(77.8%) attested to the fact that they have experienced some noticeable improvements in their health status positively as a result of the new consumption pattern. On this basis, it can be concluded that the introduction of HUP has significantly improved Household consumption among the beneficiaries.

To further prove the above result, interview was conducted using interview guide on HUP beneficiaries. Summary of the responses are as follows:

Interviewee 1: "*before I was enrolled into the programme our major meals in my house are Amala, Eba and Ogi but now we have added beans, rice, egg and fruits into our food''* (Female; 51 years old)
Interviewee 2: "*the major meals in my household are yam and eba before I had the opportunity to be HUP beneficiary. However, with the privilege of participating in the programme coupled with the training we are putting protein rich food like fish and bean into our meal*" (Female; 62 years old)
Interviewee 3: "*we are used to eating pounded yam, yam, tuwo and eko but this Federal government programme has added value to our life. We can now afford rice, beans and meat occasionally*" (Male; 48 years old)

The responses of the beneficiaries revealed that majority of the beneficiaries who are used to eating carbohydrate-based foods have added proteins (beans, egg, beverages) vegetables and fruits to their daily meal. This was made possible as a result of access to cash transfer which fulfilled one of the Project Development Objectives. This was in line with the submission of Parker and Vogl (2018) that there is

connection between poverty alleviation and the welfare of vulnerable people in the United States of America. Also, the finding is supported by De Brauw, Gilligan, Hoddinott, and Roy (2015) who reported that the programme considerably raised children's consumption in Indonesia. On the other hand, In Ekiti State, Nigeria, Oguntomi and Ighodaro (2022) reported that CCT programme did not have significant impact on beneficiaries' consumption but little.

4.1.3 Beneficiaries Household Asset Acquisition

Research Question 2: In what ways has HUP expanded the assets acquisition of the beneficiaries?

Table 3: HUP Beneficiaries Household Asset Acquisition

S/N	Items	Yes		No	
		F	%	F	%
1.	Acres of farming land owned by household	154	85.6	26	14.4
2.	Household owns livestock	118	65.6	62	34.4
3.	Household owns radio	158	87.8	22	12.2
4.	Household owns mobile telephone	160	88.9	20	11.1
5.	Household owns bucket	159	88.3	21	11.7
6.	Household owns table	159	88.3	21	11.7
7.	Household owns chair stool	160	88.9	20	11.1
8.	Household owns bed sheets	158	87.8	22	12.2
9.	Household owns blankets	151	83.9	29	16.1
10.	Household owns mosquito net	166	92.2	14	7.8

Source: Field Survey (2022)

Results in Table 3 examined how HUP programmes have helped to expand asset acquisition among its beneficiaries. This is carried out by comparing the level of asset acquisition before, during and after the programme among its beneficiaries. The result showed that among the beneficiaries of the programme, there is clear-cut difference between their household asset acquisition before and during the programmes as tremendous improvement were noticed during the course of the programme. A good number of beneficiaries testified and counted a lot of increase in the number of household asset acquired during the programme.

In terms of acres of lands owned by the beneficiaries, 154(85.6%) of the beneficiaries responded to have owned some acres of land as against 26(14.4%) beneficiaries that does not add to the size of land they possess. 118(65.6%) beneficiaries of HUP attested to have owned additional livestock while 62(34.4%) beneficiaries indicated that HUP does not increase their livestock numbers. 160 (88.9%) among the beneficiaries have been able to procure chairs and stools as against just 13 (7.2%) that were unable to procure them among others. On this basis, it can be inferred that the emergence of HUP programmes has helped to expand the household asset acquisition base of the beneficiaries.

Qualitative analysis through interview guide revealed the following remarks from the interviewees:

Interviewee: "*the programme has helped expanded my charcoal business. At every payment day we used to make contribution in my group, we are 12 in number at #5000 each because the government used to give us #10000 bimonthly apart from #5000 for the environment. This has promoted my life and I was able to buy things that are essential for living like clothing, radio and farm tools*". (Female; 38 years old)

It is evident from the result of the analysis and interview that HUP beneficiaries who are engaging in petty trading were able to expand their businesses, established saving culture of monthly contribution and cooperative societies among them. These have positively impacted their livelihood and increases their asset acquisition in the area of farm tools, domestic animals for rearing, cooking utensils like aluminum pots, camp gas cylinder, water drums and plastic chairs for rental services as group business, radio etc.
The interviewees promised to ensure sustainability of the programme even after their exit by continue with the saving culture, cooperative societies among themselves and ensure a clean environment for their well-being. The result of this study is in consonant with Darling (2002); Gbadamosi, and Ojo, 2021) which emphasized that human capital or skill give people the abilities they need to function well in society, lack of this leaves people economically vulnerable.The finding is also supported by Kate, Robert, Ignacio, Hurtado, Grabowska, and Alice (2022) and Daidone, Davis, Handa, and Winters (2019) that financial transfers had numerous advantages for people of all ages during times of distress and increased the profitability and productive assets of households with existing businesses. In the same vein, Cahyadi, Hanna, Olken, Prima, Satriawan, and Syamsulhakim (2020) reported that CCT boost investments in human capital while also generating revenue.
However, on the other hand, Seyram and Evans (2015) and Gracia and Attanasio (2017) investigated conditional cash transfer's effectiveness and its impact on vulnerable people in Nigeria and concluded that CCTs may not be sufficient to reduce poverty and health inequities in the midst of subpar healthcare facilities, according to the research.

4.1.4 Implications of the findings on SDGs 1

It is evident that Household Uplifting Programme (HUP) is a potent policy instrument in the hand of the Nigeria government to achieve the Sustainable Development Goal One (End Poverty in all form by 2030). The programme impacts the welfare of it beneficiaries positively and reduces their level of poverty. Some of the implications of the programme includes but not limited to the following; poverty reduction, human capital development, assets accumulation by households, social inclusion, empowerment of the downtrodden within the society and data evidence generation for better planning and policy formulation of government.

5. **Conclusion**

The Household Uplifting Programme (HUP) has shown promising results in contributing to the achievement of Sustainable Development Goal One, which aims to end poverty in all forms. The programme helps to improve the welfare and increases their capital accumulation in form of assets, of the beneficiaries in Oyo State, Nigeria. Moreover, it is important to continually assess and improve this progamme to maximize its impact in Oyo State, Nigeria, address any shortcomings or limitations, and

ensure sustainable poverty in the long run. Based on the findings of this study, the following were recommended.

i. Adherence to workplan and implementation timelines will help theprogramme achieve the expected goals;
ii. Ensure adequate training and capacity building because poverty is not just lack of resources but lack of ability to manage resources;
iii. Synergy among the three ties of government should be ensured for organization performance;
iv. Ensure legislative backing of HUP by institutionalize it at Federal, State and Local Government levels;
v. Establishment of a robust National Beneficiaries' Register (NBR) which will serve as a database to capture prospective beneficiaries to alleviate poverty**.**

6. Acknowledgement

The Cash Transfer Facilitators, CTFs and Desk Officers, DOs) and community leaders of the Ibadan North East Local Government (71 beneficiaries), Oyo West Local Government (35 beneficiaries) and Saki East Local Government Areas of Oyo State were appreciated for their support during data collection for this research.

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TRACK 7
Social-economic aspects of sustainability

7b. The future of employment and good work

Abstracts

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Emerging indications of employment in the circular economy: a synthesis of European case studies

Prof Pauline Deutz[1], Ms Heather Rogers[1], Dr Anna Diaz[2], Dr Natacha Klein[3], Dr Katelin Opferkuch[4], Dr Aodhan Newsholme[1], Prof Andrew Jonas[1], Prof Tomas Ramos[3]
[1]University of Hull, Hull, United Kingdom. [2]University of Graz, Graz, Austria. [3]Nova University, Lisbon, Portugal. [4]Universidade Aberta, Lisbon, Portugal

Abstract

The potential to create new types of jobs is widely assumed to follow from the greening of the economy by means such as the circular economy (CE). Indeed, a green economy was heralded by the UN Rio+20 Summit as the means to achieve sustainable development through the provision of environmentally and socially sustainable economic growth. Although there have been efforts to quantify the number of jobs potentially arising specifically from a CE, the nature, distribution and specific skills required for these jobs remains under explored; how organisations are approaching issues relating to CE-employment in practice is also a largely unexplored area. This paper is drawing on several studies which were part of the H2020 MSCA ITN 'Cresting' (Circular Economy: Sustainability Implications Guiding Progress) project, which either directly address the experience of CE employment or have raised issues relating to employment and skills in the context of organisations' approaches to the CE. Thus, we here address the questions: how CE-ready are European organisations, what type of changes to employment are underway and/or expected. Methods used included semi-structured interviews of representatives of companies and public sector bodies who are directly involved in roles with CE-relevance (product design), or management roles (with oversight of CE-activity implementation) or directly undertaking CE activity (repair sector). In addition, an online survey with follow-up interviews was undertaken of companies and a document analysis of international sustainability and CE reporting. Findings suggest that the sense that a CE is associated with employment opportunities is shared by organisations, whilst noting staffing constraints. There are critical skills shortages e.g., designers needing additional training. Higher level management skills, e.g., for co-ordination across departments, are also needed. There is an interdependent situation of job roles, responsibilities and qualifications needing to change in order to bring about the necessary transitions towards a sustainable green economy.

This paper relates to the intersection of SDGs 8 (Decent Work and Economic Growth) and 12 (Responsible Production and Consumption). It examines the relationship between a system (circular economy) primarily targeted at reducing the environmental impacts of consumption, but the consequences of which are still uncertain. The contribution to the theme of the conference is similarly investigating the potential trade offs emerging between the 5Ps (particularly people, planet, prosperity), as we progress towards the target date for the SDGs.

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Quality of working life in the Circular Economy: the case of self-employment in the repair sector

Ms Heather A. Rogers[1], Prof Pauline Deutz[1], Prof Andrew E.G. Jonas[1], Prof Tomás B. Ramos[2]
[1]University of Hull, Hull, United Kingdom. [2]Nova University, Lisbon, Portugal

Abstract

Establishing a circular economy (maximising value from resources, recirculating materials rather than disposing of waste) is assumed by some definitions to incorporate social benefits. These benefits are seldom explicitly analysed. For example, there is a widespread assumption of the generation of circular jobs – and indeed the activities of the circular economy are likely to require at least a rebalancing of different economic roles. One such role would be product repair, as a consequence of reduced consumption by extending product life with or without a chance of ownership. To date, however, scant attention has been paid to the experience of working within a circular economy. The implicit assumption is that having a job is sufficient in terms of social benefits. Furthermore, there is an assumption that work is in the form of employment, whereas emerging opportunities may be in self-employment. Although there is a field of research around the quality of working life, to date this has been predominantly quantitative and only recently starting to consider self-employment. This paper therefore addresses a major research gap by applying a qualitative approach to the experience of self-employment in the circular economy. We undertake a case study of the quality of working life in the self-employed repair sector in the City of Hull, NE England. This further allows us to consider the spatial context of employment in the circular economy. Five semi-structured interviews were undertaken in 2020/21 exploring multiple dimensions of quality of working life. Findings indicate that stresses of work in the circular economy are similar to those of other fields, with self-employment offering opportunities both for job satisfaction and additional stresses. Some interviewees were reluctant to undertake the responsibilities of becoming employers. This suggests that research needs to give more consideration to the social implications of a circular transition – work may be a necessity for a satisfactory life experience (for most people), but it is under-ambitious to assume that having working is sufficient to achieve that and all that we should be looking for in a sustainability transition.

This paper relates to SDG 8 on decent work and economic growth, especially the target 8,5 on full and productive employment. However, with respect to the conference's agenda of the 5Ps, we suggest that perhaps the targets are too conservative - being overly focused on growth rather than experience of work.

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Wellbeing of Small and Medium Enterprise Migrant Workers: Analyzing Post Pandemic experience in India

Mr. Indrajit Khandai, Dr. Sanjay Kumar Singavarapu
Guru Gobind Singh Indraprastha University, New Delhi, India

MR. INDRAJIT KHANDAI

DR. SANJAY KUMAR SINGAVARAPU

Abstract

Covid-19 has had significant impact on global economy and different economies are still grappling with the disruptions caused due to it. Small and Medium Enterprises (SMEs) were worst hit due to the inherent vulnerabilities of the sector. In developing countries like India where SMEs provide employment opportunities, both formal and informal, to vast majority of working population, the impact of Covid-19 on SME workers is more precarious. It is well known that majority of SME workforce comprises of migrant labors from rural India and have migrated to urban areas in search of better livelihood opportunities. The disruptions caused due to the pandemic further exacerbated the plight of migrant workers. In order to cope with the challenges posed due to pandemic many organizations in SME sector have introduced changes in their work practices by adopting new technologies and digitalization. It is obvious that the pandemic induced changes in the work organization has rendered the jobs performed by migrant workers redundant leading to heavy job losses. The reasons for loss of jobs particularly in SME sector are varied and important among them is the skill gaps among the migrant workers. The management of SMEs often do not perceive the benefits associated with re-skilling and training their workers due to highly informal nature of employment. Even those SMEs that recognize the long term beneficial effects find it difficult or unviable to invest in imparting new or upgrading skills of migrant labors due to various constraints. Such a scenario has wide ranging implications not only in terms of job security of migrant workers but also adversely affects their wellbeing. In the light of the resultant economic consequences impinging on the sustainable development goals(SDGs), the present study aims at: (1) understanding the impact of pandemic induced changes in work practices on wellbeing of migrant workers (2) the extent to which policies and programs initiated by the government , employers & other non-government actors consistent with SDGs contributed to their wellbeing (3) the challenges being faced by migrant workers during Post Pandemic period and (4) further measures that are likely to improve migrant workers' wellbeing. Research study employs both quantitative and qualitative data collected through survey and interview methods to arrive at the findings.

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Sustainable Entrepreneurship Practices among Emerging Agro-Based Entrepreneurs and Security Implications in Ibadan Metropolis, South-West, Nigeria

Dr. Olanrewaju Abdulwasii Oladejo
Department of Peace, Security and Humanitarian Studies, University of Ibadan, Ibadan, Nigeria

D R . O L A N R E W A J U A B D U L W A S I I O L A D E J O

Abstract

ABSTRACT

As a populous country of over 200 million people, Nigeria earnestly requires steady and sustainable economic plans to ensure constant and continuous national development. Same applies to its constituent states and sub-units at the local government levels. Hence, as part of measures to achieve this feat, the intensification of economic diversification efforts by government at all levels to create jobs and encourage culture of entrepreneurship, particularly among youths, became a priority. In particular, owing to its potential to play significant roles in job creation drive and perhaps, implications on internal security, entrepreneurship in the agro-based sub-sector recently attracted attention which cannot be under-estimated in Ibadanland; a city in the heart of the fourth most populated states in Nigeria. Meanwhile, despite these attention, there are some apprehensive concerns over the sustainability of entrepreneurship practices among budding entrepreneurs in the sub-sector. Therefore, the study investigated the level of competence in sustainable entrepreneurship practice among emerging entrepreneurs, the gender influence as well as the nexus between the practice and internal security in the designated area.

The study adopted quantitative approach using structured instrument to elicit responses from the target sample made up of randomly selected agro-based emerging entrepreneurs in Ibadan metropolis; Ibadan North, North-East, North-West, Ibadan South-East, Ibadan North West Local Government areas. Human and Social Capital theories offered a framework for the study as both capture measurement of skills, education, support, capacity and attributes of labour which scholars admitted influence human productive engagements, capacity and earning potential.

As expressed in the analysed data, emerging agro-based entrepreneurs in the study area were noted to possess appreciable skills to manage people, enterprise environment (planet) and profit (prosperity) to an extent with acceptable mean scores of 1.75, 1.74 and 1.56 respectively. Gender was reported to have significant impact ($R2 = .412$; $P > 0.05$) on sustainable entrepreneurial practices with male dominating as better profit and enterprise environment managers while female had a higher impact on people management. Equally, the result revealed a positive significant relationship between sustainable entrepreneurship and internal security.

Proffered recommendations suggest that the concept of sustainable entrepreneurship practice should be popularized with emphasis on integrated entrepreneurship development strategy beaming more searchlight on the practice sustainability and its essential elements; competences to manage profit, people and enterprise environment. This is in addition to specific capacity enhancement intervention to budding entrepreneurs in the agro-based sub-sector. In conclusion, having established the significant impact of sustainable entrepreneurship on internal security, it was therefore recommended that further efforts be made to encourage the youths involvement in agro-based ventures to attract their attention and discourage them from social vices. These recommendations resonate with sustainable development goals 1, 2 and 8 emphasizing need to overcome poverty and hunger, with the instrumentation of inclusive and sustainable economic growth (respectively) through viable entrepreneurship exploits.

Keywords: Sustainable entrepreneurship, Internal security, Emerging entrepreneurs

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Interreg Program to support artistic craftsmanship as social cultural richness

Dott. Ph.D Luca Parodi, Prof. Adriano Magliocco

Università di Genova - Dipartimento Architettura e Design, Genova, Italy

Abstract

The industrialized world is relegating more and more of the workforce to two macrocategories: workers with no qualifications to support the operation of machinery, and super-specialized workers capable of designing and programming complex production processes. Italy's manufacturing sector in the field of interior furniture and accessories boasts a very high number of firms, which straddles the line between industrial and artisan firm size (Vercelloni, 2008), with excellent market results at the international level. This has contributed, perhaps, to the shrinking market for small artisans in the arts sector, who, due to their company size and preparation in marketing, struggle to stay in the market. A sector, that of the handmade, which represents, moreover, an element of strong recognition for Made in Italy production, as well as being a distinctive feature of the culture and economy (Micelli, 2011). And while the international market has undergone considerable mutation in recent years, characterized by an implantation of awareness about the ethical and aesthetic quality of products, the design and manufacturing sector seems to be called upon to combine contemporary visionariness with local manufacturing background. Even though industrial culture thought that the world of manufacturing was evolving in an increasingly transparent and simplified way, the sector is experiencing a different development. High technology is increasingly combining different forms of manufacturing in an inclusive way, and the multiplicity of conditions in which design culture takes place seems to reflect the semantic ambiguity typical of the discipline of design (Alison, De Fusco, 1991). Confirming this phenomenon are numerous projects, exhibitions, publications, and events aimed at recognizing (and enhancing) the potential of a profession that, through an experimental approach, proves to be a bridge between disciplines (Didero, 2016). Aware of the urgency covered by the theme of sustainability, the design system is tracing new ways (Gambardella, 2020) by recognizing craftsmanship as an important resource to draw on for the purpose of sustainable production, attentive to processes and impact on human capital, the landscape, and the planet (Molteni, 2021). The projects of the Art Lab partnership (Art Lab Net, Art Lab Exeriences, Art Lab Services), supported by the Interreg Maritime Italy France program, from 2017 to the present, have focused on activities to support businesses in this sector, partly to highlight critical issues related to survival in a global market that offers multiple opportunities, but subject's players in the sector to grueling competition. By recognizing the correct value of the technical skills of workshops, increasing the value of national production competitiveness, and supporting the craft sector, it is possible to contribute to the achievement of the Sustainable Development Goals in the Western world as well; in fact, craft activity, especially in the artistic sector, is able to meet the demands for SDG's SDG 5 - Gender Equality and SDG 8 - Decent Work and Economic Growth. After all, the field of traditional applied arts and local culture has been undergoing a real rediscovery in recent years.

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ACTIVE AND INTEGRATIVE LABOR MARKET POLICIES TO ACCELERATE POST-PANDEMIC UNEMPLOYMENT MANAGEMENT

SYAHRUL SAJIDIN, shinta puspitasari
faculty of law brawijaya university, malang, Indonesia

Abstract

The Covid-19 pandemic, which began in Wuhan at the end of 2019, was finally declared a global pandemic in March 2020. The regional lockdown policy had an impact on people's social and economic activities, resulting in termination of employment and even closing of businesses. Therefore, based on these matters, current labor market policies need to be adjusted. The job market is not only structured in the old ways, the pandemic condition requires policy makers to accelerate labor market policies. Integrative and adaptive labor market policies need to be implemented as an accelerated step by policy makers to quickly recover from the pandemic, especially in the context of reducing unemployment. Active labor market policies, which include measures such as job search assistance, training programmes, wage subsidies or public employment schemes, are a key element in a portfolio of policy tools designed to bring unemployed workers back into work. In manpower planning, the supply of labor is a very important part because the supply of labor is a human resource that needs to be utilized optimally in achieving progress. This supply of labor is often referred to as the work rate. For this reason, it is necessary to estimate the number of workers, namely how much and how the quantity and quality will be in the future which is based on a planning period that has been determined nationally. In order to support manpower planning, it is also necessary to make policy adjustments and planning in other sectors besides employment, to accelerate the resolution of the post-pandemic unemployment problem. An active labor market policy is a labor market policy aimed at strengthening business resilience and preparing a quality workforce. An integrative labor market policy is a labor market policy that involves other sectors involved in creating an active and integrative labor market.

Full Papers

Emerging indications of employment in the circular economy: a synthesis of European case studies

Pauline Deutz[1,6] Heather Rogers[1], 1. Anna Diaz[2] Natacha Klein[3] Katelin Opferkuch[4] Aodhan Newsholme[1,5] Andrew E.G. Jonas[1] Tomás B. Ramos[3]

[1]School of Environmental Sciences, University of Hull, UK
[2]Institute of Environmental Systems Sciences, University of Graz, 8010-Graz, Austria
[3]Department of Environmental Sciences and Engineering, Nova University, Lisbon Portugal
[4]Department of Science and Technology, Universidade Aberta, Lisbon, Portugal
[5]Current address Munster Technological University, Ireland
[6] Corresponding author: p.deutz@hull.ac.uk

Abstract

The potential to create new types of jobs is widely assumed to follow from the greening of the economy by means such as the circular economy (CE). Although there have been efforts to quantify the number of jobs specifically from a CE, the nature, distribution and specific skills required for these jobs remains obscure. How organisations are approaching issues relating to CE-employment in practice is largely unexplored. This paper is drawing on several studies which were part of the H2020 MSCA ITN 'Cresting' (Circular Economy: Sustainability Implications Guiding Progress) project. We ask: what type of changes to employment are underway / expected; how CE-ready are European organisations (e.g., companies and public sector bodies); what are the social implications? Methods used included semi-structured an online survey with follow-up interviews and a document analysis of international company reporting. Findings suggest organisations share the view that CE is associated with employment, whilst noting staffing constraints. There are critical skills shortages e.g., for designers. Higher level management skills, e.g., for co-ordination across departments, are also needed. There is an interdependent situation of job roles, responsibilities and qualifications needing to change in order to bring about the necessary transitions towards a sustainable circular economy.

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Keywords: Circular economy, green economy, employment, work, self-employment

1. Introduction

Wedded to the principle that the route to uplifting standards of living globally is through economic growth, the United Nations (UN) adopted the idea of a green economy from 2012 as a means to provide investment and employment opportunities protective of the environment (U.N., 2012). The link between economic growth and assumed opportunities for employment has been further institutionalised via the Sustainable Development Goals (SDGs), with for example Goal Eight being Decent Work and Economic Growth. The targets of that Goal are firmly within a growth paradigm (Bianco-Varela et al., 2021). The idea that the relationship to employment might be complex, or that the quality of work also needs some consideration is relegated to two targets referring to the need for 'decent' work and the protection of basic human rights (e.g., modern slavery, human trafficking). Whilst the latter is absolutely critical, one might extend Millar et al.'s (2019) contention that the social benefits of the SDGs are largely assumed. The social benefits as framed are at best secondary to economic. In this sense little progress was made between the framing of expectations for green employment in 2012 (Deutz, 2014) and the subsequent SDGs. This paper steps into the lacuna of attention to social sustainability to consider the employment opportunities emerging from the implementation of circular economy (CE) strategies in the European context.

A CE has been defined as a "regenerative system in which resource input and waste, emission, and energy leakage are minimised by slowing, closing, and narrowing material and energy loops" (Geissdoerfer et al., 2017 757). In origins and intention " circular economy" is an umbrella term for a range of pre-existing strategies for promoting resource efficiencies (Blomsma and Brennan, 2017; Rieke,

2018). Nonetheless, policy and research interest in CE has exploded in an unprecedented way over the last decade by offering a potential road map to achieving sustainability (Cecchin et al., 2021). The European Union has been at the forefront of policy implementation of CE, building on waste and pollution regulations since the 1970s (e.g., Deutz et al., 2020), which at present continue to inform resource policies in the UK. In addition, the EU has begun to take a more holistic approach, at least in rhetoric, to acknowledge the scale and scope of transformation required and at least pay lip service for this to be managed in a 'just' way (Calisto Friant et al., 2021). A number of authors have proposed emerging employment opportunities as a benefit (Ghisellini et al., 2016; Webster, 2017), with the European Commission (2018) estimating a net gain of 650,000 to 700,000 jobs for the European Union by 2030. However, the empirical foundations of the social features of developing CE in Europe are under examined.

This paper draws on a number of studies conducted with the EU H2020 Marie Skłodowska-Curie project "Circular Economy: Sustainability Implications, Guiding Progress" (Cresting). These studies have separately addressed a range of aspects of CE implementation: product design, industrial symbiosis, public sector implementation, repair, company understanding and reporting. Methods have comprised semi-structured interviews, surveys and document analysis in a range of geographic contexts. For most of these studies, employment was not the primary focus of the research, but has emerged as a significant consideration. Thus, in this collaborative paper we are able to approach the issue of CE employment from a unique range of perspectives. With the overall aim of better understanding the implications of a CE for employment, we changes to employment underway and/or expected and what are the social implications?

2. Employment Perspectives from the Circular Economy Literature

One of the challenges in considering CE employment is to define the scope of what is a CE, and by extension what is a circular job. One issue is the relationship between circular and green jobs, which have already attracted attention (e.g., Deutz, 2014; Consoli et al., 2016; Cecere & Mazzanti, 2017). Green jobs can be defined most straightforwardly as those that "contribute substantially to preserving or restoring environmental quality" (UNEP, 2008, p. 3). More specifically, in their study of skills, Consoli et al.'s (2016) understanding of green jobs drew on the US government's definition of a green economy "related to reducing the use of fossil fuels, decreasing pollution and greenhouse gas emissions, increasing the efficiency of energy usage, recycling materials, and developing and adopting renewable sources of energy" (Dierdorff et al., 2009, p. 3; Consoli et al., 2016, p. 1048). Burger et al. (2019) distinguish between jobs relating to the core strategies of the CE and those in necessary enabling roles. The 'core' CE jobs relate to repair, re-use, refurbishment and the prioritisation of regenerative resources (e.g., promoting the use of renewable, re-usable and non-hazardous materials/energy) and the redesign of business models (e.g., to incorporate servitisation, rental, sharing). This understanding corresponds to that of Wijkman and Skånberg (2015), who define CE activity as relating to the decoupling of economic growth from resource and energy use. The idea of a CE as a generator of employment has been taken on board by policy-makers including the EU (EC, 2015; 2020) and also academic observers (e.g., Ghisellini et al., 2016). The EC quotes an estimate of 700,000 new jobs to emerge by 2030 through the adoption of CE principles (Cambridge Econometrics, Trinomics, and ICF, 2018, cited in EC, 2020).

Practices widely recognised as relating to the CE include sharing and re-use that have implications of degrowth (controlled downscaling of the economy, Latouche, 2010). Circular activities around re-use, redistribution and sharing can be organised by charitable organisations and social enterprises drawing on voluntary and subsidised labour (Lekan et al., 2021). This simultaneously opens opportunities for people sometimes systematically excluded from the capitalist labour market whilst potentially closing opportunities for employment in mainstream outlets for production and consumption. Likewise, repair is a CE-adopted strategy for extending product life, which can be a mechanism for affordability (salvaging used items for people who could not afford new equivalents e.g., Sharp and Luckin, 2006; Gregson et al., 2013). However, labour costs can contribute to putting repair costs above the price of a new item (Bovea et al., 2017), which calls into question the potential for employment generation on a significant scale (c.f., Morgan and Mitchell, 2015) at least without the financial incentives (Stahel, 2013) provided in Sweden, for example (Rreuse, 2017).

Some consideration of the skills impact of a CE can be taken from work relating to green jobs. In particular, Consoli et al., (2016) define three broad possibilities regarding changing employment skills. First are existing jobs in increasing demand as a result of a shift to green consumption; second are existing jobs whose holders will need to re-skill to reflect changing priorities and third the emergence of new jobs. The second category tend to comprise jobs involving formal qualifications, as well as experience and on the job training. Conversely, new green jobs are less likely to be in sectors where formal educational qualifications are significant (putting more emphasis on training within a job). Observing the potential for emerging low-skill CE jobs, Morgan and Mitchell (2015), offered the possibility for CE jobs to be widely spread geographically (with local processing of recovered products/materials), potentially not only avoiding the risk of jobs being off-shored (or clustered nationally), but potential helping to fill employment gaps left by industries that have already moved (whilst noting the current labour shortage in the UK and elsewhere, we also note that there are still people out of work).

In sum, whilst debates around the nature of the CE and the social implications of a developing CE have progressed apace, the employment opportunities arising are assumed with limited empirical scrutiny. Much remains to be understood – especially from a qualitative perspective and from the perspective of those undertaking CE roles.

3. Methods

This paper draws on five PhD projects carried out by early stages researchers (ESRs) within the Cresting project. Our approach is steered by critical realism (Sayer, 1999), which treads a path between constructivist and objectivist research approaches - recognising that understandings of society are coloured by the subjective perspectives of both the researcher and researched, but that nonetheless some perceptions are closer to the existing objective reality than others. Summarised in Table 1, methods include semi-structured interviews of representatives of companies and public sector bodies who are directly involved in roles with CE-relevance (product design), or management roles (with oversight of CE-activity implementation) or directly undertaking CE activity (repair sector). In addition, an online survey with follow-up interviews was undertaken of companies and a document analysis of international sustainability and CE reporting.

Table 1. Case studies and the methods employed

Location	Perspective & focus	Methods	Reference for methods
Germany/Austria	Company: design	15 Interviewees with three years' experience in sustainable product design; large companies in high-income economies	Diaz et al., 2021
International; NL and IT companies	Company	Survey and interviews with NL and IT companies in CE vanguard; Analysis of company reports and reporting requirements	Opferkuch et al., 2022 and Walker et al. 2021
Hull, Humberside, UK	Public body view of regional transformation	23 interviewees in the UK at the national to regional level (business and policymakers); including 21 specifically in	Newsholme, 2023

		Hull/East Riding; document analysis	
Lisbon, Portugal	Public sector – national government	Interviews, survey, documents	Klein et al., 2021; 2022
Hull, Humberside, UK	Public opinion & work in repair	Survey (n=740), 5 interviews with self-employed repairers	Rogers et al., 2021; 2023

4. Circular Economy Employment Case Studies

4.1 Business View of CE Employment Relating to Circular Product Design

This case study indicates that current product designers, even recently qualified, are not trained for CE priorities. Designers had a limited understanding of the sustainability implications of products designed for circularity. Moreover, sustainability was primarily understood in terms of environmental, not social, impacts. Designers were unclear about the goals and principles of CE, and consequently, not well prepared to translate them into their work routines. For example, one option for implementing material recovery would be to institute a reverse logistics programme – unheard of by one company. A further area where competences are lacking relates to comparing the implications of available options. Designers had familiarity with life cycle assessment (LCA) as a process, but outsourced to specialists. They also missed the potential of LCA as a predictive model of potential future impacts (as opposed to measured or estimated current impacts). LCA is needed at the early stages of design, because decisions at that point can fix impacts in place by constraining the more detailed decisions at later stages of design.

In addition to the new skill sets for designers, issues emerged that need a different approach at a managerial level, assuming that a company has made the strategic decision at the top level to implement CE approaches. This requires not just additional knowledge and a willingness to implement, but also the ability to redefine and communicate strategic goals of the company. Addressing this at the higher level, might help the designers to overcome hesitation around the risks associated with innovation, which by definition involves potentially uncomfortable steps into the unknown. Circular and other environmental design considerations are competing with other criteria for the attention of designers, who are seemingly predisposed to familiar solutions to problems in order to meet cost and time constraints. Thus, change requires appropriate messaging and support from management. Management were more confident of their abilities to meet the necessities of change than their staff. Nonetheless, the impression is given that sustainability is viewed as a burden, or at least challenge, rather than an opportunity. Companies were fond of detailing their achievements, even if in reality these were quite modest.

4.2 Company Implementation and Reporting of CE

This case study is drawing on projects examining how familiar companies are with the CE, where it fits into their understanding of sustainability, and how their practices are monitored and reported. Without an appreciation of CE embedded at company level, implementation is unlikely.

The Dutch and Italian companies' responding to the survey see the CE as relating to sustainability – some expressing some exasperation as to the need to take on something new with connotations that they did not necessarily appreciate (Walker et al., 2021). When asked about social aspects of CE, employment tended to be the one thing that came to mind. This may indicate limited knowledge of the potential ramifications/aspirations of a CE, potentially confined to emerging regulatory requirements. Or alternatively, they may have been aware of more socially focused definitions of a CE, but choosing not to take that approach. In a separate pan-European study of company reports, only 2/94 companies had a target relating to employment (Opferkuch et al., 2022, fig 6 p. 446), which related to re-training existing, rather than hiring new, staff. Only 1/94 companies mentioned an indicator relating to employment. In the review of reports based on what companies are actually doing, employment was not widely mentioned. Current CE reporting is largely confined to environmental aspects (e.g., waste management)

and not co-incidentally concentrated amongst manufacturers, but starting to expand beyond manufacturing, albeit so far not reaching the financial sector (Opferkuch et al., 2022).

In terms of employment, companies saw reporting on CE activity as beneficial for attracting new talent to the company. Respondents assumed that an enhanced environmental reputation would help especially with the generation starting work now, who are assumed to be more enthusiastic for sustainability than predecessors. If the assumption is well-founded, then using CE activity to attract new staff, should re-enforce and strengthen that activity by helping to build a critical mass of engaged staff. Notably, the discussion is about seeking a certain quality of staff who are being hired anyway.

4.3 Regional Policy Perspective on CE Transformation

This case study concerns the perspective of local government bodies trying to establish a CE for the benefit of their locality. Cities and regions have aspired to circularity as part of both undertaking, and being seen to undertake, a sustainability transition (Prendeville, et al., 2018). The City of Hull together with its neighbouring authority of the East Riding of Yorkshire comprise North Humberside. They see themselves as trying to influence but not directly implement a CE (Newsholme et al., 2022). Humberside is one of the most carbon intensive regions in the UK, and so needs a substantial change in economic focus. It also contains a substantial element of deprivation. There is a need for more employment opportunities with either low skill requirements, or more ideally the opportunity to upskill the population.

It is not yet well understood what training for CE might involve. A representative of one local authority in Humberside saw a role for their organisation in supporting businesses to predict what might be needed in order to protect the livelihoods of those already in employment. Thus, although CE is seen by the public bodies as something to be brought about by companies, there is a concern that companies might not have the vision to manage the process in a way that is supportive of their workforce. None of the companies interviewed, or company documents reviewed, raised the issue of jobs, employment or skills, which does support the idea that the public bodies may need to drive this aspect of a CE-transition. Whilst there is an identified (if non-specific) need for training for the local population to engage with the CE, there is also a reflection on the training and experience of those who are leading the initiative for the public agencies which appears to influence the approach they take.

4.4 Organisational Change in a National Public Sector Body

This case study concerns a public sector body trying to transform its own operation to incorporate circular approaches. Interviews were conducted with the employees who would be responsible for driving and implementing change in the central public administration in Portugal.

The central public administration in Portugal are seeking to adopt circular practices within their own operations (PCM (2018) Resolução do Conselho de Ministros n.o 141/2018). Notably only 1/3 of organisations surveyed already include CE in their employee training (Klein et al., 2022). The data collection captured people working through a CE transition in their place of work and the results indicate that this set looks to involve some changes, e.g., a training for skills they might have assumed to be irrelevant, alongside a change in the culture of the workplace to implement those skills. Some activities will be reduced (e.g., purchasing of new items, disposal of waste) as work is either dematerialized or items are recirculated internally. This might involve some loss of jobs or changing of roles. For other staff there may be more subtle changes to responsibilities (such as how and where office waste is disposed of, or permissions to purchase). These additional duties and the exercise of environmental decision making may be outside of the comfort zone for essentially office workers, whose role is fundamentally to make plans for others to implement and to judge their success at doing so. One example of this would be a suggestion of a digital platform to organize sharing between different departments (within and/or between ministries) – requiring certain skills, as well as changing the culture of the workplace on a very mundane level (such as using reusable cups, reducing the use of printing). The very triviality of these tasks can make them difficult to change as treated by people as something taken for granted, as opposed to other aspects of their job that are more commonly subject to reflection.

Respondents reported that a barrier to CE implementation was finance, with one symptom of that being a shortage of staff to organize and/or implement changes (Klein et al., 2021). Overcoming that barrier may involve increasing CE awareness on a political level. Assuming that the financial barrier can

be overcome, interviewees emphasized the usefulness of hiring CE experts who would be able to train and incentivize others. Significantly, the suggestion is to have CE champions at both management and staff levels to both drive strategy and the day to day activity (c.f., Davis and Coan, 2019). A further suggestion is to improve collaboration between ministries to capture any synergies or simply exchange experiences.

4.5 Public Perspective and Experience of CE Work

The final case study relates to a particular CE in the City of Hull, which is the major urban area within North Humberside (see 4.3).

For repair to emerge as an opportunity for paid work, there needs to be a market for repair as a service, and/or for re-sold repaired goods. An online survey of Hull residents, conducted in cooperation with Hull City Council, had 740 valid responses. Respondents indicated that in Hull there is an acceptance of repaired goods and willingness to purchase used goods (second-hand as this has been known) (Rogers et al., 2021). 79 % had previously used a professional repair service and 76 % had repaired something themselves; 69 % said they sometimes or often shop second-hand. Only 14 % of respondents considered repaired items less reliable than new and only 7 % expressed a distrust of repair services. These figures are lower than previous studies (e.g., Bovea et al., 2017), possibly reflecting the disadvantaged nature of the city (Rogers et al., 2021). However, the second most cited barrier to repair as an activity was lack of skills (given by 59 %). This suggests an identification with repair as something one would do for oneself. Those shopping second-hand were significantly more likely than others to self-repair – but not to use a repair service. Having one's likelihood to engage with repair contingent on the ability to do it oneself reduces the potential of creating paid work as a corollary of (an eventual) reduction in demand for new goods.

Hitherto, the CE literature has been silent on the experience and perspective of those expected to be carrying out the work. Here we draw on Rogers et al. (2023) to present the perspectives of individuals working in the repair sector in Hull. The individuals interviewed are self-employed, working either as sole traders or with a maximum of four employees). Two women were working as seamstresses/tailors and three men in the repair of various electronic goods (specialising variously in mobile phones, televisions and appliances). The gender division matches that found for likelihood to self-repair, suggesting deeply entrenched gendered roles in society. The concept of a CE was not a driving force in their work. Attitudes to the work varied between the interviewees, partly according to their time in the trade (four to 27 years). Whilst the agency afforded by self-employment was widely noted (e.g., ability to schedule around childcare obligations), establishing a new business is stressful. Respondents referred to working long hours under time pressure as they were nervous to turn away any job. In some cases, the pressure of work interfered with customer interactions, whilst for others the sense of being helpful to individuals was the chief source of job satisfaction.

5. Discussion

The case studies illustrate the that CE activities are becoming normalized across a range of contexts. There are people with experience of working with CE activities across a range of contexts, albeit in all these cases interwoven in the "less than circular" economy. Seemingly, very few roles would not be impacted in some way by a flourishing CE. A category of work not considered in the previous classifications (Consoli et al., 2016; Burger et al., 2019) is the office worker populating public and private sector organisations. With parallels to the experience of domestic resource retention activities (notably recycling, but also energy efficiency and ideally sourcing re-use and shared options for consumption), all work experience is likely to involve an extra level of reflection (what, why, how) as well as some basic knowledge of things like the suitability of different plastics for different activities, or identifying different types of materials for correct disposal. These are not technically complex issues necessarily, but may outside of the traditional skill-set expected of people in office roles. The need for some form of monitoring of outcomes may also be new, i.e., performance targets (potentially collective) that do not relate to one's primary role.

Repair is an example of a job that pre-dates CE, but the demand for which should increase (Consoli *et al.*'s 2016 first type of green job). The self-employed repair workers interviewed in this study have

relevant skills, but little or no ambition or experience relevant to develop a structure to make their services available on a larger scale. Some existing roles (such as public sector purchasing, product design, or waste management in likely any context) will need additional skills and expertise to engage with circular practices. These relate to Consoli *et al*.'s (2016) second category (existing jobs needing to re-skill). As discussed in case study two, the product designers were aware of having limitations, which is an important change threshold to cross, but had limited knowledge about what areas they might need to reskill into. This chimes with earlier research (Deutz *et al*., 2013) that product designers were typically not following a well-developed design process, let alone applying a design process with sustainability criteria in mind. These are highly skilled technical roles that would benefit from changes to formal qualifications, but whilst that is necessary to achieve change other structural and organizational barriers to implementing circular design would remain (Diaz *et al*., 2021).

As in previous studies, CE development requires roles and corresponding skills aside from the directly hands-on (Burger *et al*., 2019). These include CE-co-ordination roles such as sharing information within and between departments (or teams) in large organisations, or along a supply chain. Networking and communication skills are likely to be essential here, but IT skills can be important too (as mentioned in case study four). As in the Portuguese central administration, existing staff may need to take on such skills, or potentially need to apply existing skills to different fields (such as managing internal performance alongside, or alternatively to, managing external service delivery). More knowledge of CE, its options and ramifications, are needed to determine quite what needs to be done. At a higher level of management, leadership skills are needed to drive change. The challenge here is also to envisage the change, and communicate this to people able to attract and organise the financing needed. In the public sector, there is a need for people with both knowledge of the CE and an ability to communicate to private sector bodies, even if the latter are then in the best position to consider their own specific needs. And, indeed, those needs may be best served by CE strategies that do not best serve the location.

One of the most innovative areas of activity around the CE research and development may be the measurement of circularity and, more importantly, sustainability (Roos Lindgren *et al*., 2022). As a safeguard to avoid unintended consequences of product changes (a famous example of disastrous changes includes putting CFCs in refrigerators to extend food product life) as well as to measure organisational progress. However, although a comprehensive LCA might have avoided such developments, LCA appears to be used more often to benchmark existing products rather than as a tool for comparing options for products in the design. So wider changes in practice, as well as new skills, are required. Furthermore, for social LCA, the skills required are uncertain. This is a much more novel procedure and requires research, e.g., what is the relevant data, how can it be sourced, as well as translation into an operational form not requiring research-level of time and skill. How to judge acceptable outcomes is also to be determined. Similar considerations apply in terms of company reporting, i.e., staff involved in reporting will need to adjust to different issues, learn to collect and present different forms of data. But, again, companies need first to decide that they are going to engage (assuming reporting is voluntary), or how (if it is not). Some additional roles are likely in this area for large corporations, potentially also within organisations who attempt to interpret such reports (such as investors), and in bodies setting the requirements (such as EC).

The social dimension of CE is seemingly an afterthought in both public and private sector contexts. When asked for a social aspect, companies offer employment as an example. Clearly jobs will evolve, or need to, to take on more circular aspects – a level of on the job and pre-job training will be needed. But more attention is needed to the quality of that employment. As seen from case study five, having a socially beneficial job that brings help and satisfaction to individual customers does not preclude the stresses and concerns of earning a living. Along with some of the responses around LCA, we can see that new, or newly significant, CE roles may not be in a company context. The level of uncertainty around what is needed may breed opportunities in consultancy, which can be lucrative, but carries uncertainties of continuously looking for the next role, with consequent pressures for planning one's life. There are gender dimensions which need far more consideration. The types of jobs emerging, and disappearing, will vary according to the context of the place, with no guarantee of a good geographic match, or that those who have not done well out of previous economic changes, will do any better this time.

6. Conclusions

This paper has examined the employment implications emerging from five case studies of different aspects of a CE. We note that although there may not be many entirely new roles (just as a CE itself is a concept drawing on many pre-existing ideas and activities), very few roles will be entirely untouched by a CE transition. Some roles involve 'doing' CE activities (from repair of old products to design of new ones), measuring/assessing, communicating, championing, training and recruiting others to do any or all of those things. However, although on a generic level one can identify areas of activity, the precise knowledge and skills involved are more difficult to specify. They are also likely to be variable according to economic and geographic context, and furthermore are contingent on decisions made about how to implement CE initiatives. Another complication is the lack of knowledge and indeed the lack of control amongst those trying to, or contemplating trying to, implement a CE. A major point to emerge from this study is the interdependence of different roles. The situation is not so much that a CE will generate new jobs, but that people who know about a CE are needed to be in position to bring about the changes that might create those roles. What emerges will depend on the decisions of those at the top level in organisations; what we see as CE will be influenced by actions of those people as well as those hired to undertake implementation. A critical role is likely to be the coordination of CE and non-CE activity. Transformation will be intimately connected with employees – those doing the work of the CE at different levels. This will produce and reproduce the CE. It is not that CE leads to opportunities, there will be no well-developed CE ahead of these positions being in place. Furthermore, some critical roles may emerge outside of organisations in a consulting capacity. It might well be that if you want a job in the CE, you need to be in a position to create a role for yourself. There is much further research to be done in this field, for example addressing different industrial sectors, and different locations to those included here, notably outside the Global North. The experience of work and gender dimensions in particular need further examination.

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Quality of working life in the Circular Economy: the case of self-employment in the repair sector

Heather Rogers[1], Pauline Deutz[1,3] Andrew EG Jonas[1] and Tomás B Ramos[2]

[1] School of Environmental Sciences, University of Hull, Hull UK
[2] Centre for Environmental and Sustainability Research, Department of Environmental Sciences and Engineering, NOVA School of Science and Technology, NOVA University Lisbon
[3] Presenting & corresponding author: p.deutz@hull.ac.uk

Abstract. A circular economy (maximising value from resources, recirculating materials rather than disposing) is often assumed to incorporate social benefits e.g., job creation. To date, however, scant attention has been paid to evidence such as the experience of working within a circular economy. The implicit assumption, including in SDG 8.5, is that employment is a sufficient social benefit. Furthermore, emerging opportunities may be in self-employment. Research exists in "quality of working life", but to date predominantly quantitative and considering employment. This paper addresses a major research gap by applying a qualitative approach to the experience of self-employment in the circular economy. We undertake a case study of the quality of working life in the self-employed repair sector in the City of Hull, England. This further allows us to consider the spatial context of employment in the circular economy. Five semi-structured interviews were undertaken (2020/21) exploring quality of working life. Findings indicate that stresses of work in the circular economy are similar to those of other fields, with self-employment offering opportunities both for job satisfaction and additional stresses. It is under-ambitious to assume, as per the SDGs, that having work is all that we should be looking for in a sustainability transition.

1. Introduction

Circular Economy (CE) is a dominant approach to resource efficiency in academia, business, and public policy (Cecchin et al., 2021). It is frequently cited as a tool towards job creation and in turn, social sustainability and equitable economic distribution (Burger et al., 2019; Padilla-Rivera et al., 2020; Sulich & Sołoducho-Pelc, 2022). For the purposes of this research, CE can be understood as a system where value is retained throughout the extended lifecycle of materials, and is realised through a number of retention options including: refuse, reduce, repair, refurbish, remanufacture, repurpose, or recycling (Ghisellini et al., 2016; Geissdoerfer et al., 2017; Reike et al., 2018). While job creation in this (or any) area is generally considered a social benefit, comparatively little work has been done to understand the quality of work that might be created through a CE transition, with the notable exception of health and safety concerns over waste management and informal employment (Bakhiyi et al., 2018).

One sector undoubtedly fitting the description of CE is repair. Repair, the act of restoring the functionality or aesthetics (or safety) of a product (Bakker et al., 2014), in itself is not a new activity; but it is being rediscovered and given new life thanks to the CE. Repair is fundamental to extending product life, implied by the 'refusal' to purchase something new. But it can also be seen as a sign of hardship or lack of options (Cole et al., 2019) although the cost of repair can be higher than replacement (McCollough, 2009; Bovea et al., 2017) and pose a significant barrier to adoption (Rogers et al., 2021). Upcoming initiatives such as the right to repair may help to overcome obstacles (e.g., information, supply of parts) (Svensson et al., 2018). Repair, moreover, covers a huge range of activities, including to high-level, long-lasting items such as buildings, cars, white goods, industrial equipment and other items that are expected to have a lifetime longer than their components, as well as, smaller consumer items, electronics clothes, toys, whose life time is more likely to be limited by that of the first component to fail. The work carried out may be done by a department within a manufacturer, or as a service department in any type of organisation, or by a specialised company which could be an automotive repair chain or an individual. Recently so-called repair cafes have begun to appear offering services for free. The balance between different models of delivery and opportunities to earn a living in repair will vary according to the geographic context.

In addition to mainstream capitalist employment, a CE may in certain geographical contexts provide new economic niches from which individuals may seek to earn a living through self-employment. This may be particularly the case in geographic areas that have lost some of their larger companies/heavy industries without the emergence of newer, tech-focused companies through which technological innovation might create other types of CE opportunities. In the UK, for example, self-employment is growing faster than the growth of salaried/employee positions in the same region, and the majority of that self-employment is by the solo-self-employed (i.e. business owners with no employees) (ONS, 2018). This category of solo self-employment holds different characteristics than both employment positions, and the self-employed with employees. For example, the earning potential for the solo-self-employed is significantly lower than those with employees (Sorgner et al., 2017). The opportunities to earn a living in repair will vary according to the geographic context. This paper focusses on the case of small, independent repair shop owners (including, but not necessarily solo-self-employed) as an example of a skilled trade occupation within the CE.

The theoretical framework for the study comes from the quality of working life (QWL) literature. Although there are commonalities of interest (e.g., quality of life), there are no previous studies linking QWL to sustainability or CE. Sustainable Development Goal 8 is concerned with productive employment, but with a growth focus and overlooking the experience of that employment beyond the implementation of international minimum standards (Bianco-Varela et al., 2021; Dantas et al., 2021).

The aim of this study is to explore the experience of and influences on self-employed people working in the CE in city which is undergoing a transition to less carbon intensive economic base focussed around renewable energy and the CE. This research uses the case of Kingston upon Hull – a port city situated in the NE of England, which is often described as an economically deprived region (Wurzel et al., 2019). We ask: to what extent has self-employment been a choice, does this role provide job control, and in what ways do they take satisfaction from their work?

2. Quality of working life

The Quality of Working Life (QWL) field (Burchell et al., 2013; Barroso, 2018) field emerged from an appreciation that job experience is widely varied, and that certain minimum standards are needed for worker wellbeing (Grote & Guest, 2017). Aspects of study include psychological well-being; consideration of the "whole life space" and how work impacts other aspects of life; external contextual conditions of employment; skill development; and job satisfaction (Findlay et al., 2013; Leschke & Watt, 2014; Van Aerden et al., 2014; Grote & Guest, 2017; Barroso, 2018).

QWL is observable and measurable at various levels or spatial scales (1) individual, (2) organisational, and (3) societal levels. For example, the distinction between quality of work and quality of employment alludes to first an organisational level of internal job characteristics (work) and then to a societal level of contextual conditions (employment), such as national pension policies (Barroso, 2018). There is an inherent geographic implication in these analyses, as many aspects of employment, particularly the political and legal context, will vary widely at the national scale (Findlay et al., 2017). There is an important connection between the individual as a worker, and the individual as a human, whose life is made up of many more dimensions than their working life, but which may be affected by the quality of their working life (Grote and Guest, 2017). A case study approach is useful to capture the relationships between these scales. A qualitative approach also enables the contextualization of job satisfaction, helping to overcome the apparent perceived subjectivity of self-reported quantification (Seashore, 1974; Findlay et la., 2013; Leschke and Watt, 2014).

Beyond the emerging qualitative approaches to QWL, the field has also recently incorporated the study of self-employment and solo self-employment.

2.1 QWL in Self-employment

There are conflicting findings on the impact of self-employment on health, financial distress, and job satisfaction. For example, in a multi-country analysis, it was found that financial distress had a greater impact on the health and wellbeing of self-employed individuals than it did on wage-employed individuals (Berrill et al., 2021). However, while financial burdens specifically may weigh more heavily on the self-employed, overall, Gauffin and Dunlavy (2021) saw no evidence that low-income self-employed workers in their Swedish study were in a more vulnerable health situation than the employed. In general, notwithstanding financial burdens, self-employment has been shown to have a positive impact on health, reducing hospital admissions in Portugal by half (Gonçalves & Martins, 2021), and resulting in less work-related stress in Australia, particularly among the solo-self-employed (Hessels et al., 2017). This discrepancy could, however, be explained though national public health and social security differences, which affect access to health care and soften the impact of low earnings on wellbeing. Where individuals are coming into self-employment from a state of unemployment or resource disadvantage, for example in the UK, where policy support is found lacking, self-employment "shifts the social risks and responsibilities of employment from state and employers to those individuals with least capacity to bear them" (Danson et al., 2021:1). In fact, the transition from unemployment to self-employment is often due to a lack of employment options (Albiol-Sánchez et al., 2021), with the precarity of the situation bringing with it additional sources of anxiety (Danson et al., 2021). Even from wage-employment to self-employment, poor job quality is found to be the significant factor pushing such a transition, outweighing "pull" factors relating to opportunity identification or personal characteristics (Henley, 2021). The discrepancies in these studies highlight the need for a geographically contextual understanding of QWL.

The transition to self-employment has also been shown to reduce skill-mismatch (i.e. the match between the skills required for a job, and those of the worker), with evidence suggesting that a better skill fit leads to improved outcomes for workers such as economic performance, productivity, and psychological wellbeing (Albiol-Sánchez et al., 2021). Furthermore, studies have shown that self-employment leads to higher overall job satisfaction, particularly when the values of workers prioritise criteria such as autonomy and personal interest (Benz & Frey, 2008). However, over time, job satisfaction may wane, reverting back to pre-transition levels, with increased satisfaction being more permanent for men than women (Georgellis & Yusuf, 2016). This gender discrepancy is also borne out by the structure and motivation of women's self-employment, where part-time work, working from home, and caring responsibilities are significantly higher than both self-employed men, and wage-employed women (Bari et al., 2021).

Thus, the QWL literature identifies many relevant concerns and criteria to consider in the analysis of employment opportunities arising from CE, including repair. A tension exists in the QWL literature between objective measurement and the importance of personal experience, particularly in relation to the validity of self-identified job satisfaction as a useful or accurate measure of job quality. The quality of work represents a social dimension of employment, as distinct from the more purely economic considerations of whether one has a job and the level of remuneration. In this study we are utilising a critical realist approach to a qualitative case study of the experience of working in the circular economy in a particular place, the city of Hull in the north east of England. The purpose of this is use the QWL-based criteria as an entry point to discussion, and then to explore the underlying influences.

3. Methods

This study uses critical realism as a middle ground between positivism and relativism. Where positivism asserts that reality is observable, measurable, and absolute, and relativism that reality is contextual and subject to experience – critical realism nods to both views (Fletcher, 2017). There is a level of observable and experiential truth that is filtered through human interpretation, but "while interpretive understanding [is] an important and necessary feature of any social science, it [does] not mean there [is] no scope for causal explanation" (Sayer, 2000:6). Critical realism relies on an understanding of the underlying structure and the conditions or context under which a causal mechanism may activate, regardless of its frequency (Sayer, 2000). The need to explore the contextual circumstances around a particular situation (e.g., employment characteristics) is best served by a case study approach. Case study research is an empirical, in-depth inquiry into a contemporary phenomenon, which specifically allows the researcher to

explore pertinent contextual conditions (Yin, 2014) and "disentangle a complex set of factors and relationships" (Easton, 2010:119). For this study, in order to understand how employment in CE might contribute to social sustainability, we have used a case study of repair services in Hull.

The city of Kingston Upon Hull (hereafter referred to as "Hull") was chosen as the spatial boundary for this study. Hull is located in the NE of England in Yorkshire, along the Humber Estuary. It is a port-city and has a long-standing history based on blue-collar employment. Historically a fishing town, the collapse of the fishing industry in 1976 led to wide-scale unemployment in the area (Atkinson et al., 2002). While some manufacturing and light industrial repurposing of the port has occurred, the city has more recently been categorised as a "structurally disadvantaged city" (Wurzel et al., 2019). The Index of Multiple Deprivation indicates that neighbourhoods in Hull score amongst the most deprive 10 % in the country on a range of measures (Kingston Upon Hull Data Observatory, 2019). Furthermore, Hull continues to stand among the least educated cities in the UK, with unskilled labour accounting for a disproportionate amount of the workforce compared to UK percentages (Nomis, 2021). The potential for places to benefit from environmentally-based economic initiatives can be questioned (Deutz, 2014), but if CE job creation is to have distributed benefits, it is these deprived regions which require attention and examination to understand the extent to which any benefits might be realised. Citizens in Hull have been shown to have a high willingness to participate in the repair economy (Rogers et al., 2021), therefore the examination of the repair service sector as an opportunity for job creation and quality of work assessment was chosen, with particular focus on small, independent businesses.

Semi-structured interviews were chosen as an appropriate choice for a qualitative data collection to capture of individual experience as well as the context surrounding that experience, complementing a critical realist approach. Interview questions were developed with the purpose of discovering the quality of working life of individuals. For a multi-dimensional exploration, social sustainability principles (Missimer et al., 2017a; 2017b) and various QWL criteria were used as a basis for the themes to be covered during each interview. Questions were adapted to encourage generative and expansive responses, with the option for follow up inquiry using a conversational approach. Following University of Hull ethical policies, five interviews were carried out in 2020/21. Interviewees are referred to anonymously as follows: Interviewee 1: electronics; Interviewee 2: televisions; Interviewee 3: seamstress/tailor 1; Interviewee 4: appliances; Interviewee 5 (seamstress tailor 2).

4. Results and Discussion

This section will present the results of the interviews, discussed around the emerging themes of self-employment identified in the literature review.

4.1 Route to self-employment

Interviewees had been in their present occupations for between four and 27 years. Despite this generational difference in the age of the businesses, there was a common theme of necessity (applying skills to earn a living) rather than an entrepreneurial spirit to set up a business to exploit a perceived market, or in an attempt to develop a new market. Seamstress/tailor 1 notes that her choice to start a business was borne out of necessity to provide for her family. Likewise, seamstress/tailor 2 started her business after being made redundant from her previous employment. Nonetheless, the sense of independence and flexibility of being one's own boss was highly valued by respondents. This was partly to cope with caring responsibilities, but also a more general sense of satisfaction at not working for someone else. As will be discussed below, however, these benefits come with disadvantages too.

4.2 Identification with the circular economy

Very little emphasis was placed on the environmental aspect of repair by the interviewees. All have been working in the repair sector since before the CE reached its current prominence (though one can note that academic prominence does not equate to public awareness). Asked to consider the environmental aspects of the job, appliance repairer says: "I like to think it is a worthwhile kind of job. Some appliances go to landfill. I am not a particularly green person. But fortunately, I do quite a green job." The television repairer extensively describes his reuse of materials, and in fact he keeps a large inventory of unrepairable

products to be used for spare parts. However, this choice is largely based on economic factors rather than any desire to be eco-conscious.

An ethic of care emerged as a defining aspect of the sense of self-worth as an aspect of job satisfaction. For example, the electronics repairer describes a relationship that he has built with a repeat customer, where he finds himself making decisions in the interest of the customer rather than on immediate profitability. Similarly, the television repairer reminisced about his most rewarding activity related to his work, when he would volunteer to check the televisions in the hospital. This sense of pride in being able to help someone who might not have the skills or ability required to fix something themselves was a common theme among interviewees. The electronics repairer reflects that "it makes me feel happy to see other people happy". While things like flexibility and stress have a significant impact on their day to day experience, is was often these aspects of care that came through as significant and meaningful for the interviewees. This is a well-documented phenomena in care-services (e.g. long-term care, nursing), where the perceived social benefit is seen to improve job satisfaction among workers (Gray et al., 2016).

4.3 Skills, knowledge and experience

Lying behind these examples is the possession of marketable skills on the part of the service provider. As self- or solo-employed individuals, they have defined the remit of their business around the skill-sets they possessed. This has resulted in a gender-stereotypical division with the two female interviewees working with fabrics, and the three men with various electronic items. While repair work is a technical trade, interestingly, little formal training was mentioned by interviewees. Those who had received formal training minimize its importance for their work or success. Exceptionally, the appliance repairer valued the safety component of continuing education. All interviewees, however, emphasised experience and natural aptitude as drivers of success. Instead, lifelong learning is embedded in repair work, as every job will present different challenges, and technology changes over time require new skills and updated information.

The business and managerial skills required to operate a business, however, required a more concerted effort to attain. In these cases, training or mentorship programs would be helpful. For example, the seamstress/tailor 2 concedes that, "I'm only good with the sewing, the rest of it is the hard part." Those with employees were able to delegate some of these undesirable tasks (customer service, logistics, or book-keeping to name a few) to others and focus more on the work that they enjoyed. Skills required for the management of staff, however, was a barrier for some, and while those individuals may have benefitted from delegation, either the pressure of maintaining enough work for multiple people, or the concern over personality dynamics prevented them from scaling their business up. For these individuals, the transition to self-employment may have improved their skill-mismatch in terms of the use of their technical repair skills, affirming results seen from Albiol-Sánchez et al. (2021). However, the competencies needed to run their business, and particularly to manage staff, opens another dimension of skill acquisition that was not always present or pursued. Furthermore, the fast-paced nature of the work leaves little time for future planning or capacity building, particularly when the business is new, with a sense of survival permeating day to day operations. That same interviewee, however, also spoke about more recently exploring and developing her marketing skills, and indicated some regret about not pursing this sooner. It seems therefore, that with the maturity of the business, capacity for skill development also increases. Nonetheless, opportunities for self-development appear to be limited.

When hiring staff, again, formal qualifications were not a priority. For example, the electronics repairer requires a demonstration of skill when hiring new staff (e.g. performing a screen replacement), however the way in which those skills are obtained was less important. Similarly, the seamstress/tailor 2 states that none of her staff have formal education, but instead were self-taught. Practical and proven skill and quality of work is clearly valued much higher than formal qualifications in this industry, which may indicate an opportunity for employment for people without access to extended formal education. Customer service and social skills also ranked high in skill requirements for hiring staff.

4.4 Work-life balance and control

Interviewees reported contrasting experiences of work-life balance, the extent to which they felt in control of that, and their attitude towards it. Most interviewees expressed that they felt rushed during the day. Variations in how interviewees felt about this partly reflected the difference between being solo-self-employed, or having employees with whom to share the work. The electronics repairer, for example, worked alone and expressed a struggle and/or frustration to complete jobs and schedule work, reflecting that at times his interactions with customers may seem short or unfriendly, simply because he is stressed about finishing a job on time for a previous customer. Conversely, another owner with no staff (appliance repairer) says that he needs to turn down jobs in order to ensure that he has adequate time to complete existing jobs to a satisfactory level of quality. The difference between these two experiences may be related to the maturity of the business. Several interviewees shared that they experienced a transition between the early years of their business, when all jobs were accepted to keep the business afloat, to later years when a customer base was established, and they were able to have more flexibility to turn down jobs that they did not have time for, or were not comfortable with, the work. In either case however, these solo owner/operators relate to the feeling of being rushed in a negative way, and either cope with the stress out of necessity, or take steps to balance the workflow.

On the other hand, those working with a team of staff seemed to relate differently to the rushed or stressed atmosphere. The television repairer characterizes the experience of being very busy as a "steady flow", saying that "there's never two days the same in that shop", suggesting that the variety in work holds his interest. Another interviewee (tailor/seamstress 2) with staff again discusses the time pressure and hectic environment in the shop, saying that they are too busy to offer an express service, however she also states that the team will always take tea and lunch together, and talks about trading jobs based on enjoyment or expertise, ensuring the work is done efficiently. This team atmosphere seems to transform what might be a very stressful grind for an individual, into an energetic challenge for the group. These observations might lead one to believe that working within a team provides opportunity for greater health. This finding is somewhat in conflict with previous work which found that self-employed with employees experienced substantially higher work-related stress than the solo-self-employed (Hessels et al., 2017). However, these results do not necessarily indicate that the team atmosphere corresponds to less stress, but rather that the experience of that stress is changed by the comradery of the group. This result would also be highly dependent on the group dynamics of the staff, and the skill set of the employer.

Some aspects of work/life balance relate to schedule flexibility. Three interviewees brought up their families in different ways. The appliance repairer observes that having control over his schedule as a business owner has enabled him, as single parent, to work around his child's schedule. Seamstress/tailor 2 mentions how much she appreciated being able to temporarily drop work one day a week to care for her new granddaughter. While these examples reflect an ability to maintain agency in work/life balance, that is by no means guaranteed. Seamstress/tailor 1 states that it has been difficult to separate work life from home life. For example, she discloses that she has not taken a holiday in 20 years and frequently mentions the immense pressure that she is under to maintain the business. In theory, she can determine her own hours and elect not to work e.g., around school hours. But in practice this was immensely difficult, given the total number of hours' work needed to gain a viable income. Having even one employee might offer some greater flexibility – but with low profit margins that is hardly an option.

It is worth noting here that of the five interviewees, three mentioned familial responsibilities. Of those three, two were women. While the gender discrepancies revealed in previous studies (Georgellis & Yusuf, 2016; Bari et al., 2021) are crucial to addressing systemic inequalities between gender groups, in this case, the root of this inequality seems be attributed to care responsibilities, regardless of gender. In this case the CE-relevant skills had enabled interviewees to set themselves up in business - i.e., by having some directly marketable skills they can sell their abilities as self-contained services to directly to clients - drawing on the lack of skills/confidence of the wider population (e.g., Rogers et al., 2021). This has allowed some sense of control, but also controls them.

4.5 Context

A significant issue to emerge from the interviews was the role of contextual factors, i.e., circumstances that are beyond any element of control by the service provider but which frame the circumstances of their

operation. Interestingly, the most prominent contextual factor is one that relates directly to the CE, i.e., collaboration with other companies in the value chain. Interviewees expressed concerns in relation to access to information and/or components and spare parts. The appliance repairer explains that "the problem that we have in the industry is that manufacturers guard their information very jealously." For example, the electronics repairer explains that while there are components readily available through online retailers for most cell phones, the quality of these parts can be very low and difficult to assess before purchase. Conversely, original equipment manufacturers' (OEM) repair technicians will have access to original parts. The television repairer also expressed frustration that his access to components was limited, and, when available, marked up to a price which undermined the competitiveness of the repair. The three electronics interviewees mention these external forces, often indicating an unfairness with regard to competing interests of large OEM corporations or the rate and trajectory of technology changes in general. Their perception was of limited to no personal agency to affect these conditions. This lack of public access to information and/or parts needed for repair is a known issue that has received attention from the public and has gained some traction from policy makers (Svensson et al., 2018).

What we note in particular here are the constraints on individuals attempting to earn their own living from a CE. Larger companies tend to have advantages in a capitalist system, where power dynamics and economies of scale influence their access to manufacturing, logistics, influence on legislation and their ability to safeguard their intellectual property even when this appears to be against the public interest. For small or micro businesses, competing with these larger companies from a purely economic standpoint may be futile in the currently pervasive economic system, although alternative economies and value propositions may serve to bolster their competitiveness in the local community.

The appliance repairer was also concerned with regard to disclosure of information to consumers. He mentions that model-specific repair manuals, to his knowledge, do not actually exist. Although as an engineer he does not need them, he suggests that access to such information would go a long way in enabling the average person to tackle a repair themselves. He argues that the single best change that could be made for the industry is to have a reparability index or grading system available for customers, so they can make an educated decision when purchasing an appliance and know how repairable it is. While the focus on these industry-wide impartiality barriers (as opposed to those encountered internally among employees) is likely related to the interviewees position as owners of their businesses, it remains an industry-wide challenge to be noted, particularly with regard to local and small business success. The viability of repair as a positive force towards CE relies on local enterprises, as the logistics associated with transporting goods long distances diminishes the environmental benefit of the repair, and also sacrifices the opportunity for local employment benefits (i.e. social benefit).

5. Conclusions

This paper has taken a critical realist approach to examining the experience of CE work in the form of a solo- or self-employed repairer, using the city of Hull as a case study. In the terms of the QWL criteria, we found that the respondents experienced varying levels of ability to control their work-life balance, and their experience of stress in response to similar conditions was variable. They are skilled workers, using pre-existing skills to find an opportunity to earn a living on the margins of the mainstream capitalist economy. Their work is helping to prolong the lives of products and keep associated materials, labour and money circulating locally (c.f., Lekan et al., 2021), indicating the dimension of CE focused on Hull.

CE-relevant skills had enabled interviewees to set themselves up in business i.e., by having some directly marketable skills they can sell their abilities as self-contained services to directly to clients, drawing on the lack of skills/confidence of the wider population (e.g., Rogers et al., 2021). This has allowed some sense of control, but ultimately the running of especially a solo-self-employed business appears to dictate the quality of working life, which indeed becomes difficult to separate from quality of life. On an empirical level, the maturity of the business influenced the capacity to both develop skills and manage time. Having a small team involved in the business was important for improving the ability to manage workload and achieve some flexibility (e.g., the ability to turn work away during busy periods). Even managing the daily routine to cope with family obligations cannot be assumed. Furthermore, the passage of time does not guarantee that opportunities for self-development or for expanding the business will come about. Business maturity may be less of a factor than the profit margins of the specific occupation. The time that would be needed for development (whether learning how to run a business, coping with the administration of hiring staff and then managing them, or developing new technical skills)

comes out of the time that is spent running the business as is and/or directly doing the work. For individuals, this is a disadvantage of self-employment compared to working in a larger organisation with more flexibility for distributing work. Furthermore, the business does not necessarily generate profit margins sufficient to utilise some of that profit for hiring another worker. Income is limited by the rate it is possible to work, in addition to the amount of work available, and the amount that the public are able/willing to pay for the service. If the demand exists, then hiring staff might enable some economies of scale and the ability to gain more control through the exploitation of others, but the threshold to reach that point is too great.

These livings being made around the fringes of the mainstream economy are nonetheless inextricably entwined with it. A major constraint on the electrical/appliance-based enterprises was access to information and parts needed to repair products. Although discussions around right to repair might redress the balance, manufacturers decidedly hold the upper hand. Even if and when changes are made, it will remain to be seen whether the public repair for themselves to seek help. Indeed, the manufacturers and distributors may see this as an opportunity for business development.

Although respondents were pleased to learn of the environmental benefits from their work, these were not motivating them or helping to achieve a sense of satisfaction. Social aspects, or an ethic of care (for people not the environment) was a strong motivation. The social aspirations and satisfaction of these CE workers resonate more with the aspirational academic definitions of a CE than the more resource/environmentally driven vision of policymakers. This is specifically true of the resource-focused approach Hull City Council as well as England (e.g., Newsholme et al., 2022). These aspects of a social circular economy may not work as well in different types of cities, but notably even in Hull, is providing a recipe for a lifetime of hard work, rather than an escape from the so-called rat race of employment.

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Interreg Program to support artistic craftsmanship as cultural richness

Luca Parodi[1], Adriano Magliocco[2]

[1] luca.parodi@unige.it
[2] adriano.magliocco@unige.it

Abstract
The industrialized world is relegating more and more of the workforce to two macrocategories: workers with no qualifications, and super-specialized workers capable of designing and programming complex production processes. Italy's manufacturing sector in the field of interior furniture and accessories boasts a very high number of firms, which straddles the line between industrial and artisan firm size (Vercelloni, 2008, p. 99), with excellent international market results. A sector which represents, moreover, an element of strong recognition for Made in Italy production, as well as being a distinctive feature of the culture and economy (Micelli, 2011, p. 9). Confirming this phenomenon are numerous projects, exhibitions, publications, and events aimed at recognizing (and enhancing) the potential of a profession that, through an experimental approach, proves to be a bridge between disciplines. Aware of the urgency covered by the theme of sustainability, the design system is tracing new ways (Gambardella, 2020, p. 95). The projects of the Art Lab supported by the Interreg Maritime Italy France program, from 2017 to the present, have focused on activities to support businesses in this sector, partly to highlight critical issues related to survival in a global market that offers multiple opportunities, but subject's players in the sector to grueling competition.

1. Introduction

More than 30 years have passed since the definition of the term "sustainable development" was formulated from the Brundtland Report, that is - as Carlo Vezzoli discusses in Methods and Tools for LifeCycleDesign. How to design products with low environmental impact – "the systemic conditions whereby, at the planetary level and at the global regional level, human activities do not exceed the resilience limits of the geosphere and biosphere, beyond which irreversible degradation phenomena begin and, at the same time, do not deplete the natural capital that will be passed on to future generations, understood as the totality of nonrenewable resources and the systemic capacities of the environment to produce renewable resources" (Vezzoli, 2009, p. 173). The spin-offs have been many, from perhaps the best known in architecture (Canepa, 2018, p. 42), due to the management of the energy problem, to the production sector more generally. It has also happened in the design area, where it is necessary for designers to possess information and methods of analysis and evaluation, as well as decision guidance tools (Vezzoli, 2007). There is much talk about the topic of environmental sustainability, as the issue of ecological protection seems to be the most obvious and cross-cutting one, with effects on a planetary scale. However, it is clear how much social and economic aspects, at all scales, impact and affect each other, as the now famous diagram of the three dimensions of sustainability (image from eu sites) reminds us. In this paper we want to focus on the application of these principles to the arts and crafts sector, describing the aspects that interact with the three spheres of sustainability and then mentioning several cross-border projects funded by the European community through the Interreg program, focused precisely on supporting arts and crafts activities. In recent decades the 'handmade' often becomes "a phenomenon in stark opposition to industrial globalization, a way of affirming a political message of rebellion against production processes that erase human dignity, with logical repercussions from the point of view of what we have defined as social design. Phenomena such as that of the Makers relate to these reasons, as does that of the Fablabs, digital and computerized self-production laboratories that are spreading all over the world. In other cases, craftsmanship is just a means of regaining control over the finished piece: too many

times, makers have felt "betrayed" by the industrial realization that the engineering process of large companies has imposed on them, so working with directly governable tools becomes a way to follow the result more closely to its completion" (Dardi, Pasca, 2019, p. 265). Fundamentally, in the past Made in Italy represented an industrial model deeply rooted in the tradition of craftsmanship and the culture of the territories, today Italian craft enterprises constitute a very important capillary network. The Italian economy is also based on this network, known for intuition, commitment, and experimentation. Despite this, there are many problems nowadays related to finding young figures of art masters to be included in local supply chains. The resulting risk is related to the impossibility of guaranteeing a future for all those sedimented processes that unite the product to the customer and the territory to its history. The role, function, and value of craftsmanship compose a macro-area characterized by entrepreneurship, the ability to work on a customized product, and the contemporary use of tradition.

2. Literature Reviews

The traces of a multifaceted investigation of the contemporary relationship between design and craftsmanship can be found in many publications and research in recent years. These are projects, writings and events that have helped to define its basic images and coordinates by proposing different interpretations. The cultural production examined, which cannot be ascribed to a single strand of thought, is studied chronologically to refocus the entire process through which craftsmanship has not only been rediscovered but has proved to be a virtuous (re)starting point for the future of Made in Italy design. Through the interweaving of thoughts and experiences, it is possible to systematize the different creative strategies adopted and configure the parallel reality to modern industrial design. For a long time, progress in design disciplines has been associated with highly specialized professional figures. But today achievements, publications, exhibitions, and events show that things have changed. Increasingly, in fact, there are forays between the design discipline and different sciences, techniques, and fields. Starting from a common barycenter-the centrality of the product in its multiple expressions-the design system appears to be projected toward new disciplinary exchanges. This change of approach generates new points of view, different from the stereotypes of the past. Specifically, the evident return to craftsmanship, associated with the diffusion of a greater ethical and aesthetic sensibility, is disconnected from the beliefs that-for long years-have conditioned it. In parallel, an anchoring of this mode of action of the project to the current conditions of society, the world and the market is revealed (Antonelli, 2012, p. 121). The incessant transformations taking place weave together expressive, cultural, philosophical, social, and technical spheres, confirming the propensity toward the development of complex systems, based on networks of knowledge (Bassi, 2017, p. 104).

Britain and the Netherlands are today referred to as “the epicentre of the Crafts Renaissance” (Antonelli, 2012, p. 121). This happens because they have stimulated discussion among economists, sociologists, and design scholars. The experiences offered in these countries show that the figure of the designer has renewed its role. In this geographical area, university teachings are imbued with a strong hands-on component that pushes students to think (also) through tools and materials. A future that clearly does not clash with industrial design or modern digital technologies and is the protagonist of the book 'Futuro Artigiano' by Stefano Micelli, a best seller that was awarded the prestigious XXIII Compasso in 2014. The author, a professor of Economics and Business Management at Ca' Foscari University of Venice, addresses these issues in the text with a particular focus on the Italian manufacturing reality. His analysis delves into the transformations taking place and emphasizes the potential contained in small manufacturing districts. How to revive today that “heritage of knowledge that is too little valued today, and how to trigger a new dialogue between the culture of doing and politics? The challenge is won by focusing on the figure of the global craftsman, a craftsman capable of investing in the mastery of the gesture and its valorization on an international scale” (Micelli, 2011, p. 192). The author offers a survey of the role and perception of craftsmanship in Italy. He highlights the political and educational weaknesses that characterize the education system. In recent years, the need to project small territories into an international dimension has grown, so artisans are required to have a different vocational training. A command of languages and a good command of information and communication technologies is also important. This opens a new chapter in which the local sphere embraces globalization and promises interesting opportunities not only for new generations, but also for artisans currently working in the territories.

Quoting the words of Claudio Germak, it is possible to dwell (and reflect) on his vision of the relationship between designers and artisans: “The ones, collaborating with the others, contaminate each other giving meaning and value to the artifact, orienting it - moreover - to contemporary models of consumption and increasing the quality of the project and the process” (Germak, 2015, p. 43). The interest in craftsmanship today seems to represent a chance for recovery towards new professional horizons. Giovanni Anceschi and Massimo Botta state that “the profession of designer increasingly resembles the polyglot figure of the director, the astute figure of the strategist, the innovative figure of the technologist and the prescient figure of the planner” (Anceschi, Botta, 2010, p. 29).
The paper, therefore, explores in this context the role of the figure of the designer as activator-facilitator, but also registers polyglot and prescient planner (Anceschi, Botta, 2010, p. 19), with particular attention to the Mediterranean context and the needs of contemporaneity.

3. Methodology

To identify possible communication strategies and commercial placement of products, some popular projects were studied. The first is the Internoitaliano project, presented in 2012 by designer Giulio Iacchetti. The proposed concept is based on the idea of creating a network with all artisan workshops distributed across the country. By starting a collaboration with each workshop, it designs and produces furniture and accessories inspired by Italian culture. The project's mission is to tell - through objects - the Italian way of life. A way of living that has always been appreciated and recognized all over the world. Each product made is typically made in Italy and tells an authentic way of living, careful of people, traditions, different skills**,** and geography of materials. One of the very interesting aspects of this project is the signature of the products because each artisan personally signs the piece. Each product is signed by the designer and the artisan. Through this large diffuse factory, the artisans cooperate in the development of the products and become co-authors of the individual pieces. In a similar way, a few years later, the Fondazione Cologni dei Mestieri d'Arte in collaboration with Living-the interior, design**,** and lifestyle magazine of the Corriere della Sera newspaper-proposes a new format at the Fuorisalone of Milan design week 2016. It is DoppiaFirma, a project designed to enhance design innovation combined with the tradition of the great Italian masters of art. Products born from the fusion of contemporary design culture and a 'know-how' that represents the authentic expression of territories. Same mission as the Best of Italy project, proposed by the Coincasa brand in collaboration with Elle Decor Italia magazine. The designers involved, as co-authors of the products, include Matteo Cibic, Francesca Lanzavecchia (of the Lanzavecchia + Wai studio), Giorgia Zanellato and Daniele Bortotto, Serena Confalonieri, Sara Ricciardi, Simone Crestani, Federica Biasi, Agustina Bottoni and Francesco Meda. Each year the format offers a small capsule collection of products dedicated to a different material. The pieces are made through the fusion of the creativity of the youngest generation of designers and the best Italian craftsmanship. Collaboration between different fields not only suggests possible design insights, but also possible new strategies to the online marketing and sales system. A particularly virtuous example is represented by Artemest, the largest e-commerce platform that brings together the work of more than 1100 Italian artisans, artists, companies and designers and distributes it to more than 70 countries around the world. The marketplace, founded in 2015 by jewel designer Ippolita Rostagno and manager Marco Credendino, aims to create business and revive Italian 'savoir-faire' on the international market. "We have formed a team of about 50 professionals from different countries, creative and digital based between Milan, our headquarters, and New York," Credendino explains "Made in Italy always remains synonymous with quality and uniqueness, culture and attention to detail. We with Artemest try to defend every day the creativity and art that resides in every small gesture of our artisans and masters of art. Effectively communicating it to the world" (Rubatti, 2021, online). Often the products offered on the platform arise from interesting collaborations between designers and artisans, both linked by the wish to experiment, learn, and disseminate. In this context, cultural traditions return to the center of design and the discipline of design grows between art, technology, sociology, and attention to the contemporary. The Department of Architecture and Design (DAD) of Genova, starting in 2017, is also developing several projects within the Interreg Maritime Italy France program, in synergy with the partnership composed of: Chambre des Métiers et de l'Artisanat Corse, "Mario Sironi" Fine Arts Academy in Sassari, Architecture and Design Department of the University of Genoa (DAD), the association of cultural promotion named Pigna Mon Amour (PMA) in the historic center of Sanremo and, depending on the project, the consulting firms TEAM S.r.l and Insight Risorse Umane S.r.l, as well as the Sardinian artisans association Artimanos

(Cagliari). The program presents several objectives, all related to the sharing of knowledge and experiences of territories that share historical events, climatic-environmental characteristics, and socioeconomic peculiarities: for Italy, Liguria, part of Tuscany, Sardinia; for France, Corsica and the PACA Region (Provence-Alpes-Côte d'Azur). Among the objectives is to support the local economy, in strategic and characterizing sectors such as, for example, tourism. The Art Lab Net project was the first and the one that made it possible to fine-tune the collaborations between the partners, also according to their specificities and skills. The project organized many activities to support the sector. As regards the aspects related to environmental sustainability, attention has been paid at various times to the possibility of replacing commonly used materials with other similar ones with a lower environmental impact. Some seminars and workshops on sustainability in the production of objects of various kinds were held, thanks to the collaboration of the teachers of the DAD with the PMA association and the Fine Arts Academy. There was talk of eco-design, recycled materials for packaging, recovery of fabrics for the creation of table sets. Thanks also to the collaboration of various guests, there was talk of ethical fashion (with Sara Conforti Hòfer, an artist committed to spreading the culture of circular fashion), of urban gardening (with David Zonta), of restoration with traditional techniques (with Antonio Rava and the School of Specialization in Architectural and Landscape Heritage of the University of Genoa). The historic centres of some cities, a reference point for the project partners, have been the site of interesting itineraries to visit the artisan workshops (for example with the collaboration of the Tree cycle company which organizes pedal assisted rickshaw tours through the historic centre of Genoa). The project that followed, Art Lab Experiences, focused on the collaboration between young graduates from the design, art and architecture sectors with specific craft laboratories. Based on the products characterizing the various artisans involved, it was proposed to use "non-bloody silk" for those who use this material for the creation of bijouterie, to use natural dyes for fabrics (clothing), preparations based on vegetable oils for wood (objects and furniture), biopolymers for 3d printing (jewellery). In supporting the activities of the artisans, young people at the beginning of their professional activity were shown how the artistic craftsmanship sector also needs other professionals such as social media manager, marketing expert, web designer, etc. The third project, Art Lab Services, instead saw the partnership engaged in identifying service providers useful to the artisans who, according to the Interreg Maritime tender, started their business no less than two years ago and no more than five. In fact, this period of time was considered by the Program Management Authority (within the Tuscany Region) as the most delicate moment in the professional life of a craftsman, as it is already out of the possible supports that the various legislative and regulatory provisions allow at the time of opening a business, but without having – at least for many this is the case – the experience and ability to remain stable in the market. In fact, it seems that it is in this period that the craft businesses often close.

4. Results and Discussion

Conscious of being amid the 2030 Agenda, the Interreg Program evaluates and takes into consideration the 5Ps of the SDGs: people, planet, prosperity, peace, and partnership. Through cooperation with other project partners, many people with different educational backgrounds and histories have been involved. The team, through brainstorming and interwoven collaborations, fostered new synergies attentive to current conditions on the planet and sensitive to future changes.

As mentioned in the introduction, artistic handicrafts are a sector made up of micro-enterprises, often formed by a single person, spread throughout the territory, where the presence of women is very high, and the economic impact is almost entirely local. However, the products-especially those that in size and specificity lend themselves to becoming tourist souvenirs (tourism is one of the main activities in the maritime area)-are penalized by comparison with cheaper industrial products, often from the East. The buyer is not always able to understand the qualitative difference and, above all, the economic and social value of buying an artisanal rather than an industrial product. Projects curated by the Department of Architecture and Design at the University of Genoa, in collaboration with project partners, have worked extensively on the placement of products on social platforms and, in general, on industry websites. The need to communicate what lies behind a handcrafted product requires storytelling activities that can capture the viewer. Buying an artisanal object means not only buying the object itself but having access to a cultural and personal history that the object, with its materials and forms, synthesizes. It means allowing an area to preserve its roots but also to evolve, to hybridize ancient techniques and modern tools, to continue living. It is possible to see that the world has not become

simplified and transparent, as the industrial culture thought. The situation has evolved differently and today what appears is a complex world, in which high technology can combine in the most diverse forms with mature technologies and even with craftsmanship, in which ancient knowledge can be recycled for brand new fields of use; in which, in short, instead of the expected homogenization of cultural and productive models to a single dominant rationality, diversity is being rediscovered (Alison, De Fusco, p. 121). Currently products are not sold simply as objects, but become vehicles of stories, cultures, technology, and art. This is why it appears necessary to know how to tell the story well, initiate structured processes and collaborate with universities, museums, trade associations and research centers. To incentivize the discovery of all the artisans involved in the project, the Art Lab team is developing a new, digital platform that connects all the workshops involved. It is a new tool designed to help small production realities tell their stories and those visiting Liguria to get to know them. Nowadays, tourist itineraries do not (for now) include visits to workshops. All the project teams have asked how to involve the workshops more and make them more accessible to the public. New workshops and thematic talks will be promoted in the coming months in the different partner locations. The platform currently helps artisans tell their stories, but in the future, it would like to become the starting point for promoting courses, exhibitions and guided tours. It is also a first step toward cooperation between different artisans. If the intelligence of the hand and the intuition of the mind do not live on memories alone, but need propulsive force and constancy - as Franco Cologni says in his contribution within the text ‘La Grande Europa dei Mestieri d'Arte’ - the strategy adopted by artisans seems to be based on determination and passion. Characteristics also studied by Richard Sennett in a book that is considered an opener on this topic. "The slow time of artisan work is a source of satisfaction, because it allows the technique to penetrate and take root, to become a personal skill. And slowness favors the activities of reflection and imagination, which are impossible under the pressure to achieve fast results. Mature means long-term; one secures a lasting mastery of that certain skill" (Sennet, 2008, pp. 279-280).

5. Conclusion

In Italy, many companies in the arts and crafts supply chain are experiencing great difficulties due to their limited ability to position itself in the international market. In most cases, the products made by the workshops are very strong in terms of technique, but do not meet the contemporary taste of the public. In addition, most craft workshops have difficulties in communication. They often fail to communicate with each other properly and therefore cannot easily sell the products. Through brainstorming with them, a difficulty about sharing and collaborating with other colleagues also emerges. One of the causes is a lack of financial resources and proper marketing strategies. Older artisans are averse to changes related to the production process (change of materials, use of information technology, etc.) and therefore do not easily adapt to contemporary demands.

Through the Interreg Program it was possible to encourage widespread production in the local area, interweaving design and crafts and enhancing cultural and territorial resources. Particularly interesting was the involvement of local associations in the area. During the Genoa BeDesign Week, for example, a collaboration with the Design District enabled the staging of an exhibition featuring the work of artisans. Some unseen products were displayed in the city's historic center, and many people learned about the fascinating know-how hidden within the workshops. Each day each artisan could talk with the public, offer insights into production techniques, compare with other colleagues, and experiment with students from the design university. Perhaps it is necessary to start with these small things to begin to encourage the development of a new awareness of the craft system. Bringing students, artisans and researchers together can initiate projects that are more conscious and consistent with the contemporary and open to possible future advances. The designer, in this context, is confirmed as "the artist of the age," ready to respond to people's needs by solving problems, regardless of stylistic preconceptions or false artistic dignities (Munari, 1997, p. 28). The role of innovation assigned to design, then, seems to be that of the director. It enables the drawing of new relationships between disciplines and traces new vistas that enable the codification and formative recognition of the role of the designer-craftsman. Today the role of thinking is as important as making and 'meaning' overrides the physical production of products, systems, and services (Bassi, 2017, p. 123).

6. Acknowledgement

The findings and study described here are part of the results obtained in the Art Lab project supported by the Interreg Maritime Italy France program, from 2017 to the present, in synergy all the valuable partners of the initiative. It is very important to thank all the people who were part of the project, without them, it would not have been possible to complete this research. If in the Italian tradition, the sense of enterprise is linked to the magic of the impossible, and therefore to the initiatory, symbolic, alchemical culture (Morace, Lanzone, p. 19), we must recognize the determination of many people. It is important to remember that without virtuous teamwork it would not have been possible to accomplish the work done. The team of this project is composed of people from different backgrounds, and everyone was able to make the best of their contribution. It is important, therefore, to thank all the project partners. Not only the colleagues who worked in the Liguria Region, but also the team from Corsica, the team from the Sardinia Region, and all those who contributed directly from the French Riviera. They, among others, are the ones who suggested very important insights for the evolution of this type of project. The French situation, around artistic professions, is very virtuous. It is no accident, therefore, that their support has been invaluable. By studying today's conditions in the world of contemporary design and culture and experiencing the support activities dedicated to craftsmanship, some considerations are possible. Italian universities, building on these new consciousnesses, can invest more in production spread throughout the territory. And they can intertwine design and craftsmanship by enhancing cultural and territorial resources, without necessarily excluding industry. University curricula can involve local artisans and promote mixed experiences. Different artisans with different professionals can help promote novel educational paths. Old techniques used by artisans can be preserved and passed on to Generation Z. The collaboration between different partners and institutions has made it possible to understand a very good starting point for thinking about new synergistic links between making, research and culture. As the world changes rapidly and international dynamics change with the course of an increasingly fluid and globalized life, it is very nice to be able to move in a different direction. Enhancing the recognition of artisans and fostering new collaborations has been crucial. Thanks to the willingness of each person, it is possible to affirm these things today. Through the interweaving of values, interests and passions that are the main hallmarks of local knowledge, it is necessary to focus on "that all-Italian ability to transform the particular into the universal, which is one of the great foundations of the success of Made in Italy" (Micelli, 2011, p. 19). After all, the value of small production districts and the cultural distinctiveness of products tell the identity of territories. They are a resource of beauty and culture. They represent the past, the present and the future.

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TRACK 7
Social-economic aspects of sustainability

7c. Economic and financial innovations for sustainability transitions

Abstracts

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From Malthusian Nightmare to the "Brave New World": the search for Sustainable Development

Professor Shobhana Madhavan[1], Dr Robert Barrass[2]
[1]Westminster Business School University of Westminster, London, United Kingdom. [2]Independent Consultant, London, United Kingdom

Abstract

In his essay on The Principle of Population (1798) Thomas Malthus identified the ultimate demographic choice "starvation or restraint", because unrestrained growth in population was always liable to exceed any increase in food supply. We could construe this as an early statement of threats to sustainability. Fortunately, technological development has thus far largely averted the spectre of famine. Agricultural productivity has massively increased, permitting population growth far beyond the level envisaged by Malthus.At a later date Aldous Huxley's Brave New World (1932) depicted a dystopic future for the world. This world was based on boundless consumption underpinning production, and where technological progress including genetic engineering and the nature of the organizational basis of peoples' lives removed restraints to "happiness." Brave New World could be regarded as a warning about what type of future we can expect if injudicious resource use and uncontrolled technological developments go unchecked. This may be seen as sustainable development, but not as we would wish it. Technological developments, especially, latterly, where machine learning and programming culminating in the ever-growing use of Artificial Intelligence (AI) along with globalization have accelerated economic and social change in a way that is historically without precedent. The process of change that began with the industrial revolution has intensified with the onset of globalization driven by the development of information technology, sometimes characterized as the second industrial revolution.The concept of welfare as the objective of human activity has long been debated by philosophers, economists and others. Political debates tend to focus on economic variables notably GDP and consumption as measures of welfare with increases in their magnitudes as beneficial to individuals and society. The context is the market economy, predominantly focussing on the short term, without much regard for the inherent uncertainties of the long term. Half a century of economic growth, driven by economic liberalisation across the globe has highlighted the social limits to growth and the unsustainability of resource allocation in the market economy. Inequality has widened at many levels and poverty persists in many parts of the world. While technical innovations and economic and social policy measures have "prevented the Malthusian nightmare becoming a reality," globalisation, and information technology, which helps to diffuse state of the art technology, will give a continuing impetus to economic growth and abundance in a market economy. The triumph of the market economy has been a phenomenon of modern history. What is needed is a strategy for sustainability, in a form that is generally beneficial. The Sustainable Development Goals set out a policy framework to counter unsustainability in resource allocation, imply changes in human behaviour, and manage processes for improving economic and social welfare. These reflect a conscious effort to balance human needs and resource use without the reliance on apocalyptic solutions like famine and war. Promotion of these goals would also avert the dystopic future of the *Brave New World*.

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ESG investing: decomposing reporting standard

Hiu Ching CHUNG[1], Dr Wanxin Li[1,2]
[1]City University of Hong Kong, Hong Kong, Hong Kong. [2]Tsinghua University, Beijing, China

Abstract

When the world has embraced green finance for materializing sustainable development, ESG reporting, which sets the precondition for green finance to work, has attracted unprecedented attention from regulators. In 2011, Hong Kong Exchanges and Clearing Limited (HKEX) published its first consultation paper on the ESG reporting guide, promoting voluntary based. In 2019, HKEX published its third consultation paper, imposing compulsory ESG reporting. Within eight years, like the annual report, all the listed companies and a company applying to list in Hong Kong must publish their ESG reports annually. To push companies to address climate risks, the HKEX requires companies to disclose climate-related issues, encouraging them to follow the Task Force on Climate-related Financial Disclosures (TCFD) recommendations. However, there is no mandatory assurance on ESG reports. The lack of consistent reporting standards makes it hard for investors to compare the ESG performance of different companies or even the same company across different years. Given the information asymmetry, the regulatory agencies force publicly listed companies to inform the public and investors of their operations' environmental and social impacts and corporate governance. However, the format and content of published ESG reports vary significantly. Except for Appendix 27 Environmental, Social and Governance Reporting Guide, nine other reporting standards were found in the 2020 ESG reports from 268 sampled Hong Kong listed companies (PwC, 2021). If we look at the global level, we can see that the increasing investment flows into sustainable finance. Starting in 2016, USD 22.8 trillion went into the pool, While four years later, the investment amount has already increased by 50% to USD 35.3 trillion (Global Sustainable Investment Alliance, 2021). To make ESG information and related rating products useful, there are three challenges:

1. The format and/or language of the self-reported ESG data are not standardized.
2. There is a lack of assurance on the credibility of the self-reported ESG data. Although financial reports of listed companies must be audited, there is no mandatory assurance on ESG reports (Ngan & Kwong, 2021). The HKEX only does a random check on ESG reports, and until now, no enforcement action has been mentioned.
3. The metrics for evaluating ESG performance are not standardized.

This project tries to build a taxonomy of ESG factors by the decomposition of existing frameworks to develop a transparent methodology for decomposing and assessing ESG reports. Furthermore, the project also conducts network analysis for mapping the ESG eco-system for identifying influential individuals and organizations in the field, as well as the inter-connections between the organizations and their publications.

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Interaction of emotional intelligence in investment decision making.

Dr. Hooi Cheng Eaw[1], DR. Boon Keong Lim[1], Dr Siew Ming Choo[2], Dr Elia Syarafina Abdul Shakur[1], Associate Professor Dr. Kim Yew Lim[3], Mr. JIA MING CHONG[4], Mr. WEN CHEAN CHOONG[5]
[1]UTAR, Selangor, Malaysia. [2]UATR, Selangor, Malaysia. [3]INTI International University, Kuala Lumpur, Malaysia. [4]UCSI, Kuala Lumpur, Malaysia. [5]UCSI, kuala Lumpur, Malaysia

Abstract

ABSTRACT

The main purpose of this research study is to measure the relationship between emotional intelligence influence investor decision marking. The study found from the SPSS regression analysis of the five independent variables, three variables found a significant relationship towards investor decision-making, there is self-awareness (p-value 0.006), Self-empathy (p-value 0.000), and relationship management (p-value 0.016). Two variables found no significant relationship towards investment decision-making there is self-management (p-value 0.097), and self-motivation (p-value 0.729). The measurement analysis has brought the impactful policies recommendation to stakeholders to target a different group of investors by providing them the market information and building a strong relationship with the market analysis to build on the investor confidence level.

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Biodiversity and economic instruments: implications on biodiversity due to using harmful financial tools.

MSc Diana Carolina Huertas-Bernal, PhD Hájek Miroslav, PhD Ratna Chrismiari Purwestri
Czech University of Life Sciences Prague, Prague, Czech Republic

MSC DIANA CAROLINA HUERTAS-BERNAL

Abstract

Biodiversity is so rich that many species are still to be discovered, and many others are in danger of extinction. The biodiversity that forests house differs from one place to another depending on the type of forest, management practices, and the availability or lack of economic instruments in the country or region where forests are located. For more than 30 years, it has been evidenced that many economic activities are not economically profitable unless they receive certain types of subsidies, such as transportation, agriculture, mining, and manufacturing. Said activities generate significant impacts on natural resources and biodiversity; however, as they are economic activities that increase the competitiveness of countries, they continue to be subsidized regardless of the environmental effects generated. Thus, this research aims to review the impact of subsidies on biodiversity through the systematic review of articles indexed between 1990 and 2021 and the content analysis of the implications and consequences of their use regarding biodiversity and other environmental effects as well as the perception of forest actors through in-depth interviews to learn from experience how they perceive the use of economic instruments in the management of their forests. Preliminary results indicate that environmental degradation continues to be evident despite the constant modifications to evaluate and improve subsidy schemes. Likewise, the perception of forest stakeholders means that private owners conserve their forests and take mitigation and adaptation measures due to their interest, not due to the subsidies provided, since the processes to access require too much time, lengthy bureaucratic procedures, and specific knowledge that does not compensate for the support received in exchange. Additionally, they prefer to invest their funds to benefit their forests if they have the means. Based on the results, it is intended to inform society and decision-makers so that they request the reduction of harmful environmental subsidies and improve the subsidized systems of initiatives of good management and conservation practices that improve environmental conditions in multiple small areas and local communities. The study is relevant for goals 10: Reduce Inequalities and 15: Life on Land, since it focuses on the biodiversity associated with forest ecosystems and proposes how, through small and medium-scale use, state subsidies can be used to improve the quality of natural resources and the quality of life of the communities where the projects are carried out. Likewise, the presentation is aligned with the evaluation of the 5Ps of the SDGs because it evaluates the environmental consequences of the use of subsidies for more than 30 years in traditional economic activities and exposes the need for the conservation of biodiversity and of the local communities that face the consequences of not having access to financing for the proper management of their resources and the preservation of their culture. The presentation focuses on the results and how to engage decision-makers and the community to demand changes in subsidy schemes to reduce environmental pressure.

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The transformation of the global financial system to sustainability

Dr Sebastian Thomas[1], Ms Angela Bruckner[2]
[1]Curtin University, Melbourne, Australia. [2]Blue Praxis, Melbourne, Australia

Abstract

Climate change presents material risks for the finance and investment sectors. While the costs of the physical impacts of extreme events are significant, the regulatory landscape is also rapidly changing. Emerging legal and fiduciary requirements present 'transition risks' that demand extensive work in identifying, assessing, and reporting asset exposures and climate-related impacts on business performance. Financial institutions seeking to ensure positive long-term investment performance, recognition as trusted partners, and alignment with clients' increasingly ambitious sustainability goals must develop robust, science-based responses to climate change in the form of net zero targets, climate action plan, and comprehensive sustainability disclosures. Board directors increasingly understand the diversity and seriousness of the risks posed by global heating, and over the last decade have consistently rated climate change, extreme weather, and the failure to act on climate as the most severe global risks in the next 10 years. While governments work to establish appropriate and effective regulatory parameters and pathways, the private sector must proactively and ambitiously find ways to decarbonise investment portfolios and establish new metrics of value creation and financial performance. This is a necessary strategic response to growing regulatory and legislative requirements imposed by jurisdictions including Europe, Singapore, Australia, and the United States, where mandatory climate risk disclosure is already or will soon be mandatory. There are global movements to integrate climate and nature considerations into financial thinking, and these have implications for how organisations invest and do business. As new macroeconomic scenarios are integrated into corporate strategy, and regulators require increasing stringency around disclosure of risk, finance flows are changing with clear implications for sustainability outcomes. The net zero transition is also a multi-decade global investment opportunity of more than USD 4 trillion per year – up to $200 trillion by 2050 – with robust corporate and consumer demand. There are substantial opportunities in key energy sectors including energy efficiency, renewable energy, electric vehicles and charging infrastructure, and transmission and distribution. This paper examines the ongoing transformation of the international financial system and the implications of this shift for the Sustainable Development Goals, in areas from climate change and renewable energy to modern slavery, Indigenous empowerment, and biodiversity on land and in the ocean. The paper provides a review of the 'state-of-the-art' in net zero transition. The study considers (1) the costs of climate change and the business case for decarbonisation and net zero; (2) the global regulatory and voluntary architectures of financial sector decarbonisation; (3) the challenges, barriers, pain points, and solutions that exist in finance sector transition; and (4) the key frameworks and tools that are in place and emerging to address the financial transition, and (5) the roadmap to 2030, 2040, 2050, and beyond. The study is relevant to all SDGs, but this paper examines in detail SDGs 7, 8, 9, and 11.

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Sustainable Digital Financial Inclusion - Leveraging Social Capital to Improve Adoption and Usage by Subsistence Retailers

Professor Shainesh G
Indian Institute of Management Bangalore, Bangalore, India

PROFESSOR SHAINESH G

Abstract

The poor in emerging countries have limited access to formal financial service institutions for savings, loans, investments & insurance. They depend on informal sources including family, friends and money lenders to borrow for their financial needs. Unfortunately, many of them end up in a debt trap, especially when borrowing from moneylenders who charge very high-interest rates. Recognizing this reality, governments and financial service providers have launched several digitally driven programs to improve financial inclusion. In India, some of the major programs include Jan Dhan, which provides a basic savings bank deposit account and Mudra, which provides loans among micro and small entrepreneurs. Programs for financial security through pension, life and accident insurance have also been launched. All these programs have been built on the foundation of digital access enabled by Aadhaar (identity) on mobile phones for financial transactions. The programs have been phenomenally successful in attracting millions of users. 475 million basic bank accounts, with a total deposit of ~US$ 22bn, have been opened after the launch of Jan Dhan[i] in August 2014. However, analysis shows that approximately 18% of accounts have turned dormant with no transactions in the last two years. It indicates a very high initial adoption but low usage thus perpetuating the cycle of low financial inclusion and perpetuation of poverty. India's Financial Inclusion Index (FII) of 56.4 for 2022 highlights opportunities for improving financial inclusion. This research focuses on improving financial inclusion by increasing usage among subsistence retailers. Retailing in India accounts for over 10% of GDP and 8% of employment. The industry estimated at $ 883 bn. in 2020 is dominated by small shops. Almost 96% of the over 19 million outlets are smaller than 500 square feet (46 m2) in size. We study two specific research questions:

- What is the impact of different forms of social capital on preference for digital financial services?
- Does the preference contribute to increased usage among subsistence retailers?

The multistage, multi-method study involves in-depth interviews with retailers, a survey questionnaire, survey-based conjoint analysis, field experiments and conditional logit analysis.

Our hypotheses include –

H1: Preference towards flexibility is moderated by the level of social capital.

H2: Sensitivity to barriers to service access is moderated by the level of social capital.

H3: The impact of product innovation on consumer preferences is moderated by the level of social capital.

We applied a conjoint-based choice modelling approach to test the hypotheses.

Results show that

- Subsistence retailers with higher levels of social capital prefer better and more flexible services.
- Social capital has a significant positive impact on preferences to the adoption of innovations such as mobile / app

Our research contributes to the literature on social capital, subsistence consumers and financial inclusion. We bridge the gap between consumer preferences and service design. Our research underscores the importance of social capital and innovation in improving access and affordability for subsistence consumers.

We believe that the financial service providers can improve financial inclusion through increased usage of financial services among subsistence consumers by leveraging social capital.

TRACK 8
Social foundations of sustainability

8a. Gender, inclusivity and human rights

Abstracts

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Crisis of Climate Induced Internally Displaced Female: Challenges to Achieving Sustainable Development Goals for Bangladesh

Ms Zelina Sultana
pgr student, Anglia Ruskin University, Cambridge, United Kingdom. Associate Professor, Department of Law, Jagannath University, Dhaka, Bangladesh

MS ZELINA SULTANA

Abstract

Bangladesh, a geographically vulnerable country to climate change, is facing problems for slow on-set climate change impacts and climate change extreme and frequent disasters. It results economic loss, loss of life, livelihoods and increases poverty, hunger, miseries of the affected particularly for the female who are internally displaced. Climate induced internally displaced persons' particularly female (hereinafter CIIDP) humanity crisis is concerning matter and it has been already estimated that 20 million people could be displaced over the next three decades in Bangladesh. The rehabilitation and livelihood settlement of this huge amount of CIIDP are pertaining to centered by integrating their issues in the forthcoming climate change policies and actions. Bangladesh has taken some adaptation strategies and action plans for climate change and disaster risk reductions including a strategy for CIIDP in 2022 which focus the norms of many international instruments related to the internally displaced but inadequately and insufficiently focus the female rehabilitation issues. However, the female need more concentration on adopting the strategies as they are the most affected section of society for climate change. Their housing, land and property rights should be protected in all phases of displacement and a durable solution should be formulated with the assistance of government, non government organizations, regional and international organizations synergistically to meet their resettlement crisis. It will increase their humanity crisis and ultimately halt the achievement of sustainable development goals (SDGs) within 2030 for Bangladesh. The aim of the paper is to examine the extant climate related policies and strategies, climate actions plan to evaluate the strategies of Bangladesh regarding reducing the crisis of female CIIDPs by adopting a policy analysis method. It also intends to focus on the female CIIDP's troubles which mutely looming the achievement of SDGs. The study finds that Bangladesh is failed to address female CIIDPs problems in its climate change legal policies and actions, development policies, plans and unable to implement the provision of protection of their rehabilitations and livelihoods. It also fails to understand and co-ordinate the developments that place human rights protection of CIIDPs is the best way to achieve the SDGs in future. So, the paper argues for female CIIDPs friendly climate actions and other development strategies, plans to ameliorate their human rights which surely stimulate to achieve the SDGs in due time.

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Sustainable Development Goal 5: Exploring Gender Equality Practices of Social Enterprises

Dr. Reeti Kulshrestha, Dr. Arunaditya Sahay
Birla Institute of Management Technology, Greater Noida, India

D R . R E E T I K U L S H R E S T H A

Abstract

Introduction: Despite making up half of the world's population, women are underrepresented, overworked, and underpaid which is against the spirit of Sustainable Development Goal (SDG) 5 that addresses gender equality and women empowerment. Therefore, studies are required in various sectors of employment on gender equality. This study explored how social enterprises are mainstreaming gender, contributing to SDG5, and suggested measures for empowering women, thereby bringing gender equality.

Methodology: Using an identity lens in a longitudinal study with four social enterprises, we conducted multiple unstructured interviews of participants adopting a narrative approach. It allowed the authors to delve deeper into 'gender equality' issues and practices of women empowerment facilitating the collection of rich and thick data. The data so collected were analyzed using thematic analysis.

Findings: The study revealed how SDG 5 was an overarching goal set by all social enterprises. Findings revealed that the gender equality practices of *'identity work', 'gendering', 'performativity', 'equal pay' 'negotiating identities',* and *'denouncing 'othering'* empowered women and helped the sustenance of families and contributed to society.

Discussion: The study is expected to contribute to the achievement of SDG Goal-5 which has a positive spillover to most other SDG goals. "Assessing the 5Ps of SDGs (people, planet, prosperity, peace, and partnership)" with the perspective of gender equality helped us understand how practices that are oriented towards bringing gender parity are ultimately going to bring more prosperity to the planet and people in terms of strengthened workforce, economic upliftment, and equal participation.

Implications: The study contributes to the achievement of SDG goals by social enterprises and how it creates a more sustainable society that encourages and embraces diversity, inclusion, and equity. The study also highlighted the systemic changes required to tackle deeply rooted 'gender challenges' arising out of the societal structure and social vulnerabilities.

Scope for future work: Future work may include a more nuanced and inclusive "gender agenda" which can be studied in different contexts, geographies, and temporal setting

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Women's influence on sustainability performance in Higher Education Institutions: the case of Universidad Pontificia Bolivariana (Medellín, Colombia)

Prof. Ana Elena Builes-Vélez, Ms. Ana María Osorio, Prof. Juliana Restrepo, Prof. Lina Maria Escobar
Universidad Pontificia Bolivariana, Medellin, Colombia

PROF. ANA ELENA BUILES-VÉLEZ

MS. ANA MARÍA OSORIO

PROF. JULIANA RESTREPO

PROF. LINA MARIA ESCOBAR

Abstract

Higher education institutions have been undertaking considerable efforts to embed sustainability into their system, in a world in which education and social scenario are characterized by continuous and rapid changes, Higher Education Institutions are called to act rapidly and consciously. In Latina America, Higher Education Institutions, are therefore facing a significant change, which requires the definition of policies and strategies strongly oriented toward sustainable development, becoming fundamental for long-term success and competitiveness. In this perspective, female leadership plays a key role. Over time, women have demonstrated the ability to successfully manage the challenges imposed by social dynamics and environmental change (Showunmi, 2021, Pierli et al, 2022). Despite the growing number of studies on women as sustainable development leaders, there is still little empirical evidence on how women contribute to Higher Education Institutions' sustainable development performance. The paper aims to address this gap by developing a qualitative case study based on the administration of a questionnaire in one Colombian Higher Education Institution, Universidad Pontificia Bolivariana in Medellín, which is characterized by the presence of women in research groups, teaching staff, and leadership positions and the review of scientific papers written by women and research projects headed by women at UPB in the last five years. Therefore, the objective of the research work is to analyze how female leadership facilitates Higher Education Institutions' transition toward sustainability. Findings suggest that female leadership contributes to the promotion and implementation of environmental and social practices through several characteristics intrinsic to their nature, such as the ability to emphasize and comprehend and the predisposition to sharing and collaboration. Additionally, women heading sustainability courses, research projects, and boards exhibit similar skills and trials, such as: thinking systematically, managing complexity, and inclusive approach to leadership in Higher Education Institutions. This study shows that women's representation in research projects, teaching staff, and management sustainability boards has a positive impact on the university's sustainability performance.

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Protecting The Well-being of The Disabled in Achieving The Nation's Sustainable Development Goals

Charmilaa Krishnamoorthi[1], Dr Ahmad Azam Mohd Shariff[2], Dr Mohamad Azhan Yahya[2], Dr Hanim Kamaruddin[2], Dr Muhamad Sayuti Hassan[2]
[1]Raj May & Associates, Petaling Jaya, Selangor,, Malaysia. [2]Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia

Abstract

As the nation is leaning towards achieving the Sustainable Development Goals (SDG), it is pertinent and crucial to look into the plights faced by people with disabilities in this country. This study delves straight into the current socio-legal climate surrounding them. It adopts methods of content and critical analysis when analysing the data qualitatively. The findings show that even though the overall social acceptance and reception have improved over the years, some members of the disabled community have faced unfair treatment during job scouting, job interview or while at work. From legal point of view, an ambiguity in a provision under the Persons with Disabilities Act 2008 has resulted in inaccuracy and false interpretation by the local authorities, leading to poor and shoddy construction of public amenities for the disabled. Furthermore, effectiveness of the Street, Drainage and Building Act 1974 in ensuring accessibility of public facilities for the disabled remains questionable. In the concerted effort of achieving Goal No 9 of developing quality, reliable, sustainable and resilient infrastructure in support of economic development and human well-being, and Goal No 10 of reducing income inequality under the nation's SDG, the above-mentioned socio-legal problems must be urgently addressed.

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AN EVALUATION OF GENDER AT THE INTERSECTION OF RECENT DISASTERS IN TURKEY, SDGs, AND SENDAI FRAMEWORKS

Prof.Dr. İlknur ÖNER, Ms Mualla DIKMEN, Miss F.Ceren DEMIR, Miss Ahsen HANGUN, Miss Dilanur YESILYURT, Mr Sungur CAN
Fırat University, ELAZIG, Turkey

Abstract

This study focuses on gender issues at the intersection of disasters, SDG, and Sendai Frameworks. Specific attention will be given to recent disasters in Turkey. Gender issues and their connection to disasters are rarely evaluated. These evaluations are usually connected to vulnerability, resiliency, and human rights. These appearances in the literature usually came forward in time. There is a strongly accumulated knowledge on both sides the SDG's side and Sendai Frameworks (related to disasters) side. However, the connection between SDG and Sendai Framework is a rare study. Gender issues gradually came forward in the frameworks. Yokohama, Hyogo, and Sendai are different in their inclusion of gender issues. This study evolves on the recent disaster experiences of Turkey. These are 2020 and onward occurrences such as COVID-19 pandemics, floods, and earthquakes (2020 earthquakes and 2023 Kahraman Maraş earthquakes and following floods). Disaster processes are difficult times and force the achievement of SDGs and Sendai Frameworks. It is necessary to find out possible reflections of gender issues, bring out equalities and inequalities, inclusion, and needs, and reveal possible solutions during experienced disaster processes.

The findings are derived from Fırat University students' COVID-19 experiences and thoughts on occupational choices and disasters. These are derived from questionnaires and focus groups. Then 11 mostly affected cities and their earthquake and flood experiences were focused on through written materials and visually recorded materials related to them and focus group interviews and field observations. They scrutinized on the base of gender issues. This analysis deepened the intersection of the Sustainable Development Goals and Sendai Frameworks. This study will be bringing forward preliminary findings. Findings revealed that the fragility and resiliency of gender groups under different disaster issues sometimes are similar and sometimes differ. However, differences in the occurrence and essence of disasters come out with multiple appearances of gender issues related to SDGs and Sendai Framework articles. These will be a preliminary evaluation of the present situation of gender groups related to recent disaster issues in Turkey.

KEYWORDS: Gender, SDGs, Sendai Frameworks, Turkey, Disasters

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Comparative Analysis of Health and Education Expenditures for Disabilities and Non-Disabilities in Indonesia Using the NTA Calculation Method

Ni Putu Mia Tarani, Achmad Kautsar
Pertamina University, Jakarta, Indonesia

NI PUTU MIA TARANI

Abstract

Demographic Dividend is a potential as well as a challenge for Indonesia in increasing economic growth where some residents who have physical limitations or people with disabilities have difficulty getting adequate facilities and jobs compared to non-disabled because they are constrained by the burden of expenses. This study aims to analyze the estimated costs of expenditure on health, education, and other consumption for individuals with disabilities and non-disabilities. Indonesia's national socio-economic survey or commonly abbreviated SUSENAS in the core section and the consumption or expenditure section in March 2021 are the data sources used in this study. The method used to estimate in this study is the National Transfer Account (NTA) calculation method. This method is used to analyze changes in the pattern of private consumption expenditures by individuals based on the age profile of the individual with the main variable used in this study is people with disabilities. The estimation results show that people with disabilities have lower private expenditure on education than non-disabled people when they enter their productive age. Meanwhile, private expenditure on health for persons with disabilities is higher than non-disabled in every age.

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THE PROBABILITY OF BEING NOT POOR BASED ON SOCIOECONOMIC STATUS, PERSONS WITH DISABILITIES, AND DEMOGRAPHY IN INDONESIA

Grace Wulandari, Achmad Kautsar
Universitas Pertamina, Jakarta, Indonesia

Abstract

Inequality is a major problem in developing countries. Inequality can be caused by several factors such as disability, socioeconomic status like poor or not poor, education and work, the other variables like demographic conditions like gender, marital status, and area of residence. This study aims to analyze the factors that can influence individuals in poverty in Indonesia. The data used National Socio-Economic Survey. The method uses logit regression with the poverty line as the dependent variable. In addition, disability, socioeconomic status, and demographic conditions are independent variables that can influence individuals. The results of this study the probability individuals with disabilities have a higher 1.8% being poor than non-disable. Individuals with a disability have some limitations in accessing such job opportunities, health, and education. In the gender category, the probability of males will get an income higher than females is around 0.2% and the result is significant. The gap in income between males and females is still happening. Inclusivity is particularly important, especially for people with disabilities, and the gender gap in income must be reduced.

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Individual Probability of Being Poor Based on Person with Disabilities and Socio-Economic Status: Using Indonesia Cases

Grace Wulandari, Achmad Kautsar
Universitas Pertamina, Jakarta, Indonesia

Abstract

Poverty is a major problem in developing countries. Several factors individual become poor are disability, socioeconomic status, education and work, the other variables like demographic conditions like gender, marital status, and area of residence. In Indonesia, the poverty rate has experienced a decline until 2019, however, it still remains relatively high compared to other developing countries. Another issue is with over than 24 million people living below the poverty line and an estimated 15% of the population living with disability. The study aims to analyze the factors can influence poverty in Indonesia, with the focus on the relationship between PWD and poverty. The study used National Socio-Economic Survey with logit regression method. Poverty line is dependent variable and disability, socioeconomic status, and demographic conditions are independent variables. The results show that PWD have probability 2.6% higher than non-disable for being poor. PWD have some limitations in accessing such job opportunities, health, and education. On the other hand, PWD with higher education has the probability of being poor lower 1.9% compare with non-disability. In the gender category, the probability of males will get an income higher than females is around 0.2% and the result is significant. The gap in income between males and females is still happening. Inclusivity is particularly important, especially for PWD, and the gender gap in income must be reduced.

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TOWARDS GENDER EQUALITY IN MALAYSIA: LEGAL AND POLICY PERSPECTIVES

Ph.D. Candidate Asmak Husin, Law Faculty Dr. Nurhafilah Musa

Universiti Kebangsaan Malaysia, Selangor, Malaysia

Abstract

Gender equality is contained in the one of the Sustainable Development Goals or SDGs. The aim of Sustainable Development Goal No. 5 is to achieve gender equality and empower all women and girls. The United Nation has laid down several targets to achieve until 2020. It is include to end all forms of discrimination against all women and girls everywhere. After more than 60 years of Independence, women in Malaysia have achieved a certain level of equality as compared to men. Women are appointed to various decision-making level either in the public or private sectors. In the Malaysian Constitution, protection of women is a concurrent matter under the Ninth Schedule whereby the federal and the state governments have legislative and executive powers to enact law and policies. The Malaysian Government, through the Ministry of Women, Family and Community Development, has established measures to elevate women in various sectors. All states in Malaysia have an executive councilor or Exco in charge of women affairs. Kelantan, one of the states in Malaysia, has also strived, for the past two decades, to put women in equal standing with the men by drafting and implementing the Kelantan Women Policy. The latest development is the proposal mooted by the Ministry of Women Affairs and Family Development on Gender Equality Bill. This bill was proposed in line with Malaysia's commitment to Convention on the Elimination of Discrimination Against Women (CEDAW). One of the proposals stated in the Bill is the establishment of the Gender Equality Commission. This paper is an attempt to discuss and analyze the efforts made by the federal and state government towards achieving gender equality in Malaysia. The paper will also address the issue on whether Malaysian women need Gender Equality Bill and whether there are other ways to achieve gender equality in Malaysia as the commitment that made by country to the 5Ps of SDGs (people, planet, prosperity, peace, and partnership).

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Ageing Population and the Perception of Sustainable Development: A case study in rural areas, Beira Baixa, Portugal

Sandra Manso[1,2], Sandra Caeiro[3,2], Sara Nunes[1], Carlos Pardo[4]
[1]Polytechnic Institute of Castelo Branco, Castelo Branco, Portugal. [2]Center for Environmental and Sustainability Research, Lisbon, Portugal. [3]Aberta University, Lisbon, Portugal. [4]National Distance Education University, Madrid, Spain

Abstract

Over the next few decades, the ageing population is expected to increase significantly, especially in rural areas. Generally, poverty is more frequent in the elderly, being even more pronounced in women. In 2015, the adoption of the Sustainable Development Goals (SDG) defined a new agenda, which will have an impact on the elderly, for example, the goals associated with poverty reduction, improved health and gender equality. The United Nations Decade of Healthy Ageing (2021–2030) has recognised the essential contribution of older population to the implementation of the 2030 Agenda for Sustainable Development (SD). The case study presented is about a region in the interior of Portugal, Beira Baixa. The region's population represents less than 1% of the resident population of Portugal. This region holds the country's 3rd and 4th largest municipalities in terms of area. That translates as one of the lowest populational densities (almost 18 inhabitant/km2). Out of the six municipalities, five have a rural profile and have strong structural weaknesses, that are reflected in the demographic and socioeconomical indicators (eg. namely in Oleiros there are about 780 elders per 100 youth, which is the highest index in the country). The main objective of this study is to reflect on the perception the elderly have about SD, based on the results from a questionnaire applied to a representative sample of the population of Beira Baixa, Portugal. This questionnaire had as its goal to know the perceptions, the knowledge and attitudes of this population about SD and in what areas there is a need to act for its implementation in the scope of the region where they reside. The results allowed to verify that almost 3/4 of the ageing respondents have already heard of the term SD, the media being the largest contributor to this. When asked about the evaluation of SD in the region, referring to the four dimensions, and according to a traffic light, the majority considered the environmental dimension "green", and the economic, social and governance dimensions "yellow". About 70% of the elderly consider that their quality of life "is the same" or "worse" as in previous years. Regarding public policy, the respondents highlight the social area. When asked about what is important to evaluate in their region's SD and, specifically which of the SDGs are more important to their region, the main ones are Quality Education (SDG 4) and No Poverty (SDG 1). In the results analysis, statistical tests were carried out that allowed the detection of statistically significant differences for gender. A wide spread of SD among the elderly is important because they are also essential for achieving the SDGs. That is, creating the same opportunities to ensure that ageing population fully develop their human potential, but also fully and effectively enjoy their human rights.

This abstract is especially related to SDG10 Target: 10.2. The pace of population ageing is much faster than in the past. In the Decade of Healthy Ageing, the elderly are fundamental "pieces" of the SDGs.

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THE REALITY OF SEXUAL VIOLENCE AGAINST CHILDREN IN INDONESIA FROM THE PERSPECTIVE OF LAW AND HUMAN RIGHTS

Dr. Adya Paramita Prabandari, Dr. Aditya Yuli Sulistyawan, Mr. Solechan Solechan
Faculty of Law, Universitas Diponegoro, Semarang, Indonesia

DR. ADYA PARAMITA PRABANDARI

DR. ADITYA YULI SULISTYAWAN

MR. SOLECHAN SOLECHAN

Abstract

The reality of sexual violence against children in Indonesia is increasingly concerning. The Ministry of Women's Empowerment and Child Protection (KemenPPPA) even stated that currently, Indonesia is in an emergency for sexual violence against children. According to KemenPPPA records, cases of sexual violence against children reached 9,588 cases in 2022. This number has increased from the previous year, namely 4,162 cases. The weak and helpless position of children is the main cause of sexual violence against children in Indonesia. Therefore, children must receive legal protection for their human rights, such as children's rights.

In this discussion, the approach method used is a doctrinal approach with secondary data collection methods through library research. This paper will raise the discussion of: how is the reality of sexual violence against children in Indonesia today? And how about sexual violence against children from the perspective of law and human rights?

Legal protection for children from sexual violence has been regulated in: Law Number 23 of 2002 concerning Child Protection, Law Number 35 of 2014 concerning Amendments to Law Number 23 of 2002 concerning Child Protection, and Law Number 1 of 2014 2016 concerning the Second Amendment to Law Number 23 of 2002 concerning Child Protection. Meanwhile, from a human rights perspective, Article 28B paragraph (2) of the 1945 Constitution of the Republic of Indonesia states that every child has the right to survival, growth, and development as well as protection from violence and discrimination. Child protection is all activities to guarantee and protect children and their rights so that they can live, grow, develop, and participate optimally in accordance with human dignity and values, and receive protection from violence and discrimination.

The author concludes that all acts of violence against children are acts that violate human rights, namely children's rights as specified in the law. The government and all elements of society must commit together to combat sexual violence against children by increasing awareness of the importance of upholding human rights for children. This article relates to the goals and targets of the Sustainable Development Goals (SDGs) at point 16.2, which is to stop cruel treatment, exploitation, trafficking, and all forms of violence and torture against children. This paper makes a scientific contribution according to the conference's theme, namely "social foundations of sustainability: gender, inclusivity, and human rights" and thus relates to the 5Ps specifically to people, prosperity, and peace.

Keywords: sexual violence; children; human rights.

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UNDERSTANDING ONE HEALTH APPROACH FROM LEGAL FEMINISM PERSPECTIVE (is it relevant???)

Ms Aisyah Wardatul Jannah[1], Ms Rizka Nurliyantika[2], Ms Ayu Citra Santyaningtyas[3]
[1]Universitas Islam Negeri Mataram, Mataram, Indonesia. [2]Sriwijaya University, Palembang, Indonesia. [3]University of Jember, Jember, Indonesia

MS AISYAH WARDATUL JANNAH

MS RIZKA NURLIYANTIKA

Abstract

Legal feminism attends through a dialogue rather than just a method to be involved in the decision making, not far as the One Health approach it is also has the outstanding in gaining the best approaches to form the provision of global health in every aspect. Lessons from Covid-19 and other zoonotic disease, One Health then presence through the collaboration of OHHLEP by several meeting one of which by implementing new hard law in the international Health instrument. Therefore, feminism concept also argues that they should be included in considering many aspects of the gender perspectives should be taken into account in the regulatory system. the aims of this study to understanding the impact of Covid-19 with concern to the women's health issues and collecting the list of failure under International Health Regulations regime enforcement during the Covid-19 situations, therefore it will set an examples of China case that provide the late announcement to the WHO, therefore this delay have causing the violation of international law and human rights law, the study will also examine the different treatment that countries in the world to faces the situation. The method of this research using normative juridical legal research by conducting library data and by examining existing regulation concerning gender bias and the rights of women from the international convention. The result set an example from covid-19 impact to women disproportionately, mostly faces the gender inequities through unpaid care work, losses of jobs, lose a chance in getting health care access particularly for those who are pregnant and likely two times in high risk of the disease, and mostly while the restriction established women tend to receive gender-based violence and increasing number of child marriage. Therefore, the only response that can consider are through the feminism approach in recognizing the matters together with the solution by involved in the policy making with the stand to the rights based on one health approach.

Full Papers

Women's Influence in sustainability performance in Higher Education Institutions: the case of Universidad Pontificia Bolivariana (Medellin, Colombia)

Ana Elena Builes-Vélez[1], Juliana Restrepo Jaramillo[2], Lina María Escobar-Ocampo[3] and Ana María Osorio-Florez[4]

[1]ana.builes@upb.edu.co
[2]juliana.restrepo@upb.edu.co
[3]linam.escobar@upb.edu.co
[4]ana.osoriof@upb.edu.co

Abstract. Despite the growing number of studies on women as sustainable development leaders, there is still little empirical evidence on how women contribute to Higher Education Institutions' sustainable development performance. This paper aims to address this gap by developing a qualitative case study in one Colombian Higher Education Institution, Universidad Pontificia Bolivariana (UPB) in Medellín, which is characterized by the presence of women in research groups, teaching staff, and leadership positions, and the review of scientific papers written by women and research projects headed by women at UPB in the last five years. Therefore, the research aims to analyse how female leadership facilitates the transition toward sustainability in Higher Education Institutions. Findings suggest that female leadership contributes to the promotion and implementation of environmental and social practices through several characteristics intrinsic to their nature, such as the ability to emphasize and understand, and the predisposition to share and collaborate. Additionally, women heading sustainability courses, research projects and boards, show similar skills and trials such as: thinking systematically, managing complexity and an inclusive approach to leadership in Higher Education Institutions. This study shows that women's representation in research projects, teaching staff, and management sustainability boards has a positive impact on the university's sustainability performance.

Keywords: Sustainability Performance; Higher Education Institutions; Female Leadership; SDG 5

1. Introduction

Higher Education Institutions (HEIs) have been undertaking considerable efforts to embed sustainability into their system, in a world in which education and social scenarios are characterized by continuous and rapid changes, Higher Education Institutions are called to act rapidly and consciously. In Latin America, HEIs are therefore facing significant changes, which require the definition of policies and strategies strongly oriented towards sustainable development, becoming fundamental for long-term success and competitiveness. In this perspective, female leadership plays a key role. Over time, women have proven the ability to successfully manage the challenges imposed by social dynamics and environmental change (Pierli, et al., 2022) (Showunmi, 2021).

On the other hand, *Gender Equality* is the fifth goal of the *2030 Agenda for Sustainable Development* from United Nations (UN), published by its Department of Economic and Social Affairs in 2015. Although notable steps have been taken on the road to women's rights, full gender equality today is still a goal to be achieved. Some sectors, like education, have been working hard on improving in this area, but still there is a lot of work to be done, especially in administrative roles and research leadership. Higher education institutions (HEIs) are advocates of gender equality for society, as stated by United Nations Educational, Scientific and Cultural organization (UNESCO) in 2022. But how much is this reflected in their role as employers?

Gender Equality in higher education and research is essential to women's rights and social justice, and to provide all bright minds with the opportunity to contribute to solving the world's most pressing challenges and drive progress for humanity (Galán-Muros, et al., 2023), but there is still work to be done to achieve gender parity.

According to UNESCO´s Institute for Statistics (2020), the average percentage of women researchers in Latin America and the Caribbean in 2020 was 44,2%, a bit higher than the worldwide percentage of 33,3%. The last registered percentage of women researchers for Latin America reveals that the three countries with the highest percentages are Guatemala 62,8%, Venezuela 55,3%, and Argentina 53,5%. The countries with the lowest percentages are Perú 31,2%, Mexico 32,3%, and Chile 34,8%. According

to the Sistema Nacional de Información de la Educación Superior (SNIES) in 2021, 39% of registered researchers were women. However, the problems that UNESCO pointed out in 2015 persist today:

> In general, women constitute a minority in the world of research. In addition, they tend to have more restricted access to funding than men and are less represented in prestigious universities and among tenured professors, putting them at a further disadvantage when it comes to high-impact publications (UNESCO, 2015).

In an online article, United Nations (2023) states that for the specific case of Colombia, only 54.4% of women obtain higher education degrees. Also, they are 20% less likely to get a job, and have an approximate wage gap of 17.5% compared to men in cities; the rural difference is even bigger. Likewise, they dedicate double their time to domestic and care work.

Regarding female leadership in Colombia, there are also challenges. According to Asociación Nacional de Empresarios de Colombia (ANDI), in 2023 only 33% of board members are women. Also, official government statistics in the Observatorio Colombiano de las Mujeres (2018) show that by 2018 only 21.4% of companies were managed by women. This trend is counteracted today by a national policy from 2022, by the Consejo Nacional de Política Económica y Social (CONPES) o support women's entrepreneurship, which, however, does not match the transformation potential of already consolidated companies.

Considering the global situation of women, numerous efforts have been made for gender equality by the international community through commitments such as the UNESCO *Platform for Action* (1995) and Sustainable Development Goals (UN, 2015). But in higher education, gender issues have not been on the top list of HEIs priorities. UNESCO developed the *Recommendation on Science and Scientific Researchers* where they promote the recruitment of women in science (UNESCO, 2017) but still today women remain underrepresented at senior levels in academia.

This means there are still actions to be taken. According to UNESCO – IESAC (2022), in Latin America and the Caribbean universities, the percentage of women principals is only 18% the same source identifies similar representation problems in other levels of university government: “despite the fact that the percentage of girls enrolling in universities is higher than that of boys, the teaching staff, positions of responsibility and rectorates continue to be in the hands of men”. In Colombia there are only 18 registered women principals among the 141 universities in 2023, by the Sistema Nacional de Información para la Educación Superior en Colombia (SNIES).

This could be a sign that the gender stereotypes that limit women's access to these levels of decision persist.

2. Literature Review

It is important to begin this literature review with the definition of sustainability and sustainable development. The Brundtland Commission's Report states that sustainable development “meets the needs of the present without compromising the ability of future generations to meet their needs” (Brundtland, G.H. 1987). Sustainable development or sustainability in strategy is often used interchangeably with Corporate Social Responsibility (CSR). But there have been complexities when applying the term to HEIs frameworks and practices because corporate sustainability is also argued for economic sustainability, in addition to social and environmental sustainability. However, Elkington (2018) declares that the success or failure of sustainability goals must be measured by the overall well-being of people and the planet, stressing the importance of social and environmental outcomes over the economic outcome. That is why, we use the term sustainability to refer to environmental, social, and governance (ESG) outcomes.

2.1. SDG 5: Achieve gender equality and empower all women and girls

The Global Agenda for Sustainable Development was declared as a tool and a plan of action for the people, the planet, and prosperity. The goals and targets are ambitious and integrate a transformational vision to reassure governments to compromise to build a safer and greener world. SDG 5 is an aspiring approach to reduce gaps between male and female and enable women and girls to live their lives to the fullest. It proposes a multidimensional definition of, and comprehensive set of indicators for, tracking gender equality and women's empowerment, complemented with targets and indicators across other goals. SDG 5 seeks to close gaps and proposes several aspects to promote gender equity and equality, including ending all forms of discrimination and violence, recognizing unpaid care and domestic care and, -the

target that directly affects our research-, ensure women´s full and effective participation and equal opportunities for leadership (UN, 2015).

The literature outlines that there may be different organizational aspects and factors that influence the SDGs disclosure in organizations, especially in Higher Education Institutions, such as economic performance, institutional factors, organization size, and the portion of women on institutional boards (Lucchese, et al., 2022). SDG 5 gives inputs to gender diversity issues and gaps, to close this, UN calls for organizations and universities to conduct research and projects that promote gender diversity, equity, and equality inside the institutions, which will empower women and girls. Furthermore, since HEIs are called to lead social and cultural transformation in societies, "women are seen as -change actors- to guide the evolution of organization strategy, business models and reporting systems towards sustainable development values" (Lucchese, et al., 2022, p. 4).

Different studies (Rosati, Diniz & Galvão, 2019) (Cicchiello & Fellegara, 2021) agree that an organization board with a higher portion of women is more likely to articulate and work towards the achievement of SDGs, since female directors bring a new perspective to the decision-making body more aimed at energy efficiency and social welfare and climate change policies. Additionally, they argue that board diversity benefits organizations concerning SDG reporting. In Colombia as ANDI, UNESCO, and UN Women report, a high percentage of HEIs decision boards are led by women, in private and public institutions, this shows that organizations, especially Universities in Colombia, have been making efforts to close gender gaps in administrative boards.

According to (Shinbrot, et al., 2019) the Rio Earth Summit in 1992 recognized the fundamental role that women play in environmental management and sustainable development. However, there have been small tangible changes and progress toward empowering women and equality to action - based policies, this is, a lot has been written but not too much has been done regarding gender equity and equality. Additionally, researchers and scholars recognize that women can have similar, even better, contributions as leaders in sustainable development issues since women are perceived to have uniquely grounded perspectives, novel approaches, and places of authority, as supported by ecofeminism and political feminist ecology.

2.2. Gender differences in academic research

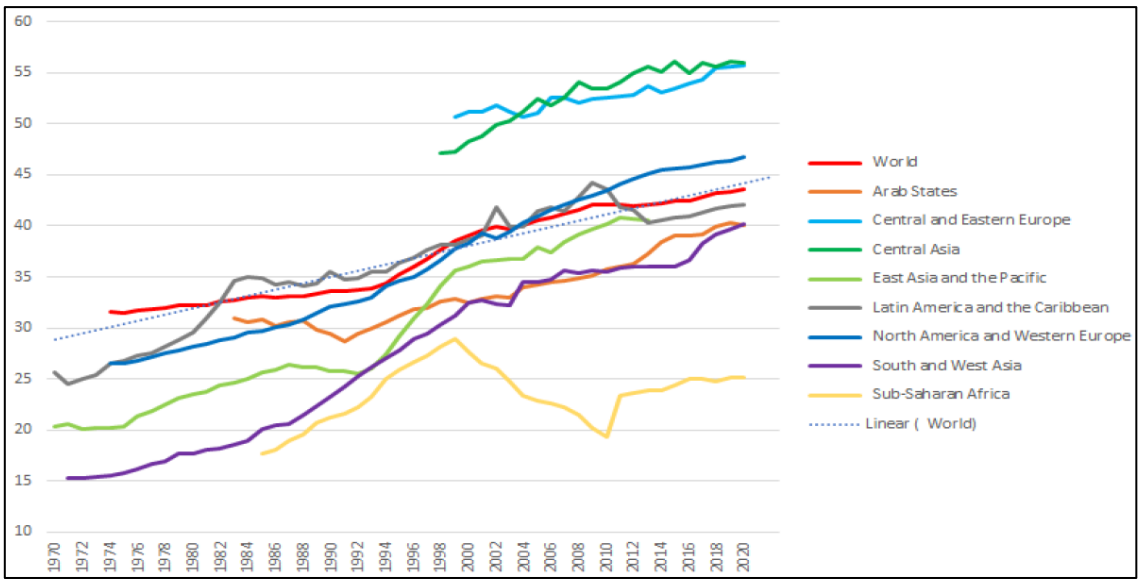
The gender gap in academia around the world is starting to close, as UNESCO – IESALC (2023) indicates in the article "Effective policy approaches to bridge the gender gap in academia", gender inequality in scientific research has been extensively studied in terms of representation, productivity, influence, funding applications, and hiring (Abramo, et al., 2009) (Rørstad & Aksnes, 2015) (Sotudeh, et al., 2018) (Van Arensbergen, et al., 2012) (Van den Besselaar & Sandström, 2017). Gender inequality might lead to the lower representativeness of females in academia and may also have a negative effect on publication activity. Scholarly publications are a common proxy of an individual's research contributions, which is a major factor in determining success when researchers compete for research grants (Doyle, et al., 2015) (Kaltman, et al., 2014) or apply for promotion or tenure (Weisshaar, 2017).

Some studies (Grogan, 2019) (Huang, et al., 2020) have focused on gender differences in academic research, for example, in productivity and impact. Such differences between female and male researchers can be partially explained by the dissimilarity in the length of a research career and dropout rates (Huang, et al., 2020). Dropout rates are higher in women, especially in science, technology, engineering, and mathematics -STEM-, called "the leaky pipeline" phenomenon (Grogan, 2019). It should be noted that academia is not a unified culture, where every research discipline has its own characteristics regarding gender differences in, for example, publications and citations (Grogan, 2019), international collaboration (Aksnes, et al., 2019), and between countries (Larivière, et al., 2013). Women are significantly less likely to be credited with authorship than men (Ross, et al., 2022). Female researchers receive fewer citations in their papers than male researchers (Chatterjee & Werner, 2021) even when publishing in journals with a higher impact factor (Ghiasi, et al., 2018). Publications have fewer citations when the name of the author is "more" feminine (Zhang et al., 2023) and when the publication has a female first or last authorship (Chatterjee & Werner, 2021).

UNESCO - IESALC (2020) reveals evidence of female representation in academia worldwide and states that in regions like Latin America, gender balance seems to be growing. According to the study, public universities in nine countries in Latin America are led by females, this is like the United States and

European Union (See figure 1). This indicates an important improvement in gender equity and equality, but still, there is work to be done regarding senior research positions and teaching positions in private universities.

Figure 37: Percentage of female tertiary education teachers, per world region. Source: UNESCO, (2023)



Female researchers tend to collaborate when they publish sustainability articles, but their levels of international collaboration among women can be boosted (particularly in Eastern Europe). This could extend their opportunities and broaden their horizons and publication impact, especially after the COVID-19 pandemic, which reduced international collaboration among female researchers.

2.5 Female leadership in Sustainability and Climate Change Crises

To achieve sustainability, companies and institutions need distinguished figures of leadership, since leaders guide towards sustainability with their actions, as they know how to select and group people to achieve any task according to their skills, abilities, and gifts. In this sense, leadership can be considered as social influence process, where leaders seek participation and collaboration from different people to achieve a common goal, in our context, Sustainable Development Goals. According to (Pierli, et al., 2022)

> […] women play a key role as promoters of a sustainability-focused approach. Throughout time, women have demonstrated their value and abilities in addressing the challenges imposed by social dynamics and environmental changes. (Pierli, et al., 2022, p. 2)

Also, the Agenda 21, declares that women have a vital role in sustainability management and leadership, since women have shown to have important characteristics and competencies that drive the achievement of SDGs, such as innovative and creative perspective, leadership attitude, social awareness, and a good ability to identify opportunities.

Effective leaders develop a sense of purpose by pursuing goals that align with their personal values and advance the collective good. This allows them to look beyond the status quo to what is possible and gives them a compelling reason to act despite personal fears and insecurities. Such leaders are seen as authentic and trustworthy because they are willing to take risks in the service of shared goals. By connecting others to a larger purpose, they inspire commitment, boost resolve, and help colleagues find deeper meaning in their work.

Integrating leadership into one's core identity is particularly challenging for women, who must establish credibility in a culture that is deeply conflicted about whether, when, and how they should exercise authority. Practices that equate leadership with behaviours considered more common in men suggest that women are simply not cut out to be leaders. Moreover, the human tendency to gravitate to people like oneself leads powerful men to sponsor and advocate for other men when leadership

opportunities arise. Women's leadership potential sometimes shows in less conventional ways -being responsive to stakeholders, for example, rather than boldly asserting a point of view- and sometimes it takes powerful women to recognize that potential. But powerful women are scarce.

Mahdawi (2022) in her book Strong Female Lead: Lessons from Women in Power, argues that real leadership is not about being the loudest voice in the room, it is about being secure enough in yourself to pass the mic to others. Real leadership is not about taking up space, it is about knowing when to yield it, and recognises that women tend to have a major ability to yield it.

2.4. Women in sustainability performance

Sustainability performance in HEI can be measured using different methodologies, such as the Global Reporting Initiative (GRI). The preparation of the sustainability report is voluntary, as well as the publication on the GRI website, however on the official site, companies are invited to compare themselves in aspects such as organizational performance or between sectors, likewise providing the possibility of making comparative studies and/or performance assessments on sustainability issues. For HEIs, Lozano (2011) indicates that the best option is the Global Reporting Initiative -GRI- methodology, although it was not designed for higher education institutions, covers most of the activities except for research and teaching.

Before referring to the impact of women on sustainability performance in HEIs, there is a need to make an approach to the definition of a Sustainable University and the implication of that definition:

> […] a Sustainable University is defined as a higher education institution, as a whole or a part, that tackles, involves, and promotes, at a regional or global level, the mitigation of the negative environmental aspects, economic, social, and health-related, generated by the use of resources for the purpose of teaching, researching, government, extension, and work in society in ways that it helps society make its transition towards a sustainable way of life. (Gómez & Martinez, 2017, p.1)

The process of transforming a University into a Sustainable University starts by structuring a committee for sustainable issues inside the institution, a group of people with influence, decision-making capacity, and leadership skills, and finally people who have a high sensitivity to environmental, social, and economic issues. This group will establish the objectives, goals, and sustainability policies for the institution. It is very important, in order to accomplish the goals and objectives drawn, to permeate all aspects of the institution with the policy of sustainability, this is: making sure that all aspects of Sustainable Development and SDGs are included in institutional levels: curricular, research, purchases, etc. and that this policy impacts all stakeholders: students, teachers, administrative staff and alumni.

Ishwar Khatri examines the board's gender diversity and sustainability performance, in a Nordic context. In the article, the author mentions that "more women on boards are associated with higher sustainability performance" (Khatri, 2023, p. 1497) The gender-social role theory suggests that women are more sensitive to environmental issues and more likely to reflect on social well-being, and ethical issues in society (Liu, 2018 in Khatri, 2023). Studies e.g. (Nadeem, et al., 2020) (Liu, 2018), found evidence of women's positive impact on administrative boards that have an equal gender composition and better environmental performance, also "voluntary climate change disclosure increases with women's percentage on boards" (Khatri, 2023, p. 1497). Studies have demonstrated that a higher percentage of women directors in the board of directors strengthens the adoption of Sustainable Development Goals' practices and external assurance of sustainability reporting (Cicchiello, et al., 2021)

2.5. Barriers to women leaders in Sustainability

The reviewed literature addresses the barriers from institutional, social, and cultural perspectives. Gender barriers are defined and preconceived by society and culture and have always framed women and men in certain duties and with different capabilities and competencies. In this sense, since leadership qualities such as assertiveness and confidence have been seen as masculine qualities, women tend to be less ignored and belittled when they are successful leaders, especially in male-dominated roles. According to (Shinbrot, et al., 2019), women who are professionally successful and in leading positions are seen as cold-hearted and with manly manners, and additionally, they are seen as an economic threat. "Women leaders have to walk a fine line of taking on what a patriarchal society defines as traditionally masculine traits while maintaining communistic feminine traits to avoid prejudice" (Garcia-Retamero & López-Zafra, 2006 in Shinbrot et al, 2019). Imaginaries and descriptions of leadership tend to but stronger skills

as masculine, while female skills are framed as creative and sensitive, which becomes an issue for women who try to enrol in administrative boards and in any leadership position, in diverse types of institutions, since sensitivity, creativity, and empathy are often seen as a weakness for business and academic roles.

Sufficient research has been made to identify differences between women and men as leaders e.g. (Eagly & Carli, 2004), (Ryan & Hassam, 2009). Results have shown that women have greater skills for collaborative work, focus on conflict resolution, and are much more empathetic, skills that allow, among other things, a better understanding of sustainability-related issues in institutions; while men tend to have a more aggressive oriented negotiation and leadership skills, and a task-oriented leadership. Nevertheless, some of these studies continue to believe that leadership skills are masculine and, in our opinion, fail to recognize the contextual, cultural, and social factors that are determinants when leading institutions, and that may, in some cases such as Colombia's, require less aggressive and more empathetic skills for the resolution of social, economic and environmental problems within and outside the institution.

3. Methodology

The research method for this study is a mixed-method. Qualitative and quantitative data are included to answer the research questions. We administered a questionnaire with open-ended questions in one Colombian Higher Education Institution: Universidad Pontificia Bolivariana (UPB) in Medellín, characterized by women's presence in research groups, teaching staff, and leadership positions. The triangulation of data needs multiple data collection tools to provide depth to studying phenomena from various perspectives. The adoption of different collection techniques is strongly encouraged for the reliability of the information, limiting the distortions, and ensuring a better study quality.

3.1. Questionnaire: The questionnaire was addressed to women who hold a leadership position in different areas and departments of the institution.

3.2. Data Collection and Analysis form publications, research projects and sustainability courses: Scientific papers written by women, research projects led by women at UPB in the last five years and different sustainability courses guided by women teachers were reviewed. The results were analysed through descriptive statistics and were then triangulated with secondary data.

4. Results and Discussion

Despite the growing number of studies on women as sustainable development leaders, there is still little empirical evidence on how women contribute to institutions sustainability performance, findings suggest that female leadership contributes to the promotion and implementation of environmental and social practices through several characteristics intrinsic to their nature, such as the ability to emphasize and comprehend and the predisposition to sharing and collaboration. Additionally, women heading sustainability courses, research projects, and boards exhibit similar skills and trials, such as: thinking systematically, managing complexity, and inclusive approach to leadership in HEI. This study shows that women's representation in research projects, teaching staff, and management sustainability boards has a positive impact on the Universidad Pontificia Bolivariana's sustainability performance.

4.1. Gender composition in sustainability research at Universidad Pontificia Bolivariana

UNESCO recognizes that:

> […] science with its remarkable breakthroughs can facilitate access to and improve the quality of basic services – from health, water, and food, to education, cultural life, and information – drastically reducing inequalities within and across countries. It can help address current and future challenges such as climate change and health emergencies. (UNESCO, 2017, p. 1)

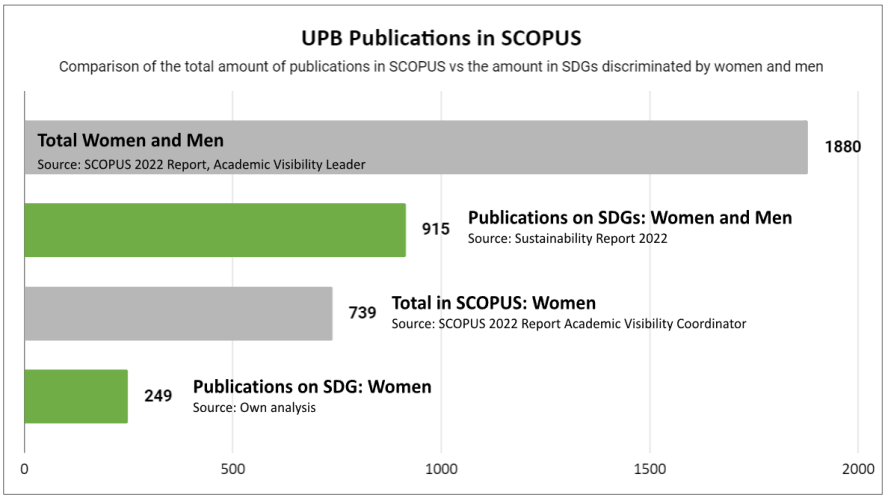
Making this possible in HEIs like UPB, requires a paradigm change in basic assumptions: justice, inclusion, and human rights must become the cornerstone of the science ecosystem. With the designation of a woman as vice-rector for research, the university has started on the road to a much more inclusive research transformation. Regarding sustainability research at the university, we found some interesting information concerning the publications, research projects, and courses made in the last few years.

This section compares the research and teaching related to the SDGs, carried out by women and men at the UPB from various perspectives: publications in SCOPUS, documents, articles, book chapters,

working papers and books found on Google Scholar, projects registered at the University Research Centre, and guidance in sustainability courses in various levels of training. Each one of these sources will be reviewed next.

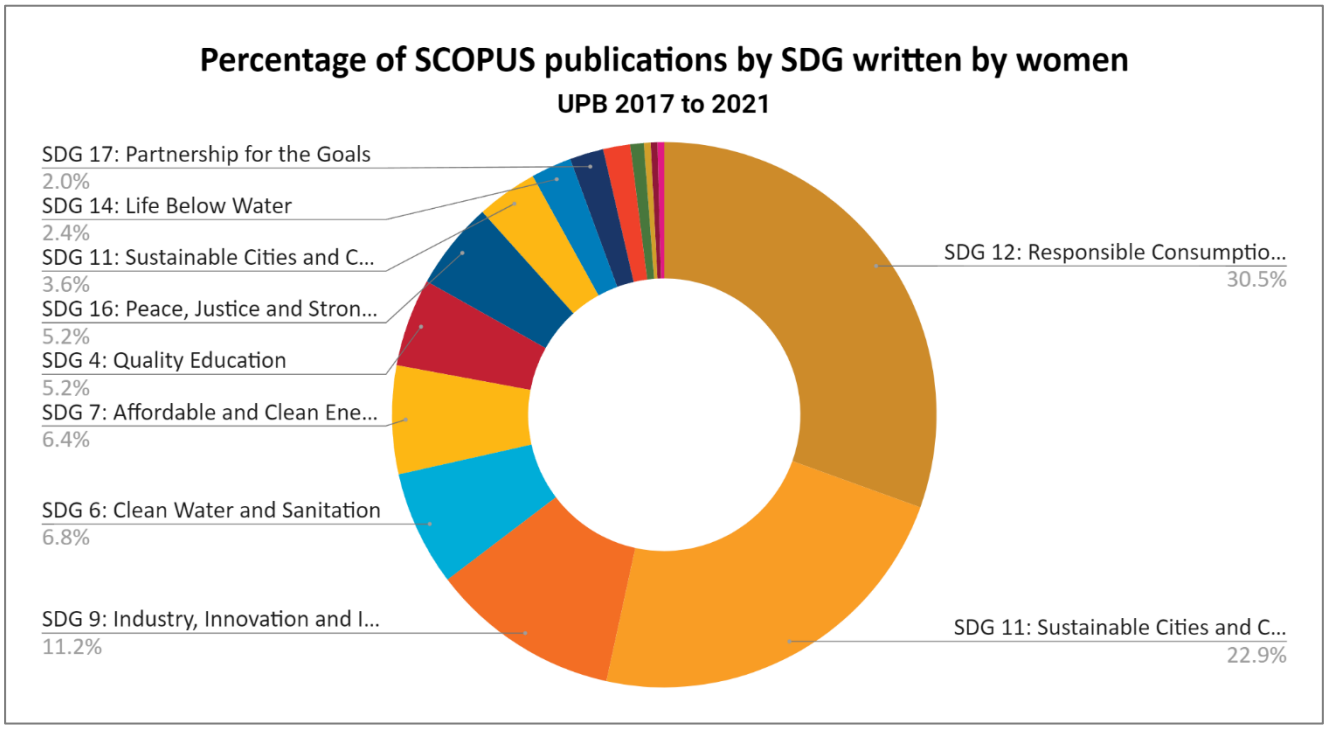
4.1.1. UPB Publications in Scopus: a total of 1880 documents -papers and conference proceedings indexed in Scopus- published between 2017 to 2021 were reviewed. From those, 915 products address issues related to SDGs from both women and men authors, therefore 48,7% of total documents. Of these 915 products, 249 have
been written by women, this is 33,7%. (See figure 2).

Figure 38: UPB Publication in SCOPUS 2017 – 2022. Source: UPB SCOPUS Report 2022



Of these 249 documents, the three SDGs to which most contributions are made are SDG 12 *Responsible Consumption and Production*, with 76 documents, equivalent to 30.5%. SDG 3: *Good Health and Well-being* with 57 documents, constitute 22.9% and SDG 9 with 28 publications correspond to 11.2%. (See figure 3).

Figure 39 Percentage of SCOPUS publications by SDG written by women. Source: UPB SCOPUS Report 2022



As mentioned in the UPB Sustainability Report (2022), the university has prioritized the following SDGs: 3, 4, 6, 7, 9, 13, 16, and 17. This means that 40% of the production, corresponding to SDGs 12 and 9 is not within the university's purpose. In contrast, SDG 13, prioritized by the UPB, reaches only 2 publications, corresponding to 0.8% of production. (See figure 4).

Figure 40: Relation between publications in SCOPUS and SDGs prioritized by UPB.

Source: UPB SCOUPS report and Sustainability Report

Prioritized and not prioritized production in SDGs at UPB (SCOPUS)

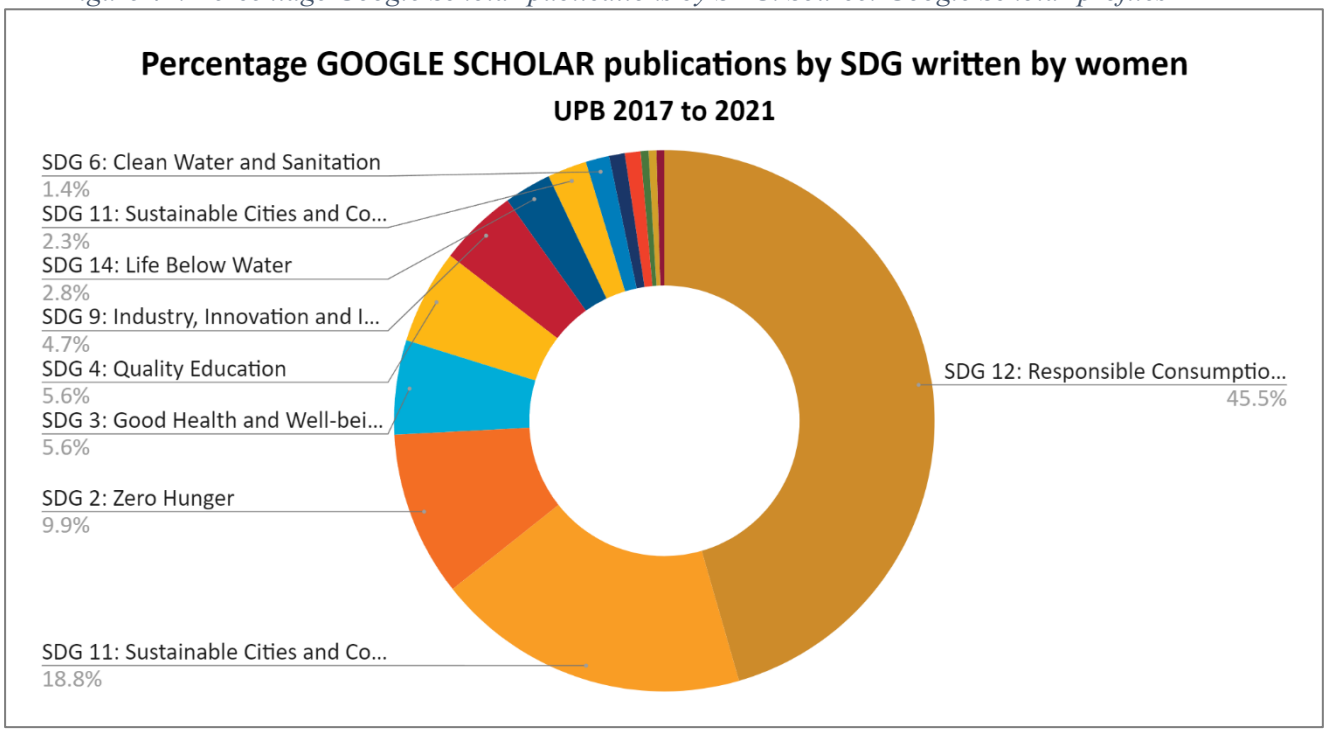
	Number of articles	Percentage
Articles on prioritized SDGs	151	61
Articles on NON prioritized SDGs	98	39

Detail of ODS with the highest number of articles	Number of articles	Prioritized
SDG 12: Responsible consumption and production	76	**NO**
SDG 3: Good Health and Well-being	57	YES
SDG 9: Industry, Innovation and Infraestructure	28	**NO**
SDG 6: Clean Water and Sanitation	17	YES
SDG 7:Affordable and Clean Energy	16	YES

Although women are not the most frequent publishers at UPB, according to the analysis made in this paper, we recognize that the percentage of women who have published on topics related to the SDGs and sustainability is significant. In addition, it is important to clarify that the analysis was conducted with the main authors of the publications and, that said, it is possible that some publications whose main authors are men, have female collaboration, which would increase the percentage of women who publish topics related to sustainability, sustainable development and SDGs.

4.1.2. UPB Publications in Google Scholar: to track the publications of UPB researchers in Google Scholar, the female authors of documents registered in SCOPUS were used as a reference. Based on this information, articles, working papers, books or book chapters linked to the SDGs of their authorship were identified. As a result, 213 documents were found. Among these, the most addressed SDGs were: SDG 12: *Responsible Consumption and Production* with 97 documents, corresponding to 46%; SDG 11: *Sustainable Cities and Communities* with 57 publications which add up to 19% and SDG 2: *Zero Hunger* with 21 documents equivalent to 9.9%. (See figure 5).

Figure 41: Percentage Google Scholar publications by SDG. Source: Google Scholar profiles



Similarly, to the findings in SCOPUS production, none of the SDGs with the highest production correspond to the SDGs prioritized by the *University Sustainability Report* (2002). As seen in the graphic below, 79% of the reviewed products belong to non-prioritized SDGs. (See figure 6).

Figure 42: Prioritized and not prioritized production in SDGs at UPB. Source: Google Scholar

Prioritized and not prioritized production in SDGs at UPB (GOOGLE SCHOLAR)

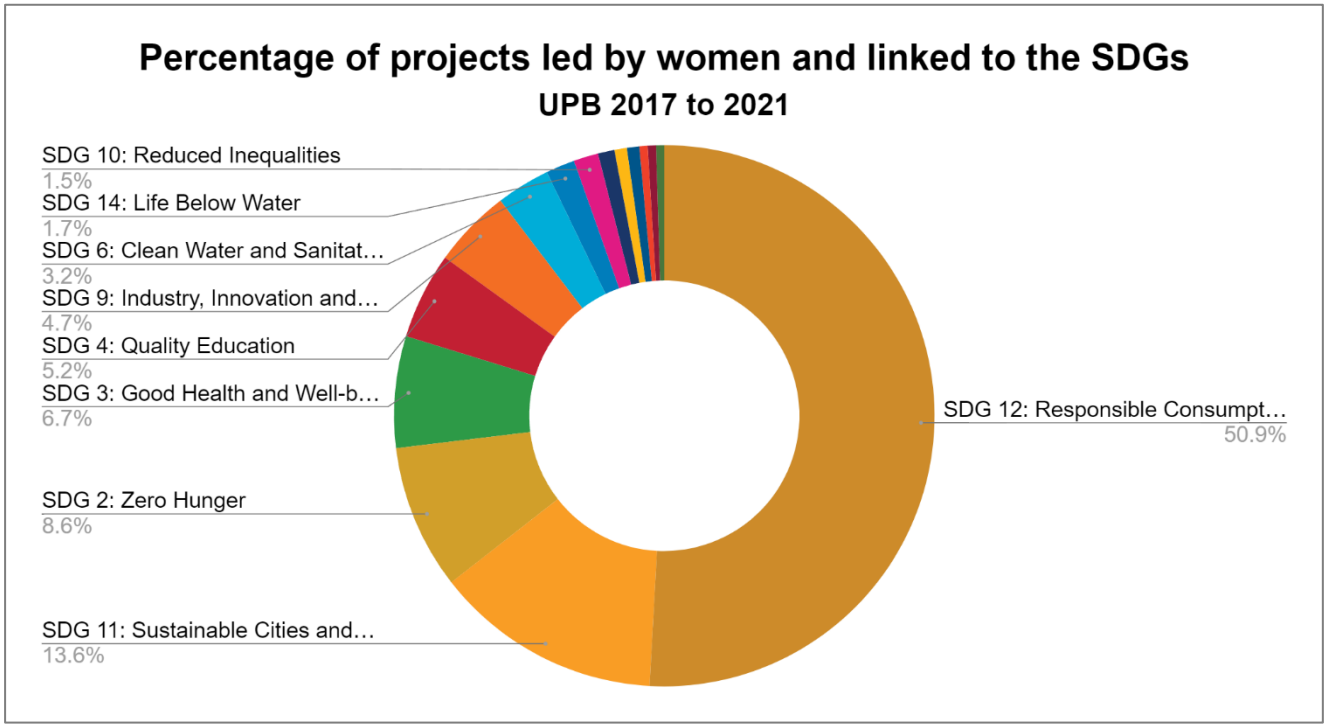
	Number of articles	Percentage
Articles on prioritized SDGs	44	21
Articles on NON prioritized SDGs	169	79

Detail of ODS with the highest number of articles	Number of articles	Prioritized
SDG 12: Responsible consumption and production	97	**NO**
SDG 11: Sustainable Cities and Communities	57	**NO**
SDG 2: Zero Hunger	21	**NO**
SDG 4: Quality Education	12	YES
SDG 3: Good Health and Well-being	12	YES

*4.1.3. Projects registered at the University Research Center: Centro de Investigación para el Desarrollo y la Innovación (CIDI): b*etween 2017 and 2022, 1200 research projects were filed, from these, 405 are related to SDG and led by women, this is equivalent to 33.75%. Inside these projects, the biggest percentage corresponds to 50,9% *SDG 12: Responsible Consumption and Production* (206 projects), 13,6% SDG 11: *Sustainable Cities and Communities* (55 projects), 8,6% *SDG 2: Zero Hunger* (35 projects). The first 3 SDGs mentioned are not prioritized by the University.

There is a lack of projects related to SDG 5, this may be the result of the University's internal policies, i.e., the institution's prioritization of the SDGs. Consequently, research related to SDGs and Sustainable Development at the university has revolved around sustainable and cleaner production; sustainable urban and rural development; health and wellness; and finally, cleaner energy. One of the most important findings is that women are leading research projects in areas that have been dominated and considered man issues, such as, production, engineering and urban development, which shows an important transformation in the roles of women in research within the university. These women researchers are not only leading the projects, but they are bringing all the knowledge to the classroom and are being role models for female students who decide to take paths in disciplines that men have dominated for years. (See figure 7).

Figure 43: Percentage of projects led by women and linked to the SDGs. Source: CIDI 2022



4.1.4. Sustainability courses lead by women at UPB: The University offers a series of courses that are focused on Education for Sustainability (ESD) and Sustainable Learning Education (SLE). In a research project conducted by three (3) HEIs, we analysed eight (8) Educational Project of different programs at the university and found very important information regarding what UPB has been doing to implement ESD and SLE in it is curriculum in all the university´s programmes.

According to the Academic Vice-Rectory office, sixteen (16) out of twenty-six (26) sustainability courses are led by women, up to 62%, which indicates a strong presence of female teachers in sustainable development and sustainability in general courses. As the literature reviewed, women are more creative, empathic and tend to collaborate and co-create more, these abilities are important when teaching and learning for sustainable development and sustainability. Interdisciplinary, collaborative and participatory work in the classroom are different strategies for the teachers to fulfil the demands of the curricula and ensure that all three aspects, ecological, economic and social, of a holistic view of sustainable development are integrated in the teaching. The interviews with teachers, showed us that women are more likely to use these strategies in their courses, which, according to ESD and SLE theory improves the competencies that students need to think in a more sustainable and responsible way. (See figure 8).

Figure 44: Women´s leadership in UPB Sustainability courses.
Source: UPB Academic Vice-Rectory

Women's leadership in UPB sustainability courses

	Number	Percentage
Courses with "sustainability" in their title	26	100
Number of courses led by women	16	62
Total groups of all courses	82	100
Groups of the courses led by women	38	46

4.2. Vision of the UPB women working in sustainability

The following results correspond to a virtual questionnaire sent to fifty female researchers and/or administrative staff of UPB whose work is related to sustainability, between August 2022 and May 2023. From the 20 responses collected; one (1) is from Economic Sciences, three (3) from Social Sciences, four (4) from Environmental Humanities, and twelve (12) from STEM. All teachers with research work, and in addition, six (6) are in charge of administrative functions related to the subject.

When asked about how they would define sustainability in two paragraphs or less, the answers obtained were mainly related to the rational use of resources, considering the future consequences of their exploitation, and the management of these resources in a systemic way; considering social, economic, environmental and cultural aspects; for the short, medium and long term. For some of the interviewees, not only the preservation of the environment is important but also to protect cultural, intellectual, and emotional capital for future generations. Additionally, there is the need to change consumption habits and behaviours and the way in which we relate to the environment in our daily lives and to produce new visions for the regeneration of the environment and austerity in consumption. In a broader sense, to question the repercussions of our decisions beyond its human interest to include all the species that inhabit this planet.

For Ana María Osorio Florez, chief of the Sustainable UPB program,

> Sustainability should be the higher purpose of humanity, not only because of the relationship between conservation and development but also because of the need to preserve ourselves as a species and guarantee the continuity of future generations, having as premise justice and equality (Osorio Florez, 2023).

These definitions show the importance that not only environmental aspects have for UPB researchers, but social and community aspects regarding sustainable development. Although most of the responses were from a technical background like engineering.

When asked about the opportunities and challenges of sustainability at the University, three types of answers were addressed: for the university as an institution, for the development of research and new teaching strategies, as follows:

4.2.1. Institutional Level: Teachers, researchers, and administrators suggested the University continues with *Neutral Carbon Certification*. This certificate has been awarded to the University five times, since 2018. The same applies to the *Zero Waste Certification*, a gold category awarded to the University three times, since 2020. Other activities such as proper waste management, better energy efficiency and optimal use of water, further reduction of paper use, promotion of eco-friendly means of transport, and zero use of single-use plastics on campus should continue to be promoted, increasing educational activities and implementing new strategies.

Challenges such as redesigning university processes and locations to make them more sustainable are also mentioned. The campus has been built since its foundation, 80 years ago. Today, most of them have been renovated to keep them useful, but a redesign in terms of new materials, bioclimatic awareness, and accessibility, among others would be ideal.

The respondents consider better visibility of actions carried out by the University on different environmental issues, as well as to strengthen public and private alliances for the development of projects in the regions, and not only in the cities where the University has its campuses. Last, it is considered that the University has the capacity to prioritize other SDGs -in addition to those that are already being worked on-, including other topics of interest such as justice, peace, gender equality, and mental health.

Many of these actions imply a budgetary availability to implement them, and the ability to project how these expenses can generate returns in the medium and long term. Also, for these initiatives to come true, synergy and commitment of senior managers in favour of the development of projects in environmental, social, and economic issues are needed, not as accessory actions, but as a core strategy for university life and wellbeing.

4.2.2. Teaching Level: In the opinion of the interviewees, today sustainability issues are addressed in the University from a few specific courses in the curricula, but these are neither systemic nor systematic. This means, the question of what would be necessary for graduate students to undertake action to achieve the ODS, has not been done yet. Curricula are still designed in base on disciplinary knowledge and not to face sustainability problems. This matter is considered a responsibility only disciplines that transform the environment have to worry about -like design, architecture, or perhaps some engineering- but educating for sustainability must not be an option for other knowledge areas, because its systemic and complex nature requires actions from all perspectives. This means professional training that has sustainability as the axis of disciplinary action and is not considered as an added value.

They also affirm that it is necessary to develop new ways of teaching in which discipline knowledge can be applied to projects that have a central question linked to the global, regional, or local challenges on sustainability. This implies the continuous dialogue with students and teachers about the relevance of sustainability as a desired skill or perspective, to build the habit of wondering about the impact of each of the decisions they make, in environmental terms. Also, other actions like promoting entrepreneurship with an innovative and sustainable basis that allows the economic development of the poorest populations are also mentioned.

4.2.3. Research Level: New and current research topics are recognized by the interviewees as needed: the use of organic waste as raw materials in new processes, the recovery of residual spaces from urban planning to be converted into collaborative orchards, the formulation of new political and economic models that allow better consumption habits, materials, and processes that have a less environmental impact and are low cost, the formulation and promotion of a new luxury concept that does not go against sustainability.

For the respondents, it is also necessary to strengthen and continue the work carried out by the University with the communities, steaming the capabilities of the University to achieve efficient, collaborative, and interdisciplinary work. As well as, the formulation of new research projects with reference to the prioritized and non-prioritized SDGs, competing for access to financing for innovation in this area. This work should be expanded from the cities of Colombia where the University is present to the regions, the countryside, and the coast, where there are great wealth and environmental challenges.

4.3. What has UPB done to close gender gaps

With the leadership of *UPB Sostenible*, the university has been developing a series of research projects and including gender issues into administrative board agendas. Although the university has not prioritized SDG 5 in its Sustainability Agenda, *UPB Sostenible*, and some teachers and researchers have pointed out the importance of working on the achievement of the targets of the SDG in order to improve gender equity and equality. This is what UPB is doing in these matters.

4.3.1. UPB Sostenible and Sustainability Report: throughout its existence, the university has had as one of its guiding principles the positive impact on each of the dimensions of what today is called Sustainability. For this reason, since 2017, and with the guidance of the Strategic Sustainability Committee -led by the Pastoral Vice Rectory and supported by the Environmental Research Group GIA-, the decision was made to implement a strategy for UPB Colombia in which sustainability is incorporated as part of the University's organizational culture. *UPB Sostenible* is a strategy led by the General Rector and Pastoral Vice-Rectory of the university. Within its team, there are nine people in *multicampus*[4], five of them are women, including the leader of the strategy. This said, we can affirm that UPB believes in women´s capacity to lead and resolve sustainability issues and projects.

In the 2022 Sustainability Report, the institution declares:

> Universidad Pontificia Bolivariana is a private, non-profit Higher Education Institution, with a tangible commitment to the fulfilment of the Sustainable Development Goals, which is materialized in the contributions of scientific publications, and in the deployment of our Institutional Development Plan facing the goals of the 2030 Agenda for Sustainable Development. In particular, by 2022, 48.65% of the publications have a direct relationship with SDG 3. Health and Wellbeing, and 13.51% with SDG 9. Industry, Innovation and Infrastructure. Likewise, we can proudly say that, of the 8 SDGs prioritized by the Institution, we make direct contributions to nearly 50% of the goals defined in this global strategic agenda. (Universidad Pontificia Bolivariana, 2022, p. 1)[5]

The *UPB Sostenible* strategy and the Sustainability Report serve as a tool to measure the impact of the actions taken in relation to sustainability and to recognize the sustainability performance of the institution. The evidence shows that it is women who have led, since 2017, both strategies in multidisciplinary and multigender teams.

4.3.2. Establishment of a series of committees working towards the achievement of the SDG 5 targets: The university has structured four working committees in relation to SDG 5, with the participation of students, faculty, and the university's administrative body. Each committee is led by a woman who is part of the institution's administration board. These committees work on the prevention of gender violence in four different ways: 1) producing new knowledge in gender equality, equity, and gender violence; 2) promoting women's safety in the environment and digital media; 3) training of students, teachers and administrative staff on gender issues, and 4) its aim is to review the policies for teacher evaluation and curriculum design in aspects regarding gender issues.

4.3.3. Proposals for research projects with communities for women's empowerment: as seen previously, there is a lack of research projects focused on achieving SDG 5, empowering women and closing gender gaps. The institutions have noticed this issue and now search for international funding to build proposals for women empowerment. These proposals are being built by multidisciplinary and multigender researchers, teachers and administrative employees at the university. The main objective is to join efforts within the institution to achieve equity, equality and empowerment for women in the most vulnerable communities in the country, as in the case of the departments of Cordoba, Chocó and Sucre.

5. Conclusion

[4] The UPB has four campuses: Medellín, Palmira, Monteria, and Bucaramanga in Colombia, that's why we call it *multicampus*.

[5] Free translation by the authors.

Additional questions have arisen for us during the review of the empirical evidence and the literature review on gender equity, equality, and differences in HIEs. (i) What are the main characteristics of a female sustainability leader? (ii) How does a female leader implement sustainability actions? (iii) How does a female sustainability leader face challenges? Even though literature responds to these questions, what happens in the practice? Some have an empirical answer, some may need more research to be driven.

The aim of this study was to identify the impact of women's work on sustainability performance at UPB and, as shown in the results, women researchers, teachers, and administrative leaders have a big impact on UPB Sustainability performance, especially regarding high-impact publications and research projects driven to impact and resolve SDGs issues. In publications by women at the UPB, an imbalance is observed in the SDGs on which they focus mostly, since SDGs 9, 11, and 12, are very prominent, leaving aside other of great importance and urgency, like 5, 6, and 7 for example, especially for environments with fairly complex emerging contemporary problems such as Latin American cities, like Medellin, Monteria, and Palmira were UPB is present.

As a start, if women have a high commitment to sustainability, but their participation in research processes is not comparable to men, valuable opportunities are lost in favour of the SDGs. Despite the little empirical evidence on how women contribute to sustainable development, it is clear that they play a very important role in private companies, the public sector, and in academia, where sustainability is a permanent concern for women researchers who also transfer this knowledge to the business sector. It is important to highlight the challenges that women face today regarding sustainability, mainly related to gender equality and equity, not only in higher education environments but also in governmental and business community environments, where they still have little representation. It is necessary to strengthen collaboration for research and publication, because, although women have a superior tendency to collaborate as explained above, better institutional and governmental stimuli are required for women who are interested in the SDGs, from different academic perspectives and in different geographic scopes, not only include large cities.

Within the literature review, a wide variety of publications were found in relation to women and sustainability, developed in different fields, and which demonstrate that the involvement of women in the business, private, public, and academic sectors can contribute to the scope of the SDGs. However, many challenges were identified in closing the gap in scientific research and development by women, both in academia and outside of it. UNESCO (2023) reveals evidence of female representation in academia worldwide and states that in regions like Latin America gender balance seems to be growing. This perspective is encouraging women scientists and researchers in Latin America to keep working on them and take their findings to the classroom where they will impact other women in training. Finally, this may increase substantially the number of researchers and scientists focused on sustainability in the future.

Although women and men have similar contributions as leaders in sustainability boards, literature shows that women are recognized to have unique perspectives on environmental and social issues and to be more empathic with the community and stakeholders. Also, men are good allies for women in sustainability boards and that is fundamental to have an equitable gender composition on the committees for the sake of governance, diversity, and justice. This study is a call for action and recognition of the role that women have in sustainable performance at UPB gender equity and equality, in order to include in the sustainable development agenda of the institution's actions and enabling approaches that empower women as leaders, and men as allies, in the common goal of a better and safer environment for all us.

Women leaders will contribute to sustainability; consequently, political efforts by the UPB, oriented towards gender equality will probably have positive effects in terms of sustainability. Thus, the role of female leaders deserves our attention, mainly in a context as Latina America and specifically Colombia, where culture is attached to gender stereotypes and there is a lack of institutional resources to implement strong sustainability policies and have a significant gender gap. In leadership, as in life, the secret lies in the mix. There is no right leadership, and female leadership won't solve all diversity and bias issues at the workplace.

Last, we must mention the limitations of this study, starting with the fact that the university has not prioritize SDG 5 and that only began this year to articulate an establish committees that work to close gender gaps, gender equity and equality, and for the promotion of safer places for women inside the institution.

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Ageing Population and the Perception of Sustainable Development: A case study in rural areas, Beira Baixa, Portugal

Sandra Manso[135], Sandra Caeiro[23], Sara Nunes[1], Carlos Pardo[4]

[1] Polytechnic Institute of Castelo Branco, Castelo Branco, Portugal
[2] Department of Science and Technology and CEG, Center for Global Studies, Universidade Aberta, Lisbon, Portugal
[3] CENSE, Center for Environmental and Sustainability Research, Nova University Lisbon, Lisbon, Portugal
[4] National Distance Education University, Madrid, Spain

[5] sandramanso@ipcb.pt

Abstract. Over the next few decades, the ageing population is expected to increase significantly, especially in rural areas. Generally, poverty is more frequent in the elderly, being even more pronounced in women. In 2015, the adoption of the Sustainable Development Goals (SDG) defined a new agenda, which will have an impact on the elderly. The case study presented is about a region in the interior of Portugal, Beira Baixa. The main objective of this study is to reflect on the perception the elderly have on Sustainable Development (SD), based on the results from a questionnaire applied to this population. The results allowed to verify that almost 3/4 of the respondents have already heard of the term SD, the media being the largest contributor. About 70% of the elderly consider their quality of life "is the same" or "worse". When asked about which of the SDGs are more important to their region, the main ones are "Quality Education" and "No Poverty". A wide spread of SD among the elderly is important, because all are essential for achieving the SDGs. That is, creating the same opportunities to ensure ageing population fully develop their human potential, but also fully and effectively enjoy their human rights.
Keywords: Sustainable Development, Sustainable Development Goals, Ageing Population, Rural Municipality, Beira Baixa

1. Introduction

The world's population is ageing fast, the number of people aged 65 and above is expected to double worldwide over the next two decades, and by 2040, more than 14% of the world's population will be 65 or older, amounting to 1.3 billion older people (Kinsella and Velkoff, 2009; Pillemer *et al*., 2011), especially in rural areas.

The Sustainable Development Goals (SDG) emerged at the Rio+20 conference in June 2012 defined a new agenda, they focus on people, on the planet, on prosperity, with the motto: "Transform our world, leave no one behind". For the first time, they have become universal goals, there is a project for everyone everywhere (Sachs, 2015; Leite, 2017; Leal Filho *et al*., 2018). The SDGs will have an impact on the elderly, for example, the goals associated with poverty reduction, improved health, and gender equality. The United Nations Decade of Healthy Ageing (2021–2030) has recognised the essential contribution of older population to the implementation of the 2030 Agenda for Sustainable Development (SD) (Shevelkova, Mattocks and Lafortune, 2023).

The case study presented is about the Intermunicipal Community of Beira Baixa (CIMBB), a region in the interior of Portugal, where most areas are farms, forests, and pastures with a high level of human desertification. The intermunicipal communities (CIM) were started towards the general goals of their municipalities, namely the promotion of the planning and management in the creation of new models of governance and transition towards sustainability.

The Beira Baixa is composed of six municipalities (Castelo Branco, Idanha-a-Nova, Oleiros, Penamacor, Proença-a-Nova and Vila Velha de Rodão, Figure 1), it has an area of 4 614.64 square km, it contains the country's 3rd and 4th largest municipalities (Castelo Branco and Idanha-a-Nova

respectively), their population (80 751 people, according to 2021 Census) represents about 0.8% of the national resident population, what translates in the third lowest populational density in Portugal (17.5 people per square km, namely Idanha-a-Nova and Penamacor had less than 9 people per square km).

Figure 1. Region Centro of Portugal: Intermunicipal communities and municipalities

Source: INE (2022)

According to CIMBB (2015) the municipality of Castelo Branco has development and social cohesion levels that go along with the national average, while the remaining municipalities of a rural profile (Idanha-a-Nova, Penamacor, Vila Velha de Ródão, Proença-a-Nova and Oleiros) have strong structural weaknesses, that are reflected in the demographic and socioeconomical indicators. According to the 2021 Census (INE, 2021), Beira Baixa has the following indicators: aging index 331, old-age dependency ratio 59.4, total dependence index 77.4%, illiteracy rate of 6%, the employed population represents 37.8% of the region's resident population. In Oleiros, for example, there are about 780 elders per 100 youth, which is the highest index in the country.

The main goal of this paper is to present the results of the elderly population based on the inquiry by questionnaire applied to the resident adult population of Beira Baixa, Portugal. This questionnaire had as its goal to know the perceptions, knowledge, and attitudes of this population about SD and what areas there is a need to act for its implementation in the scope of the region where they reside.

2. Literature Reviews

Population is ageing at a rapid speed, being a universal phenomenon considered to be one of the most important questions worldwide (Lamnisos, Giannakou and Jakovljevic, 2021; Shevelkova, Mattocks and Lafortune, 2023). Many predictions indicate that the number of older people will overcome in 2050, for the first time in human history, the number of young people, for example Jarzebski *et al*. (2021) refer that in 2019 the population over 65 has overcome the younger children (over 5 years-old) and, notwithstanding the predictions, older women normally overcome by a lot the older men and, in the older age groups, in some regions this age group is 100% feminine.

In Europe, according to the United Nations report (2017), in 2017, 25% of the population was 60 or older, and it had the most aged population when compared with other regions. According to the Ageing Report, in 2050 one third of the European population will be over 65, Europe will continue to be the most aged society in the world (Jarzebski *et al*., 2021; Morato *et al*., 2021). Kudo, Mutisya and Nagao (2015, p. 944) refer the population's ageing is mainly caused by two demographic changes: "i) decline in fertility rates" (e.g., in Europe there are 1.5 births predicted per woman by 2050) and "ii) increase in life expectancy" (e.g., in Europe it is expected to be close to 82 by 2050).

Despite the fact international policy has focused on SD, with the 2030 Agenda for Sustainable Development, Agenda 2030 and, more recently, the United Nations Decade of Healthy Ageing (2021–2030), in the last two decades, "there have been many international policy developments related to healthy

ageing, including the Madrid International Plan of Action on Ageing (2002), Active ageing: a policy framework (2002), the World report on ageing and health (2015), and the Global strategy and action plan on ageing and health (2017)" (Shevelkova, Mattocks and Lafortune, 2023, p. 2).

There are several extremely important reasons, by which one should study the connections between sustainability and ageing. First, health related research suggest environmental threats may affect disproportionally and undermine the older population's health and, secondly, as the older population grows, it can play a bigger role contributing to the environmental problems (Pillemer *et al*., 2011).

Changes in the population (e.g., population size, growth, density, age and sex composition, migration, urbanization, vital rates), as an emerging challenge for many regions, have always been a central theme in the debates on sustainability, many demographers and other social scientists investigate the relations between the populational dynamics and environmental changes (Sherbinin *et al*., 2007; Kudo, Mutisya and Nagao, 2015). Namely, the elderly are more vulnerable to environmental changes and more susceptible to disease and, generally, poverty is more frequent in the elderly, being even more pronounced in women, the elderly will be affected mainly by two of the 17 SDGs, namely No Poverty (SDG 1) and Gender Equality (SDG 5) (Pillemer *et al*., 2011; Jarzebski *et al*., 2021; Morato *et al*., 2021).

Normally ageing is analysed as a challenging obstacle in reaching the sustainability goals and, rarely, as an opportunity. The population's rapid ageing will have implications simultaneously positive and negative for sustainability, substantially, for economic growth, for the development of the public sector, in buying patterns, in changes for land use and on greenhouse gas emissions, among others (Jarzebski *et al*., 2021). For sure, all these questions will have important implications for the implementation of many of the SDGs.

Population ageing and the rural exodus led to a subsistence decline of the rural areas, its communities become fragile, that is, the harder access to essential services generates a decrease in the well-being of the elderly (Kudo, Mutisya and Nagao, 2015; Jarzebski *et al*., 2021; Ho and Shirahada, 2023). So, communities should adapt to the unexpected challenges related to ageing and support in a positive way healthier and longer lives (Wang *et al*., 2021).

Understanding the relationship between the population's ageing and the urban areas, without forgetting the rural areas, has become an important matter for public policies, presents new challenges for society, from health care and social participation to guaranteeing older citizens have safe and easy access (Kreps *et al*., 1999; WHO, 2007; Pot, Briggs and Beard, 2018; Buffel, Phillipson and Rémillard-Boilard, 2019; Morato *et al*., 2021; Possenti *et al*., 2021; Wang *et al*., 2021).

There is an urgent need for a wide social and healthcare approach towards populational ageing, with social and health care policies and strategic responses to these imminent challenges, to guarantee there is the infrastructure in all environments, to respond to the demographical issues and strengthen health promotion in ageing (Buffel, Phillipson and Rémillard-Boilard, 2019; Lamnisos, Giannakou and Jakovljevic, 2021; Liu *et al*., 2022).

Despite the intergenerational tensions representing a consequence of the changes in the age structure of the society, by approaching and recognizing these tensions, it is possible to reconcile the interests between the present and future sustainability (Kreps *et al*., 1999). Vincent (2019) suggests one should reevaluate the knowledge and abilities in the elderly in order to promote social inclusion and, as a consequence, sustainable development.

The study carried out by Jarzebski *et al*. (2021, p. 8) showed, in particular, "that this demographic transition will have major implications for implementing different SDGs, with some of the most promising emerging interventions including (a) innovations for health care and mobility, (b) improvement of green/public space design and extent, (c) social inclusion through social participation and urban knowledge coproduction".

3. Methodology

Beira Baixa and its municipalities (Castelo Branco, Idanha-a-Nova, Penamacor, Oleiros, Proença-a-Nova and Vila Velha de Ródão) was characterized through bibliographic analysis, statistical data analysis (for example the Census information), spacial/geographical analysis (for example via Google Earth), among others. To verify if people are sensible to the SD issues and how they consider it should be evaluated, for example through an Indicator System (IS), an inquiry by questionnaire was used.

So that the participation of the population could be identified and also their awareness of SD, a survey by questionnaire was applied (quantitative investigation) because it allows for a greater systematization,

greater simplicity of analysis, and a faster collection and treatment of the data (Carmo and Ferreira, 2015). Having in mind the size of the population, a sample by quota was defined (Coutinho, 2016) in the variables of municipality, gender, and age group, to ensure the characteristics and the population's representability (for the different municipalities), with the goal of generalizing the results for the population being studied, its analysis will be quantitative, and the statistical software (SPSS) will be used.

The results about the ageing population were based on a survey by questionnaire previously applied to the adult population of this region (for detailed information of the questionnaire see Manso, Caeiro and Pardo, 2019). The development of the inquiry by questionnaire went through the following stages: a) bibliographic review; b) making of the first version; c) input by "specialists"; d) alteration of the first version after collection of input; e) pre-test; f) final version. The questionnaire is organized in five parts: i) SD Perception, ii) SD Evaluation in municipality of residence, iii) What is important to evaluate in the region's SD, iv) Public participation and v) Characterization of the sample. It is made up of closed questions, most of them multiple choice and in the question about the themes for the IS a Likert scale was used (where 1 meant "not important" and 5 meant "very important").

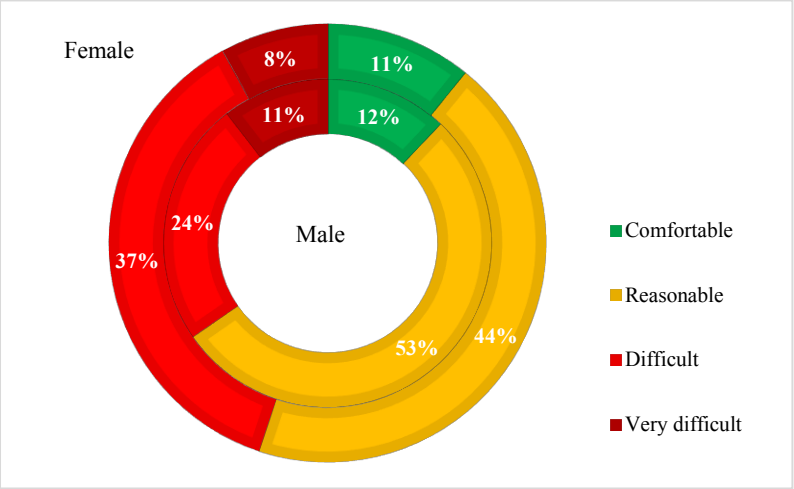
A descriptive statistic and statistics tests relevant to the inquiry of relations between variables (e.g., Pearson's Chi-Square Test, Kruskal-Wallis test) were conducted. The Pearson's Chi-Square Test was used in order to generalize or infer the results for the population under study, and the Kruskal-Wallis Test was used to compare two or more independent samples, of equal or different sizes, with the objective of verifying the existence of differences between the samples. Statistical analysis was performed using the SPSS 25.0 software.

4. Results and Discussion

The sample being studied is made up by 282 individuals, about 1% of the elderly resident population in the CIMBB, of which 155 (55%) reside in the municipality of Castelo Branco, 40 (14.2%) in Idanha-a-Nova, 23 (8.2%) in Penamacor, 29 (10.3%) in Proença-a-Nova, 21 (7.4%) in Oleiros and 14 (5%) in Vila Velha de Ródão. Over half of the respondents are women (53.2%). About 96% resides in the Beira Baixa longer than 5 years, only 1.4% resides for less than 1 year. Worthy of note is that 88.6% of the respondents is retired and 56% work or has worked in the tertiary sector, but the primary sector had been referred by 26.4% of the respondents. Almost 2% of the respondents "has no qualifications", 39% of the respondents has a primary education and, only, 12% has a higher education.

When we questioned about their subjective income, 48.5% the respondents rated their income as "reasonable" and almost 31% rated it "difficult". Although the Chi-Square test does not identify an association between the assessment of income and the gender, when analysing the results by gender, women tend to perceive their condition as more difficult (Figure 2).

Figure 2. Perception of family income

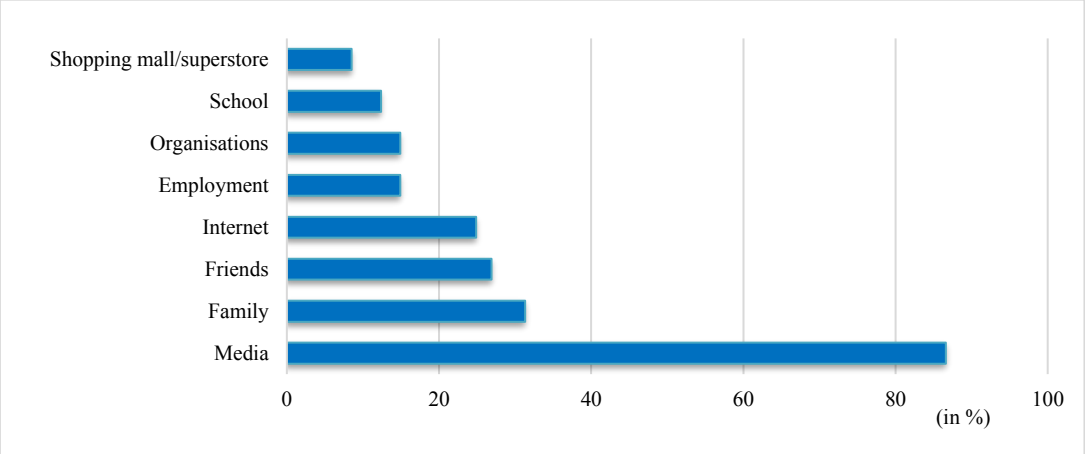


4.1 SD Perception

In the first part of the questionnaire, about the SD perception, almost 3/4 of the respondents have already heard of the term SD (about 71%). When we analyse the differences by gender there is a significant difference, 78% of men report they have heard of SD, but only about 65% of women have heard of SD. The Chi-Square test shows an association between the gender of respondents and the fact that they have heard of SD (p=0,019), showing that men tend to be more aware.

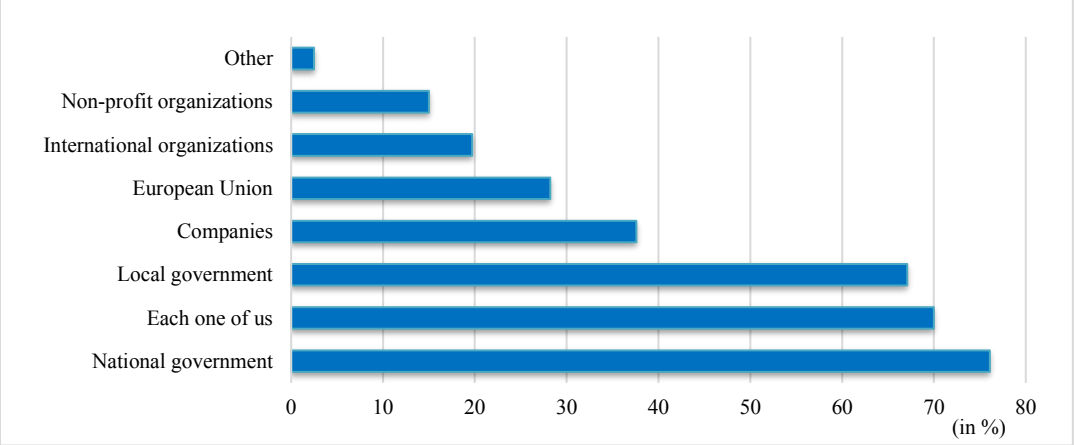
Figure 3 describes the context in which they have heard of SD, where we can see that the media has a big importance in this outreach.

Figure 3. Context in which they heard about Sustainable Development



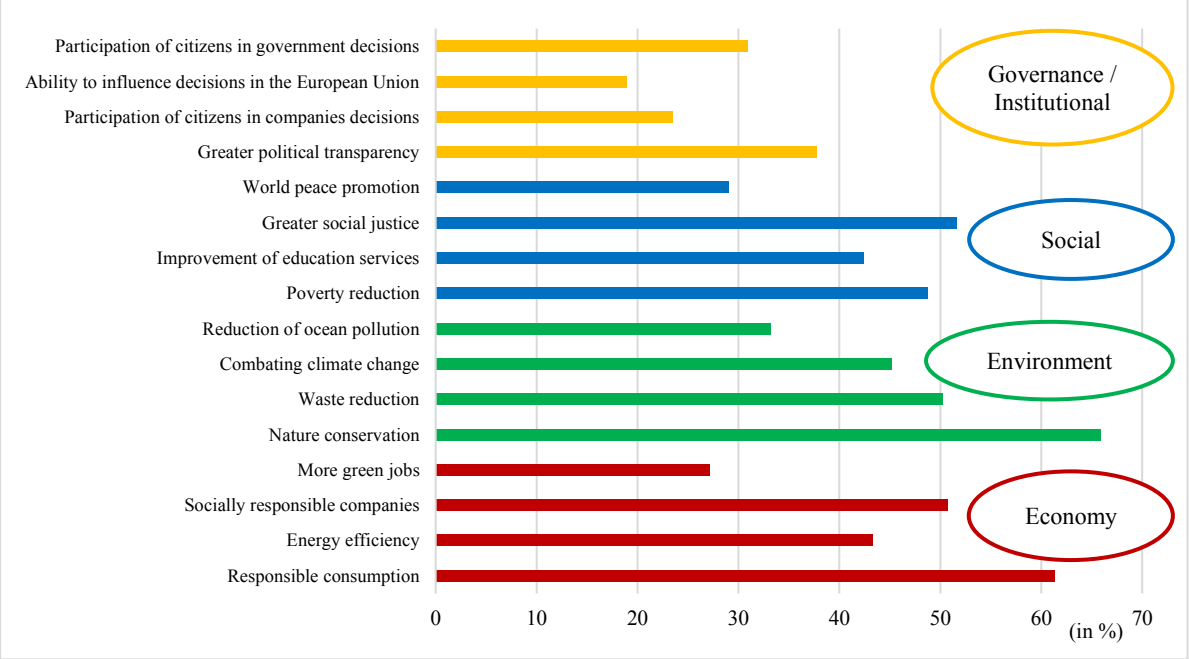
When questioned about who is responsible for the Promotion of SD (Figure 4), most respondents believe that it is to the National Government (76.1%), to each of us (70%) and to the Local Government (67.1%).

Figure 4. Who is responsible for promoting Sustainable Development



In the last question on SD perception, with regard to the dimensions (environment, economy, social and governance/institutional), more than 60% of respondents associate SD with the themes of Nature Conservation (65.9%) and Responsible Consumption (61.3%). However, almost 52% of the elderly also highlighted the theme Greater social justice (51.6%) (Figure 5).

Figure 5. Main themes associated with Sustainable Development



An index was created that resulted from the sum of the scores obtained in the items that integrated each of the dimensions under analysis (economy, environment, social and governance/institutional), referring to the themes associated with the concept of SD and whose basic descriptive statistics are found in the Table 1 (each dimension has a maximum value of 4). It is noteworthy that the environmental dimension is the most valued by respondents.

Table 1. Basic Descriptive Statistics for the main themes associated with Sustainable Development - Environmental, Economic, Social and Governance/Institutional dimensions

	Total		Male		Female	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Environment	1.9447	1.48033	1.7345	1.45785	2.1731	1.47761
Economy	1.8249	1.35971	1.8230	1.35772	1.8269	1.36845
Social	1.7189	1.48426	1.6903	1.44593	1.7500	1.53123
Governance/Institutional	1.1106	1.36651	1.1681	1.41990	1.0481	1.31000

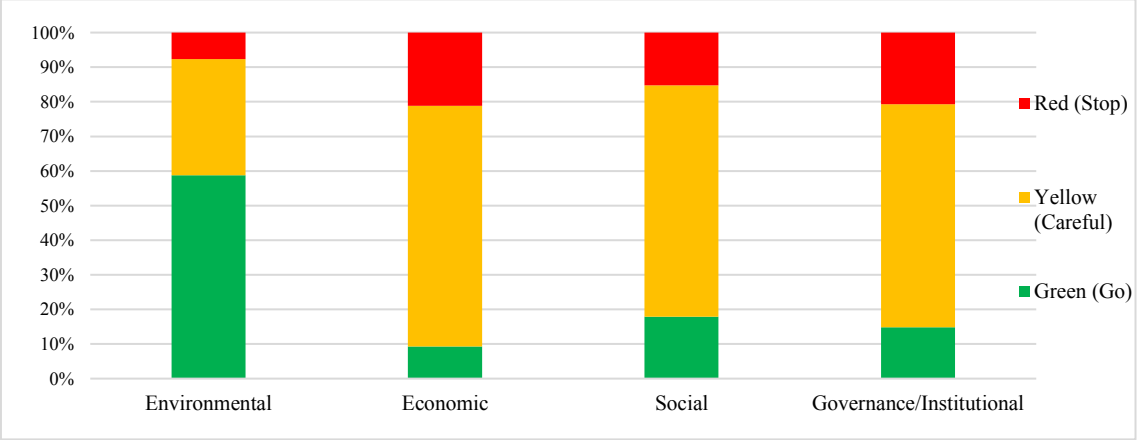
N = 217; Male = 113; Female = 104

In a subsequent phase, the existence of statistically significant differences between the scores obtained in the different dimensions under study was investigated. The Kruskal-Wallis test identified statistically significant differences for the Environmental dimension (p=0.032) according to the respondents' gender. As the table shows, women tend to attribute a much higher score than men. Women are probably more sensitive to environmental issues.

4.2 Evaluation of SD of the municipality of residence

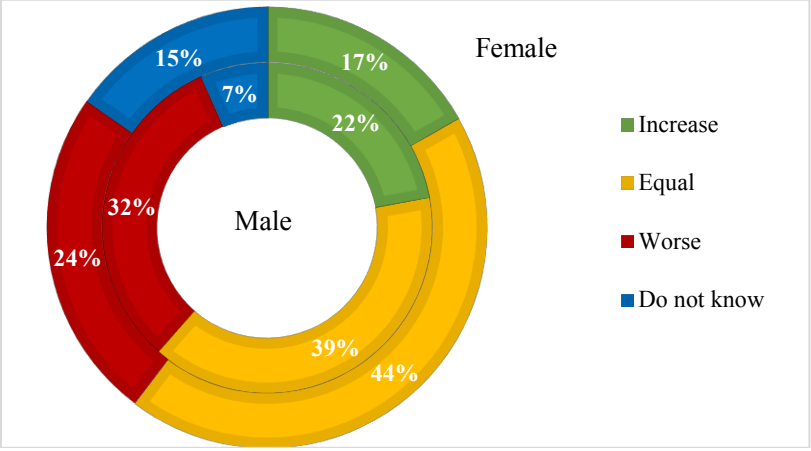
In the second part of the questionnaire (Evaluation of SD of the municipality of residence), in the first question, the respondents using the traffic light analogy (green – go; yellow – careful; and red – stop), classified the performance of their municipality in the SD dimensions (Environmental, Economic, Social and Governance/Institutional). Over half of the respondents (58.7%) classifies the environmental dimension as "Green", in the remainder dimensions, over 60% of the respondents classified them as "Yellow". Over 20% classified the economic and governance/institutional dimensions as "Red" (Figure 6). The Chi-Square test allowed the identification of a statistically significant association between the respondents' gender and the Economy (p=0.036) and Social (p=0.006) dimensions. In particular, women point out more "STOP".

Figure 6. Evaluation of the municipality in relation to the performance of the environmental, economic, social and governance



When inquired regarding their quality of life in the municipality, in the last 5 years, about 42% and 28% considers that it is "equal" and "worse", respectively. Although the Chi-Square test does not identify an association between the quality of life and the gender, the values obtained are different by gender, men tend to perceive their condition as more difficult (Figure 7).

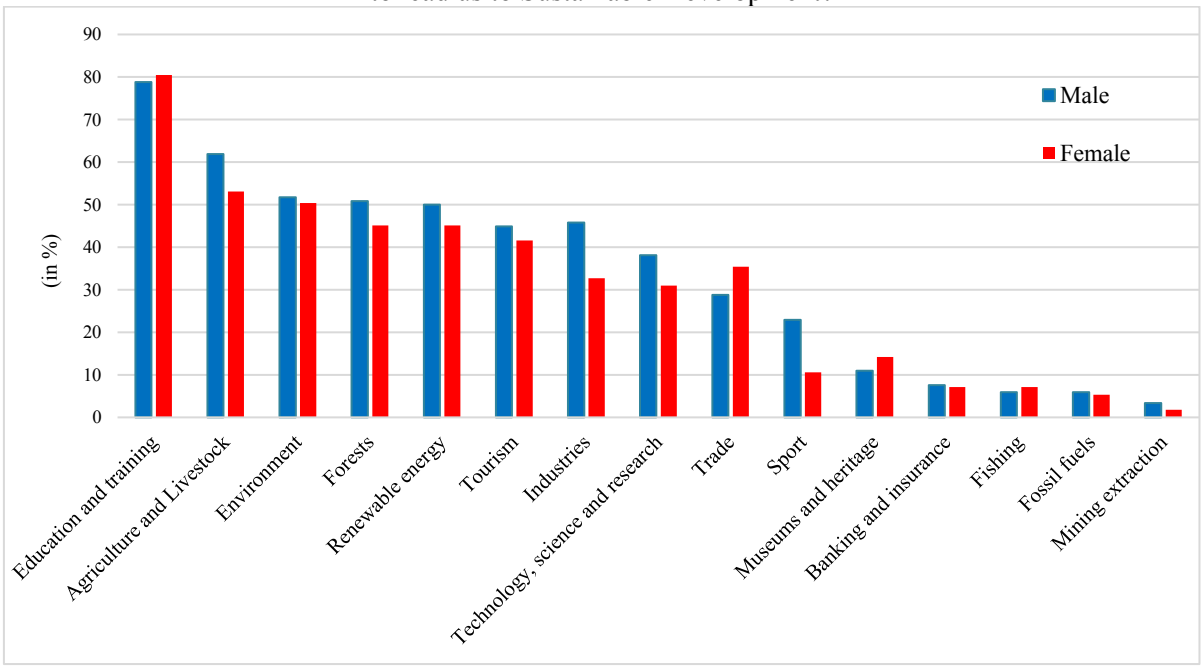
Figure 7. Perceived quality of life in your municipality in the last 5 years



When we asked about the sectors that should be invested in the municipality (Figure 8), Education and training (79.7%), Agriculture and Livestock (57.6%) and Environment (51.1%) constitute the major investment in the region according to the ageing population.

The Chi-Square test allowed an identification of an association between the respondents' gender and the sector "Industries" (p=0,043). Namely we see that 45,8% of men consider there should be investment in this sector while only 32,7% of women have the same opinion. There has also been detected an association for the "Sport" (p=0,013) sector. Namely it is seen that 22,9% of men consider there should be investment in this sector while only 10,6% of women have the same opinion.

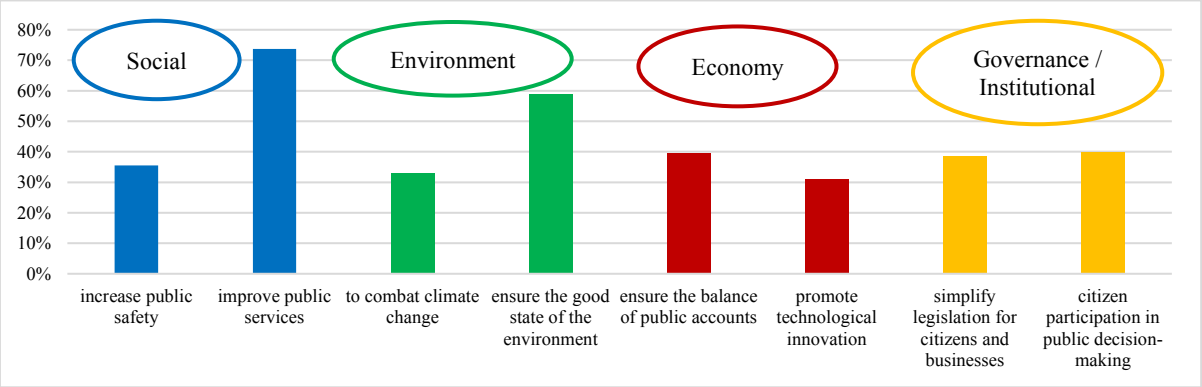
Figure 8. Results from the question: Which Sectors your municipality should invest in the near future, to lead us to Sustainable Development?



We questioned residents regarding public policies associated with SD, which they considered most important for their municipality in the social, environmental, economic, and governance/institutional areas (Figure 9). The areas most referred were, the social area, improving public services (73.7%), and the environmental area, to guarantee the good condition of the environment (58.8%). On the opposite side, the economic area, to promote technological innovation (31.1%) is the least valued. Again, coherently with previous results, the environmental area is an important one in Beira Baixa, but the concern for public services is very important for the elderly population, e.g., increase in health care or support services for the elderly.

According to the 2021 Census, in Portugal and in CIMBB there were 177 and 258 inhabitants per doctor, respectively, but in three municipalities of this region (Idanha-a-Nova, Oleiros e Penamacor) there is one doctor per 900 inhabitants (INE, 2023). Therefore, the concern with public services, especially health care, is very important for this population.

Figure 9. Priorities in the most important public policies in the social, environmental, economic and governance areas



An index was created that resulted from the sum of the scores obtained in the items that integrated each of the dimensions under analysis (economy, environment, social and governance/institutional), referring to the public policies that are considered most important in the municipality of the respondent and whose basic descriptive statistics are found in the Table 2 (each dimension has a maximum value of 2). It is noteworthy that the social dimension is the most valued by respondents, followed by the environmental dimension. And again, coherently with previous results, the environmental dimension, in public policies, was also more valued by women.

Table 2. Basic Descriptive Statistics for the Environmental, Economic, Social and Governance/Institutional most important public policies

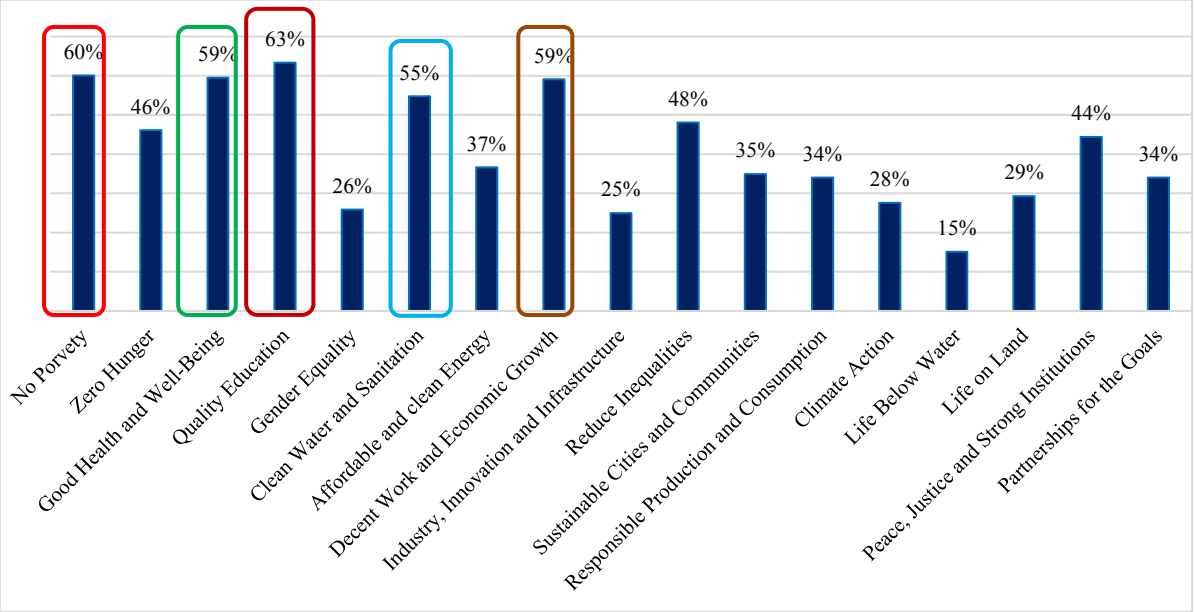
	Total		Male		Female	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Social	1.0921	.71197	1.0513	.70523	1.1351	.71968
Environment	.9167	.77805	.8376	.78737	1.0000	.76277
Governance/Institutional	.7851	.77536	.8462	.80532	.7207	.74065
Economy	.7061	.72498	.7607	.72694	.6486	.72172

N = 228; Male = 117; Female = 111

4.3 What is important to evaluate in the SD of your region in terms of the Goals for Sustainable Development

When questioned regarding what is important to evaluate in the SD of their region and, specifically which are the most important SDG for their region (Figure 10), over 50% responded Quality Education (SDG4), No Poverty (SDG1), Good Health and Well-Being (SDG3) and Decent Work and Economic Growth (SDG8) and Clean Water and Sanitation (SDG6). On the opposite side, the Life Below Water (SDG 14) was the least indicated (about 15%), probably because it is a region in the interior of Portugal. If we analyse these results and the previous ones, it is essential a wide promotion and clarification of the SDGs, namely in peripheral and aged regions and that, beside the governments, these regions play an active role in their promotion, that is, to end poverty, to promote prosperity and well-being for all, to protect the environment and to fight climate change, within the planet's limits.

Figure 10. Goals the respondents consider important for their municipality



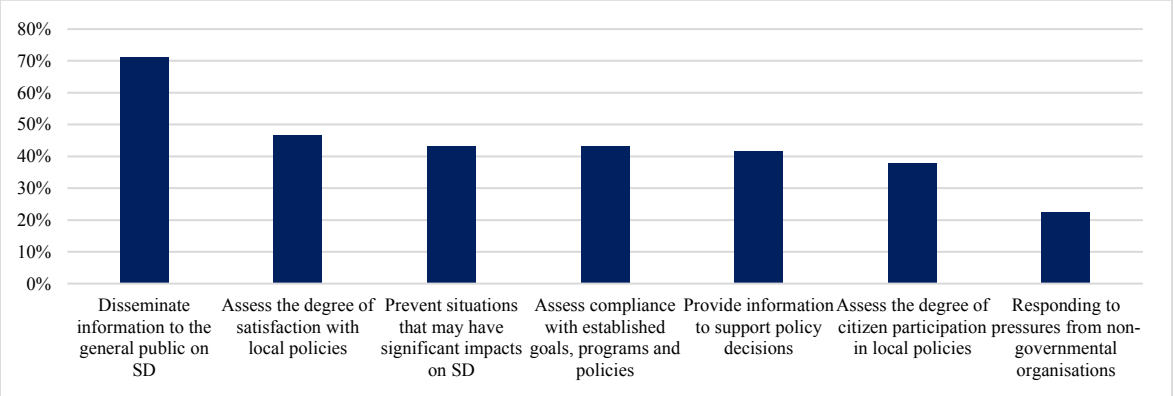
In the question related to the Indicator System (IS), almost 63% of the population refers that they never heard of an IS, as an instrument to evaluate and report the development of sustainability in a given region, the percentage being higher in women (67.9%) than in men (58.2%). Of the respondents that responded in the affirmative, 87.2% refers that they heard about it through the media and, once again the media has an important role in this.

Respondents were also presented with a list of 40 themes that could be included in the IS and asked to scale from 1 to 5 (where 1 is not important and 5 is very important) to assess the importance of each theme for their municipality. Of the themes presented, 17 received a mean of 4 or higher. The most valued themes by respondents, for example, are Health, Air quality, Education, Employment, Fresh water, Housing Forests, Nature and biodiversity, Safety, Solidarity and Freedom. Note that these items tend to have lower standard deviations, reflecting agreement by the respondents. On the other hand, the least valued themes by respondents are “Marine and coastal environment” and “Fisheries” (furthermore, these themes showed the greatest standard deviations).

However, we observe some differences per gender, the theme Freedom is highlighted (even though the global average is higher than 4), men scored this theme with 4.25, in the case of women it had a score under 4 (3.98). The theme Natural and technological risks, even though it didn’t get a global average higher to 4, women scored it with 4.05, but in the case of men it got an average under 4 (3.53).

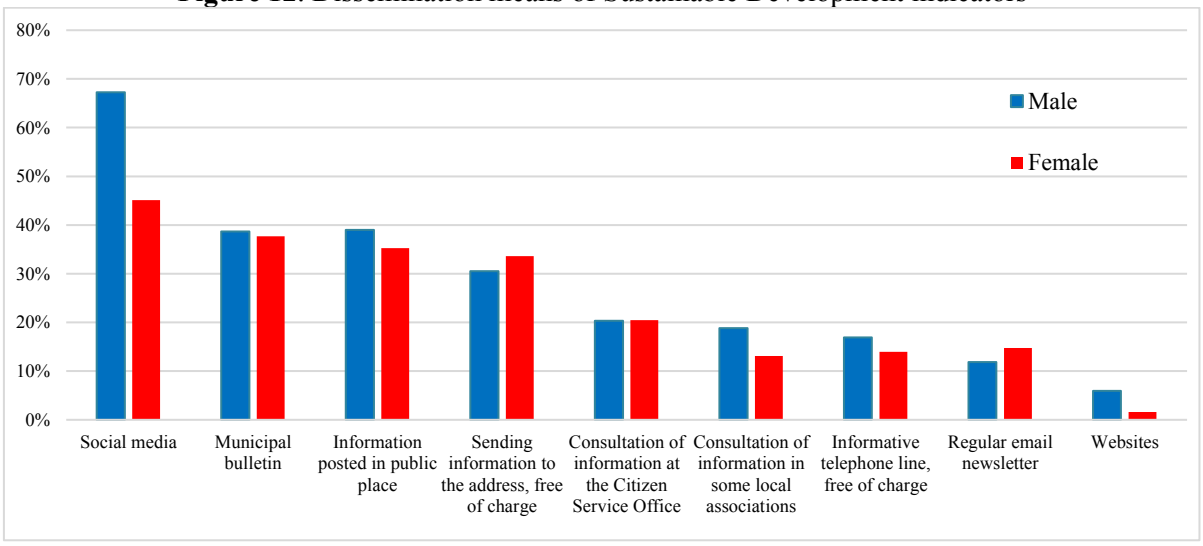
In figure 11, are the given reasons by the respondents that justify the development of an IS, so that it can contribute for the improvement of the environmental, economic, social and institutional performance management, and to make more efficient the systematizing processes and the information exchanges on environment and SD.

Figure 11. Reasons for the development of an Indicator System



The media (56%), the official municipality Newsletter (38%) and the information that is posted in public places (37%) were the main ways in which the population indicated that they would like to have access to the SD indicators of their municipality. Only 3.8% selected Websites, what is to be expected in the case of an elderly population and 12% selected "do not know", but the value is higher in women (16%). Figure 12 highlights the differences between the male and female genders.

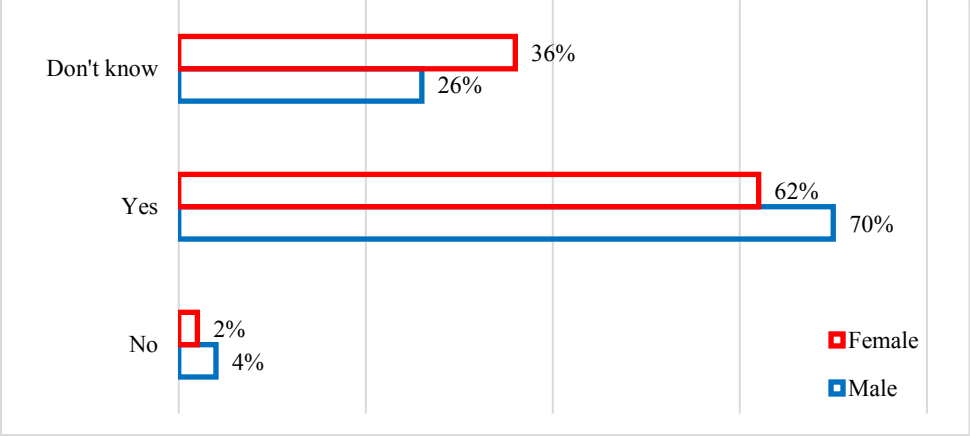
Figure 12. Dissemination means of Sustainable Development indicators



Pena *et al.* (2020) suggest one should cooperate with local government and in small municipalities (especially in rural areas) in order to promote the publication of articles on SD in local press and magazines, to be written in understandable and easy formats.

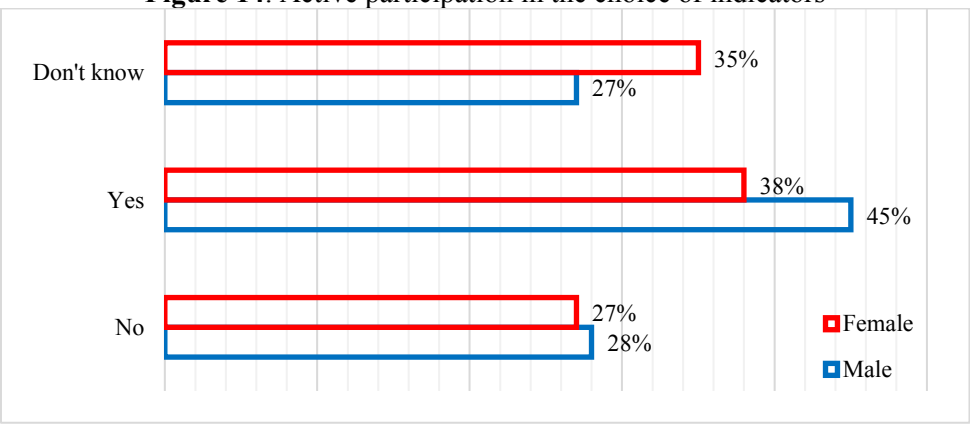
We asked if in the development/designing of an IS that allows the evaluation of the SD, the choice of the indicators should have in consideration the "opinion" of the citizens (for example, through public participation) and a majority (65.9%) of the respondents considers that it should take into consideration the public participation, but about 31% refers that they "don't know". Figure 13 shows the differences between the respondents' gender.

Figure 13. Importance of public participation in the choice of indicators



Besides public participation, we asked if they would like to directly participate in the discussion around the choosing of indicators (for example: unemployment rate, quality of life, number of tourists, greenhouse effect emissions, among others) to evaluate the improvement of their municipality's development and less than half (41.2%) of the respondents would like to directly participate around the choosing of the indicators, but about 27% refers "No". Again, coherently with previous results, there are significant differences between the gender of respondents, only 38% of women would like to have an active participation and 28% of men say they would not like to take an active part (Figure 14).

Figure 14. Active participation in the choice of indicators



Public participation is an essential element for sustainable development, especially in rural areas, where there is a strong connection between the people and the land, historical factors, and sociopolitical relations (Brooker *et al*., 2019; Wang *et al*., 2022).

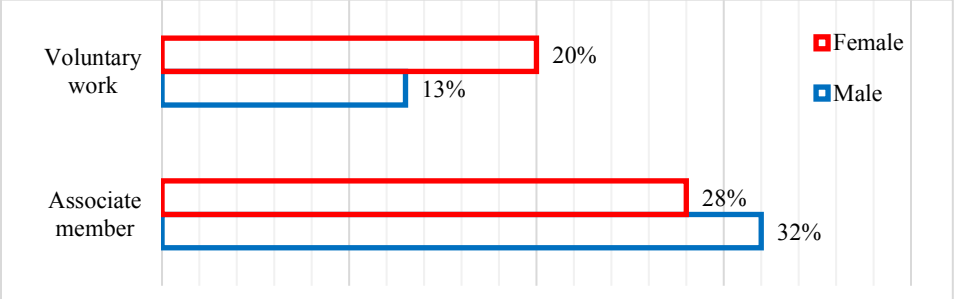
In a general way, in rural areas live the poorest elderly people and, normally, young people migrate to the urban areas (Vincent, 2019). An essential condition to improve local management, especially in rural territories and guarantee their future sustainable development, is to incorporate and/or improve the organization of a monitoring program, which allows, on one hand, to follow changes in a more precise and efficient way and, on the other hand, make informed management decisions (Pavlov and Palatkin, 2021).

Public participation in the development of local policies would allow public organizations to put in practice services that meet the interest of the community (Coutinho *et al*., 2018), especially the elderly population.

4.4 Public participation

In the last part, we asked the population about public participation, specifically if they are members of any nonprofit Institution/Organization and if they were involved in Voluntary work in a nonprofit Institution/Organization. About 30% e 17% are associated or are involved in voluntary work. The following figure analyses the results by gender of respondents, where some differences are observed. The percentage of associate members is higher for men than for women, but the situation is reversed in voluntary work (Figure 15).

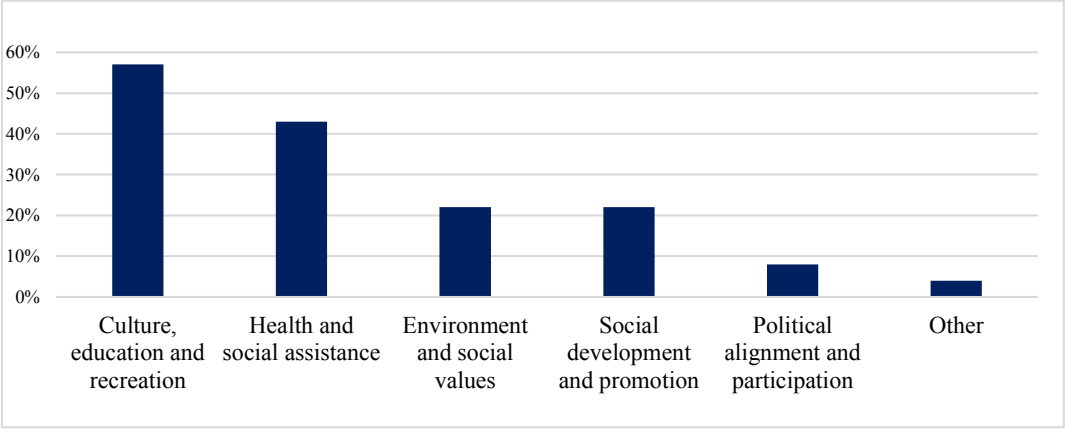
Figure 15. Public participation: associate member and voluntary work



A good part of the respondents that are members or do volunteer work do so in the areas of "Culture, Education and Recreation" (57.1%) and in "Health and Social Work" (42.9%). Of the three respondents who selected the "Other" option, they indicated "Firefighters" (Figure 16).

As a way of conclusion, the associations and volunteer work are similar to the numbers registered in Portugal (Schmidt *et al*., 2016), but in Beira Baixa they are considerably low, particularly in the ageing population. One should promote the elderly participation in community activities as a valuable resource to increase the sustainability of local communities, in an increasingly ageing society (Ho and Shirahada, 2023).

Figure 16. Typology of the intervention area(s) for the elderly



These results show the need to promote a greater involvement of the citizens, especially of the elderly population, in the matters of their community, through collaborative processes. So, the changes in the behaviours of the citizens, the institutions, and the organizations are a prerequisite for SD (Dobson, 2007).

As is referred by Ferreira (2020, p. 19), besides the strong involvement and participation of the civil society, both in the consultation and debates for the definition of a global agenda post-2015 (paragraph 6 of the Agenda 2030 text), "paragraph 41 expressly admits the civil society's role in its implementation and paragraph 89 calls for the different actors to report their contribution for the materialization of the SDGs".

In a general way, it was possible to identify that the perceptions on sustainability differ according to gender, age, place of residence (urban or rural area), population's schooling level, occupation, as already shown by other authors (Pointon, 2014; Guo *et al*., 2018; Aleixo, Leal and Azeiteiro, 2021).

Guo *et al.* (2018) justifies that the different perceptions on SD among the population should be strong evidence for the support of independent local policies adapted to the sociodemographic characteristics of each municipality and/or community, in special in areas with a high ageing of the population.

5. Conclusion

The main goal of this research was to know the perceptions, the knowledge and attitudes of the ageing population towards SD and in what areas there is a need to act for its implementation in the scope of the rural and interior region where they live.

Results showed almost 70% of the respondents has already heard of SD, the media having an essential role. However, there is an unbalance between the dimensions of SD (environmental, economic, social and governance/institutional). Regarding public policy, the respondents highlight the social and the environmental areas. The sectors of Education and training, Agriculture and Livestock, and Environment make up the largest investment in the region. All these questions were reinforced by the SDGs that the respondents considered as the most important for their region.

Regarding the Indicators System, more than half (63%) of the respondents have never heard about it, having the media again an important role. Regarding the participation in the development and direct involvement in the theme selection, almost two thirds consider important public participation, but a little more than 40% would like an active role. The most chosen themes by the population of Beira Baixa are associated with the environmental and social themes (e.g., Health, Air quality, Education, Employment, Fresh water, Housing and Forests).

As a way of conclusion, like the numbers registered in Portugal, the associations and volunteer activity are considerably low, especially in the elderly population.

Sustainable development should be analysed as a global process, which seeks coordination between the social, economic and ecological aspects of a given society located in a given region. It is important and urgent to seek the social cohesion and quality of life of the elderly, namely quality public spaces, integration and social inclusion, increase in health services, among others, through policies (global or local), while respecting the specific needs of each region.

The pace of population ageing is much faster than in the past. In the Decade of Healthy Ageing (2021-2030), the elderly are "pieces" fundamental for the SDGs achievement. That is, creating the same opportunities to ensure that ageing population fully develop their human potential, but also fully and effectively enjoy their human rights.

6. Acknowledgement

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TRACK 8
Social foundations of sustainability

8b. Communication for sustainability

Abstracts

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Communication of sustainability and the Impact on the Consumer Behavior: Study Case ISTO. Brand

Professor João Simão, Mariana Pereira
Faculdade de Ciências Humanas / Universidade Católica Portuguesa, Lisboa, Portugal

Abstract

Sustainable communication is increasingly utilized as a strategy by brands to draw attention to sustainability, as well as to increase proximity to their consumers. This communication lead by sustainable portuguese fashion brands can be perceived as a useful tool in changing the paradigm of consumer behavior, since it alerts for the problems of the fashion industry, demonstrating the importance of sustainability in this sector. Individuals exposed to this communication may adopt a more conscious and responsible behavior.

The present study is focused on a portuguese brand – ISTO. – and its impact in the behavior of consumers and potential consumers, understanding whether or not they change their behavior due to this communication. It was intended to understand if ISTO. has an impact on the fashion industry, presenting innovation and demonstrating the importance and possibility of sustainability in this sector, as well as understanding the value that consumers and potential consumers attribute to the brand's sustainability. Another focus of this study was to conclude if consumers and potential consumers of ISTO. perceived it as a reference brand in the set of sustainable portuguese fashion brands.

Regarding data collection, it was carried out an exploratory analysis of the brand, especially of its communication, complementing it with an exploratory interview to the Marketing Experience Manager of ISTO., in order to get an internal perspective of the brand. An online questionnaire was implemented to consumers and potential consumers of ISTO., collecting and analysing the external perspective. The research question that conducted the present study was: "What is the impact that the sustainable communication of ISTO. has in the behavior of its consumers and potential consumers?", where the main results revealed that the sustainable communication of this brand has a positive impact on the behavior of its consumers and potential consumers, leading them to change their daily behavior, acting more consciously and responsibly towards sustainability, not only in moments of purchase but also in other daily activities.

This study and our results also help us to better understand two of the big Ps of SDGs, people and planet, specially regarding the consumption of sustainable brands. The focus is mainly on Goal 12 (Ensure sustainable consumption and production patterns) and specially the Target 12.8 (By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature).

Keywords: Sustainability, Communication, Fashion Industry, Sustainable Portuguese Brands, Consumer Behavior

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Content analysis for the promotion of geotourism in the UGGp Network websites in Latin America

Ph.D. Paúl Carrión-Mero[1,2], Mr. Jairo Dueñas-Tovar[1,3,2], Ms. María Jaya-Montalvo[1,2], Ph.D. Fernando Morante-Carballo[1,3,4], Ph.D. Gricelda Herrera-Franco[5]
[1]Centro de Investigación y Proyectos Aplicados a las Ciencias de la Tierra (CIPAT), Campus Gustavo Galindo, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador. [2]Facultad de Ingeniería en Ciencias de la Tierra (FICT), Campus Gustavo Galindo, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador. [3]Geo-recursos y Aplicaciones (GIGA), Campus Gustavo Galindo, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador. [4]Facultad de Ciencias Naturales y Matemáticas (FCNM), Campus Gustavo Galindo, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador. [5]Facultad de Ciencias de la Ingeniería, Universidad Estatal Península de Santa Elena (UPSE), La Libertad, Ecuador

Abstract

Geoparks are areas defined by singular geological diversity (geoheritage) elements that integrate added value to local communities, including geotourism (geological tourism). For these territories to gain visibility, websites are valuable resources for enhancing geoheritage and promoting geotourism services to users. However, conducting a transversal evaluation of the geotourism elements present is necessary for effective dissemination to the public. This work aims to evaluate the presence of geotourism information using evaluation criteria based on UNESCO technical specifications through a rubric in the UNESCO Global Geoparks (UGGp) Network in Latin America (LATAM) for the development of communication strategies. The workflow consisted of three stages: (i) criteria selection, (ii) LACGN website assessment, and (iii) analysis and development of strategies. Overall, the study assesses 11 websites of the UGGp Network in Latin America. The average results of the evaluation criteria showed a measure of the diversity of the content present in the three geotourist profiles: i) geospecialist (57.09 %), ii) interested visitor (59.68%), and iii) general visitor (59.59%). It is verified that the UGGp websites reflect an interaction and development work aligned to Sustainable Development Goals (SDG) 8, 10, 11, 15 and 17, highlighting the link with strategic targets and the reality of the geopark and its surroundings.

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Information Value Chain Management: A Critical Element in Disaster Risk Reduction

Ms. Amrita Dhiman[1], Dr. Ashish R Sinha[2]
[1]Development Management Institute, Patna, India. [2]National Institute of Technology, Patna, Patna, India

MS. AMRITA DHIMAN

DR. ASHISH R SINHA

Abstract

It is a well-known fact that information and knowledge play a critical role in society's and the individual's progress. There is enough evidence that timely availability and accessibility to information and knowledge can help reduce the loss of life and property due to disasters as it facilitates informed decision-making and coordinated action by all the stakeholders. Information is critical in policy-making to implementation and ultimately benefit the people.

The idea of value chain further emphasizes the customer viewpoint in terms of identifying the right information required and providing the same in a desired way which in turn has the potential to trigger the desired response and repeating it may lead to lasting impacts and changes. The Sendai Framework on Disaster Risk Reduction 2015-2030 further emphasized on the need to accentuate the network and systems for better outreach of disaster related information to people.

This paper attempts the potential conceptualization of the idea of information as value for the disaster affected people and how emphasizing and developing on the idea of information value chain shall help minimize the risk of disasters. It is based on experiences and instances of disaster risk reduction initiatives and activities in the state of Bihar, highlighting the importance of the information value chain in disaster risk reduction. A better conceptualized and integrated information network can facilitate better policy making and implementation of schemes on the ground and equip the people to develop disaster resilience in a sustainable way.

Key words: Information Value Chain, Value Chain Management, Disaster Risk Reduction, Information Network, Resilience

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ARE WE NASTY? THE IMPACT OF DIGITAL HATE SPEECH TOWARDS CYBERSPACE SUSTAINABILITY IN MALAYSIA

Dr Norena Abdul Karim Zamri[1], Mr Faisal Mohd Amin[2], Dr. Nasliza Arina Mohamad Nasir[3]
[1]Universiti Kebangsaan Malaysia, Selangor, Malaysia. [2]Unirazak, Kuala Lumpur, Malaysia. [3]Universiti Teknologi MARA UiTM, Melaka, Malaysia

DR NORENA ABDUL KARIM ZAMRI

Abstract

The widespread expansion of social media outlets has enabled the spread of disinformation, hate speech and extremist narratives online. Moving beyond the Euro-America hate speech phenomenon, cross cultural nuanced by ethnography has evolved in Malaysia. As a result, it appears that preventing discrimination, dehumanization, and incitement to violence while maintaining individual freedom of expression is a challenge, particularly in the pursuit of democracy and the development of a sustainable cyberspace environment. Hence, there is a significant knowledge gap regarding the impact of hate speech towards cyberspace sustainability, with few studies that look at their impact and effectiveness. The study interrogates the nexus between hate speech and extremism and its implications for sustainable development and democracy in Malaysia. Focus group discussions (FGD) among experts and academics were held to gather their perspectives on this phenomenon, and the data was analyzed thematically. A cursory examination reveals a long-standing concern about the dangers of free speech in situations where it can spark ethnic and religious conflict, mass violence, and social unrest. This study demonstrates that understanding user cultures, technology, and specific political contexts will enable moral change in situations where the pressures of incivility and subjugated knowledge have emerged and erupted into the mainstream. This research contributes to Agenda 2030, which is embedded in the United Nations Sustainable Development Goals (SDG) 16 and is critical in promoting inclusive societies with integrity at multiple scales especially in maintaining sustainability in Malaysia cyberspace.

Full Papers

Content analysis for the promotion of geotourism in the UGGp Network in Latin America

Paúl Carrión-Mero[1,2,*], Jairo Dueñas-Tovar[1,2,3], María Jaya-Montalvo[1,2], Fernando Morante-Carballo[1,3,4] and Gricelda Herrera-Franco[5]

[1] Centro de Investigación y Proyectos Aplicados a las Ciencias de la Tierra (CIPAT), Campus Gustavo Galindo, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador
[2] Facultad de Ingeniería en Ciencias de la Tierra (FICT), Campus Gustavo Galindo, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador
[3] Geo-recursos y Aplicaciones (GIGA), Campus Gustavo Galindo, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador
[4] Facultad de Ciencias Naturales y Matemáticas (FCNM), Campus Gustavo Galindo, Escuela Superior Politécnica del Litoral, Guayaquil, Ecuador
[5] Facultad de Ciencias de la Ingeniería, Universidad Estatal Península de Santa Elena (UPSE), La Libertad, Ecuador

[*] Corresponding author's e-mail address: pcarrion@espol.edu.ec (P. Carrión-Mero)

Abstract. Geoparks are areas defined by singular geological diversity (geoheritage) elements that integrate added value to local communities, including geotourism (geological tourism). For these territories to gain visibility, websites are valuable resources for enhancing geoheritage and promoting geotourism services to users. However, conducting a transversal evaluation of the geotourism elements present is necessary for effective dissemination to the public. This work aims to evaluate the presence of geotourism information using evaluation criteria based on UNESCO technical specifications through a rubric in the UNESCO Global Geoparks (UGGp) Network in Latin America (LATAM) for the development of communication strategies. The workflow consisted of three stages: (i) criteria selection, (ii) LACGN website assessment, and (iii) analysis and development of strategies. Overall, the study assesses 11 websites of the UGGp Network in Latin America. The average results of the evaluation criteria showed a measure of the diversity of the content present in the three geotourist profiles: i) geospecialist (57.09 %), ii) interested visitor (59.68%), and iii) general visitor (59.59%). It is verified that the UGGp websites reflect an interaction and development work aligned to Sustainable Development Goals (SDG) 8, 10, 11, 15 and 17, highlighting the link with strategic targets and the reality of the geopark and its surroundings.

1. Introduction

Geoparks are defined geographic spaces that present a remarkable megadiversity, containing natural and cultural values that promote the empowerment of local communities to achieve sustainable development (UNESCO, 2017; Herrera-Franco, Erazo, *et al.*, 2021; Herrera-Franco, Montalván-Burbano, *et al.*, 2021; Herrera-Franco *et al.*, 2022). One of the alternatives is geotourism, which is a key term for combining tourism promotion elements with responsible practices for protecting and managing geological heritage (Dowling and Newsome, 2010).

In this sense, the Global Geoparks Network (GGN) began as an international network where its members interacted with each other under a concept of local development based on the transmission of experiences using geoheritage (Zouros, 2017). However, in 2015, UNESCO developed the Global Geoparks Network (UGGp), which offers its members recognition as areas of international geological significance with specialized support in assessing and managing natural elements. Over time, the number of members has increased, grouping more than 170 geoparks in 40 countries (UNESCO, 2022b).

The UGGp Network promotes topics on the Protection of Cultural and Natural Heritage, Climate Change, Geohazards, Education and Sustainability. (Silva and Sá, 2018). For this reason, the need for visibility arises through these themes where geosciences play a leading role, and it is an invaluable opportunity for the engagement of the general public in taking advantage of the benefits of the natural environment (Stewart and Lewis, 2017).

The establishment of effective communication strategies should address promotional needs. However, one limitation is that many geoparks still need an official protection figure (e.g. Reserves or Natural Parks) (Martini, 2009). Under these management figures, there are common frameworks for action and promotion that allow the establishment of activities and roles to promote sustainable tourism. In this context, their main concern focuses on the effects of the massive presence of visitors as a risk factor for protecting the most vulnerable elements of the natural environment (Newsome, Dowling and Leung, 2012; Aguilar-Aguilar *et al.*, 2023).

Like other types of communication in natural issues, geoscience communication is a promoter of geological heritage. It must be an element of persuasion to direct attitudes and perceptions in different action scenarios (Stewart and Hurth, 2021). Hurth and Whittesea (2017), define several paradigms in geoscientific communication. One of them is "Guide and Co-create", which uses marketing as an instrument of "societal leadership" at different levels adapting human behaviours towards forms of consumption fixed by a concept of sustainable well-being.

The existing forms of communication reflect the need to transmit awareness and visibility of geoscience issues to a broad audience (Liverman, 2008). Globally, there are successful communication practices such as the “ABC” Concept, which integrates three Abiotic, Biotic and Cultural approaches (Pásková *et al.*, 2021). This concept integrates these three axes to conceive the geopark as a "product" in a context where individual services for visitors combine with the added value provided by the natural theme of the geopark.

Several studies agree that no single profile of a "geotourist" exists. Hose (1996) distinguishes two types. The first is the "Learning geotourist", which responds to a need to acquire knowledge about abiotic elements. In contrast, the "Recreational geotourist" is interested in recreation services provided by nature. Grant (2010) makes a hierarchical visitor typology by the inverse relationship between the degree of interpretation of the natural environment and the sector's recreation. Kim and Brown (2012), define three types (Geotourists, independent explorers and general visitors) according to the level of knowledge and interest in the elements and services derived from geotourism. Hurtado, Dowling and Sanders (2014) make a four-level classification according to the visitor's interest. On the other hand, Vasilijević et al. (2018) defined five classes originating from visitors' attitudes towards the natural environment.

Worldwide, UNESCO recognizes four regional UGGp networks. In Latin America, the LACGN “Latin America and Caribbean Global Geoparks Network” was founded in 2017, under the sponsorship of the GGN, by four UGGp: Araripe, Grutas del Palacio, Comarca Minera and Mixteca Alta (Rosado-González, Sá and Palacio-Prieto, 2020). The network's operating rules allocate a chapter to disseminating and communicating member activities (Chapter V) (Red GeoLAC, 2018). This chapter includes obligations to provide information in different formats (e.g. photos, leaflets, products), in any of the official languages (Spanish, Portuguese and English), whose digital version must be found on the website of each geopark member.

However, despite the important advances in the availability of information about Global Geoparks, there are development opportunities for the continuous improvement of the general quality of the websites towards end users, regardless of their level of knowledge about geoscientific issues through geotourism strategies.

Web content analysis is vital for understanding current communication approaches in geoparks. For this reason, this work addresses the following research question: Do the UGGp websites in Latin America exhibit reference patterns for examining the region's geotourism promotion content? Consequently, the main objective of this study is to analyze the quality of the geotourism content present on the websites of the UGGp Network in Latin America through the selection of transversal evaluation criteria that allow the identification of key elements of public awareness and the generation of strategies for the continuous improvement of the present web information.

2. Literature Reviews

Promoting geoheritage online can be achieved through various means, mainly through maps, posters, information boards, and websites (Santos *et al.*, 2018). A destination website has become a crucial brand channel (Lee, Cai and O'Leary, 2006) that contains the necessary information for tourists (Bastida and Huan, 2014). Since the 1990s, academic researchers have highlighted the importance of evaluating website effectiveness. Lu and Yeung (1998) pioneered commercial web application development by presenting a comprehensive framework to assess website performance. The framework measures the effectiveness of a website by evaluating its functionality and ease of use, thus estimating its usefulness. Rozenkiewicz, Widawski and Jary (2020a) highlighted that the website's content is as important as its level of interactivity. There are different approaches to evaluating websites in the scientific literature. Chiou, Lin, and Perng (2010) presented five classifications based on: i) usability and website design (Roy, Pattnaik and Mall, 2017; Paul and Das, 2020), ii) content (Penney et al., 2011), iii) quality (Moreno et al., 2010), iv) user acceptance (Abdul Hamid et al., 2019) and v) user satisfaction (Sørum, 2011).

Within tourism research, Law, Qi and Buhalis (2010) classify website methodologies into five groups: i) counting (a method that uses a checklist and focus group as a research tool (Bai, Hu and Jang, 2007; Xiong *et al.*, 2009)), ii) user judgment (technique based on user satisfaction or perceptions), iii) automated (software capable of capturing technical characteristics, such as response time, compliance with linguistic standards, or consistency structure (Chan and Law, 2006)), iv) numerical computation (a method that uses mathematical functions to calculate the performance of the tourism website (Költringer and Dickinger, 2015)), and v) combined method (the approach that employs more than two methods at the same time (Song, Gao and Lin, 2013)).

In the context of geotourism, "geological tourism" (Hose, 1995), Rozenkiewicz, Widawski and Jary (2020b) carried out a study for the analysis of the descriptive content of the georesources presented on the official websites of the National Tourism Organizations (NTOs) of the Czech Republic, Poland and Slovakia. This study evaluated the content of the NTOs in seven categories such as consistency of location of georesources; content in English; search engine results; presence and validity of hyperlinks on geoheritage; availability of mobile applications; accuracy and cohesion of the information, and finally, level of accuracy of the language (Rozenkiewicz, Widawski and Jary, 2020b). On the other hand, Fox et al., (2022) studied the relationship between geodiversity and Cultural Ecosystem Services (CES) with hiking in Wales (United Kingdom), analyzing the images available on the Flickr website using the "photosearcher" package in the R environment. Other authors, such as (2021a) conducted a geolocalized content analysis to identify brand personality characteristics in three categories of webpages (DMO, commercial, and editorial) of notable volcanic geotourism locations such as Iceland, the Azores, and the Canary Islands. Tiago et al., (2021b) identified different brand positions and points of differentiation among the three destinations, highlighting the need to promote volcanic geotourism.

In terms of the UNESCO Global Geoparks (UGGp) network, Doyle (2021), in his review, highlights that geoheritage elements (fossils) have limited exposure on Geopark's websites and social media platforms. Abdul Halin and Ishak (2017) presented a study on community participation in geoheritage conservation on 50 UGGp websites in Asia. Pereira et al. (2011) globally evaluated the content of 77 websites based on 67 criteria grouped into seven indicators that range from the presence of the term geopark in the official name and homepage to its scientific content. Ruban and Yashalova (2018) identified that 41% of 140 geopark websites use "geodiversity" as the equivalent of geological heritage. More recent studies, such as Garipova and Bogdan (2022a), have explored the content of protected area websites, including geoparks, and the implementation of geocultural markings in Tuva and Bashkortostan (Russia). Among the problems detected by Garipova and Bogdan (2022b) are the high investment and the isolation of information from the media, and it was highlighted that the geopark project is profitable compared to other forms of organization of geocultural objects (e.g., natural parks).

Information from websites can also be used to study geological time, Ruban (2016) analyzed the content of 120 global geoparks and stressed that UGGp websites must offer a consistent professional interpretation of geological time, promote adequate information on the ages of rocks and fossils, and offer tourism programs focused on understanding the chronology of geological history. Molokáč *et al* (2023) designed a 4P marketing matrix. They evaluated the websites of 77 members of the European Geopark Network (EGN), indicating that EGN geoparks are at the level of classic marketing with low or passive activity on their official platforms. Various studies have evaluated UGGp websites globally and others

for a specific objective, and the design and information present in the interface of geopark platforms contribute to promoting geotourism, educating visitors, promoting sustainability, and raising awareness of geological heritage. The qualitative, quantitative, or combined evaluations of UGGp websites allow the detection of weak pillars and the establishment of strategies to improve the user experience and the quality of the interface, achieving effective communication of geoheritage values.

3. Methodology

Assessing the geotourism content of UGGp websites in Latin America used semiquantitative analysis to generate new insights for geoscience public communication. This study comprises three stages (Figure 1): (i) selection of geotourism content evaluation criteria, (ii) LACGN website assessment, and (iii) analysis and development of strategies.

3.1 Stage I: Criteria selection

In this stage, the measurement indicators were chosen according to the current trends in evaluating and reviewing web content on natural and cultural heritage. The study considered the main user profiles to exploit the territory's natural benefits. In this sense, the experiences focused on geoparks were considered the same as in other works that include similar approaches in natural areas with official protection (for example, Natural Parks) and UNESCO official designations, such as Biosphere Reserves and World Heritage Sites. In addition, a checklist defining an aspiring UNESCO Global Geopark (aUGGp) (UNESCO, 2022a) was reviewed. Thirty-one indicators were established using binary ratings of 1 (Yes, it complies) and 0 (it does not comply). Table 1 presents the indicators selected for the evaluation of the LACGN websites.

3.2 Stage II: LACGN websites assessment

At this stage of the study, there were two differentiated phases. First, the network websites were examined using search engines and official information on GGN and UGGp. The study covered as many websites as possible, and web availability was considered during the inspection period (December 2022-June June 2023). Finally, with the final list, the websites were evaluated (Table 2) based on the metrics designed in Stage I.

3.3 Stage III: analysis and development of strategies

Finally, the results obtained by applying the metrics established in the previous study stages were analyzed, the interests and preferences of each visitor profile were highlighted, and recommendations were developed to improve the websites of the study geoparks. In addition, affinities were identified with the main Sustainable Development Goals (SDG) promoted by the LACGN, as highlighted in related research (Rosado-González, Palacio-Prieto and Sá, 2020; Rosado-González, Sá and Palacio-Prieto, 2020; Lama-Larenas *et al.*, 2021; Rosado-González *et al.*, 2023).

4. Results and Discussion

4.1 Geoparks links examination

This study examined the availability of geopark websites between December 2022 and June 2023. In exploring the Latin American geoparks websites, nine of the ten existing as of March 2022 were initially considered within the evaluation. However, this number increased in May 2023, with the designation of two new geoparks to the UGGp Network: Caçapava and Quarta Colônia (Brazil), giving a total of 11 UGGp websites evaluated (See Table 2).

4.2 Evaluation by geotouristic profile

Due to the transversal nature of the geotourism concept, the analysis of the information evaluated elements present in websites through the conception of different visitor profiles. Therefore, this study focused on analyzing the characteristics based on three types of visitors according to the main interests identified by previous relevant studies:

- Geospecialist: This profile identifies individuals who have considerable knowledge in geosciences, especially those who have a higher academic degree (Young Career geoscientists, Masters and Doctoral candidates/graduates), whose need is to obtain transversal information on

the natural system of the territory in symbiosis with the contribution of the cultural factor generated from the local communities.

- Interested visitor: Include those visitors who, without having a solid academic background or failing that, being in development, present an acceptable level of interest in any of the elements and premises promoted by the geopark. Among the people who can be part of this group: are bachelor students in the areas of interest of the geopark (e.g. geosciences, biology, anthropology), enthusiasts for internationally recognized spaces (e.g. UGGp, World Heritage Site) and nature-aware visitors.
- General visitor: Within this profile are potential users who do not have as a priority obtaining a rigid interpretation of the natural environment of the geopark, taking advantage of the added services inspired by nature in the form of a "product". Within these services are guided tours, leisure, and sports activities. The most notable examples of profiles in this category are occasional visitors, enthusiasts of outdoor activities and local tourists.

4.2.1 Geospecialist. This profile was evaluated through 25 indicators originating from a total of 31 (See Table 1), considering their selection according to the availability of technical information and descriptions with a strong scientific basis of the natural environment of the geopark according to the themes promoted by the UGGp Network.
Figure 2 shows the results on the 11 geoparks of the network, displaying a homogeneous behaviour in most of the websites evaluated. In eight out of 11 geoparks, there was a trend towards values close to 15 points, evidencing that, in general, for this type of profile, geoparks have a level of compliance of at least 60% of the evaluation indicators suggested by this study. In the same way Table 3, in the evaluation, the geoparks: Quarta Colônia and Southern Pathways stood out, which presented 20 of the 25 indicators, resulting in an 80% presence within their respective websites.

4.2.2 Interested visitor. For this profile, 23 indicators were selected (See Table 1). The selection criteria applied included two sets of approaches of interest. The first considered the information metrics that detail the more generic aspects of the geopark as a promoter of the diversity of the territory (e.g. Biotic and cultural issues, social participation opportunities). In contrast, The second approach comprises services available to enrich the visitor experience in the geopark (e.g. tourist partners and leisure/sport activities). The compliance results of the 23 indicators show a more defined heterogeneity than the previous profile (See Figure 3), where most of the geoparks present slightly lower compliance than the previous profile, of approximately 50% of the metrics suggested. The Quarta Colônia and Southern Canyons Pathways geoparks repeated maximum metric compliance (avg. 87%) (See Table 3).

4.2.3 General visitor. It is considering the nature of a general visitor whose interest does not prioritize interpreting and knowing specific geoparks themes. The selected metrics focused on reviewing elements that examine the presence of information on elements and services that make the presence of recreation within the territory visible. This profile had the least metrics compared to the previous ones, where 18 indicators were selected (See Table 1).
Figure 4 shows that the collective performance based on the selected indicators was an average of 10 out of 18 metrics, resulting in an approximate average of 56%. However, the individual analysis of each of the individuals shows differences between scores. Table 3 shows that, like the two previous profiles, the Quarta Colônia and Southern Canyons Pathways geoparks had a high percentage of compliance, above 90%. Simultaneously, there were seven geoparks with a 50 to 66% compliance percentage. From another perspective, two geoparks (Colca and Volcanes de Andagua and Comarca Minera, Hidalgo) were the only ones that presented results that offered a development opportunity (less than 50% of the total).

4.3 Insights and recommendations for future websites

Effective science communication requires alignment with the social, economic, political, and cultural frameworks that can propel people to social action on climate change (Nisbet *et al.*, 2010). The 2030 Agenda for Sustainable Development, which comprises 17 main goals, also considers different programs and initiatives that seek improvements in education, the environment, health, and well-being, including

the Paris Climate Change Agreement (PA) (United Nations, 2023). In addition, five important sectors of action (5P) are recognized (People, Planet, Prosperity, Peace and Partnerships) (United Nations, 2015). The UGGps, with their bottom-up (Ferraro *et al.*, 2020) and holistic approach, contribute to the 5Ps (United Nations, 2015) in i) promoting community participation, education, and the preservation of cultural heritage; ii) creating awareness about the importance of geology, geological processes, and the history of the Earth, contributing to the conservation of the geological and environmental resources of the planet, iii) attracting visitors interested in geotourism, ecotourism, and cultural exchange, thus generating economic benefits for communities within and surrounding the geopark boundary; iv) fostering cooperation and peacebuilding between communities and stakeholders involved in the geopark; and v) providing spaces for developing strategic alliances between stakeholders (companies, academia, government agencies, community organizations, and environmental entities) in search of sustainable development. The UGGps websites generate spaces to display the geopark's relationships with the 5Ps recognized by the United Nations. Its content and functionality are crucial for promoting the role of communities, education about risks and geological resources, and linking visitors with geological heritage.

The study by Rosado-González, Sá and Palacio-Prieto (2020) on the LACGN and its contribution to the SDGs consider that the surveyed geoparks have the greatest benefits in SDGs 5 ("Gender equality"), 8 ("Decent work and economic work"), 10 ("reduced equality"), 11 ("Sustainable Cities and Communities"), 15 ("Life on land") and 17 ("Partnerships for the goals"). In particular, SDG 8 is the target where websites can contribute to disclosing geoproducts and provide a platform for local entrepreneurs, including community members, to market and promote their products. Websites can generate tools, such as online stores or gift shops, geoproduct catalogues, feedback mechanisms, information on success stories, and other details about where geoproducts can be purchased, thus facilitating market access for entrepreneurs. The study findings revealed that only 45% of the evaluated LACGN websites had geoproduct sections. In addition, 36%, 45%, and 45% of respondents presented information on restaurants, accommodation, and transportation, respectively. Similar to the research of Molokáč et al., (2023) highlighted in their evaluation of EGN member websites, where they pointed out that marketing efforts are unidirectional.

The three types of profiles identified in the study and the results of the evaluation of the indicators (Figures 2-4) show that, in general, the LACGN websites have aligned information for geospecialist, interested visitor, and general visitor, highlighting that the websites of the geoparks Southern Canyons Pathways (Brazil) (*canionsdosul*, 2023) and Quarta Colônia (Brazil) (*geoparquequartacolonia*, 2023) have the highest fit in the spider diagrams (Figures 2-4) reflecting the high concentration in the number of indicators. In contrast, the website of the Colca and Volcanes de Andagua Geopark (*geoparquecolcayvolcanesdeandagua*, 2023) requires greater efforts to generate communication tools on its platforms that capture the interest of each geotourist profile.

Effective communication for the three proposed geotourist profiles allows contribution to SDG 10 (developing inclusive and equitable environments within the geopark), SDG 11 (encouraging the spread of sustainable practices, eco-lodges, community-led projects, and educational programs), SDG 15 (educational material on environmental education, events, or information of interest on endangered species), and SDG 17 (highlighting joint initiatives such as the friends of the geopark program that some members of the LACGN have on their websites. Mixteca Alta UGGp (*amigosdelgma*, 2023), Imbabura UGGp (*geoparque.imbabura*, 2023)). The challenge for LACGN websites is to highlight the contributions of women in geoparks (SDG 5), not only by evaluating gender composition in the UGGp management structure (Friedrich Garcia, L. Henriques, 2022), but also by including sections within the website interface that show stories, interviews, profiles of women geoscientists or community leaders, and actions that celebrate women as presented by the Tumbler Ridge UGGp (*tumblerridgegeopark*, 2023).

The communication of the LACGN websites must be bidirectional and adapt marketing efforts to construct links in the three types of geotourist profiles proposed. Spaces must be opened to promote sustainability in general and tools to understand the needs of different audiences. The effective communication of the contribution of the SDGs on the Geopark website demonstrates UGGp's commitment to sustainable development and its efforts to address the planet's social, economic, and environmental challenges.

5.Conclusion

Geopark websites in Latin America offer an interface with diverse content of interest in three geotourist profiles: i) geospecialists, ii) interested visitor, and iii) general visitor. By addressing each profile's specific needs and interests, 57.09% of the LACGN websites met the geospecialist indicators, 59.68% with the profiles of interested visitors, and 59.59% of general visitors. The website can effectively engage a wide range of people and contribute to achieving various Sustainable Development Goals, especially SDGs 8, 10, 11, 15, and 17. However, it is necessary to implement tools or applications that demonstrate the efforts and initiatives within the geopark to promote gender equality (SDG 5). In addition, only 45% of the evaluated websites presented information related to geoproducts. Including geoproducts within websites facilitates the exchange of knowledge and generation of commitment between the producer/seller and the consumer/visitor, leading to active marketing. This commitment increases visitor satisfaction and creates a sense of ownership and participation in geotourism.

A semi-quantitative methodology was applied to evaluate the members of LACGN websites in the three geotouristic profiles. Future studies must analyse usability and user satisfaction to ensure the interactivity and transmission of knowledge according to the geotourist profiles, in geological heritage and awareness of the risks associated with Earth's dynamic processes. Additionally, greater efforts are required to disseminate the cultural heritage of geoparks, considering the "bottom approach" promoted by UNESCO.

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FIGURES

Figure 1. Study stages in this research.

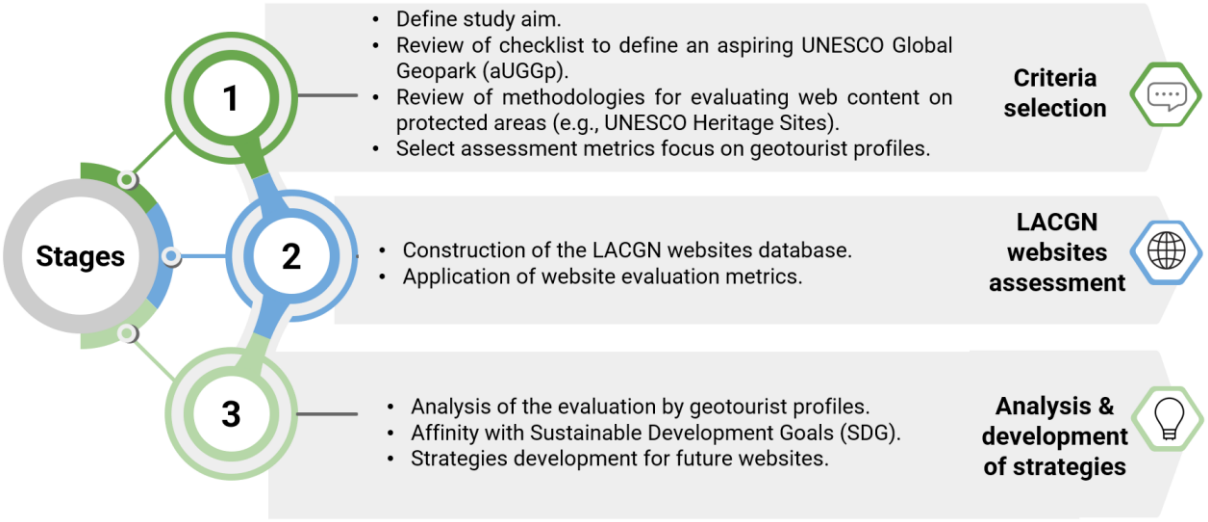


Figure 2. Total results for geospecialist tourist profile

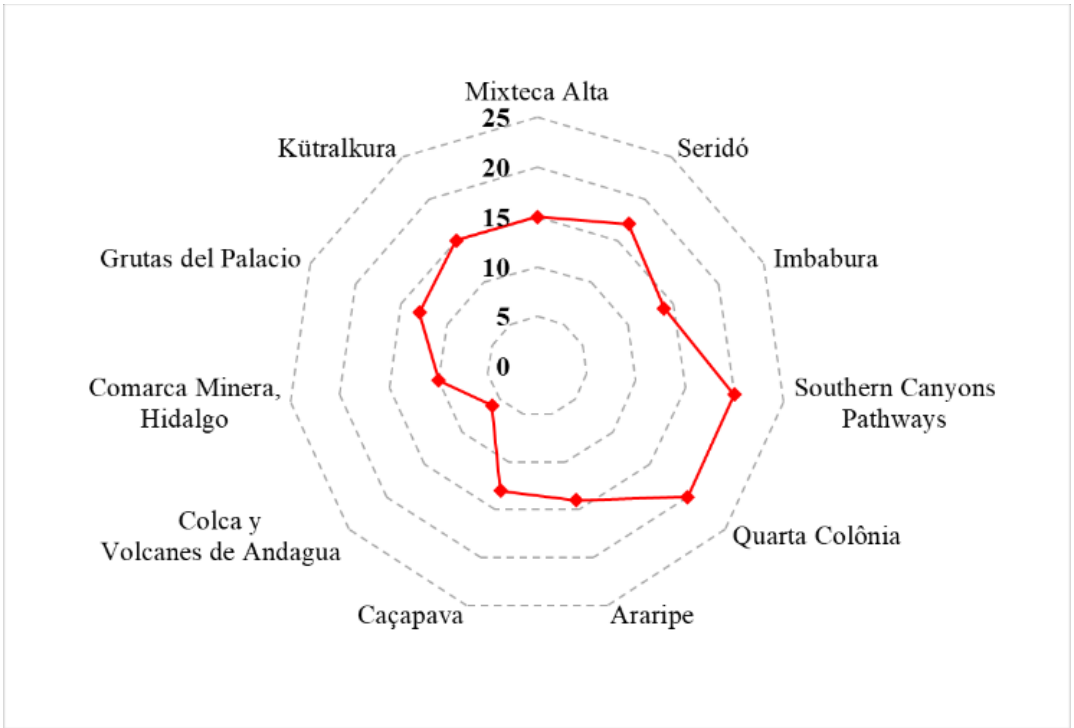


Figure 3. Total results for interested visitor geotourist profile.

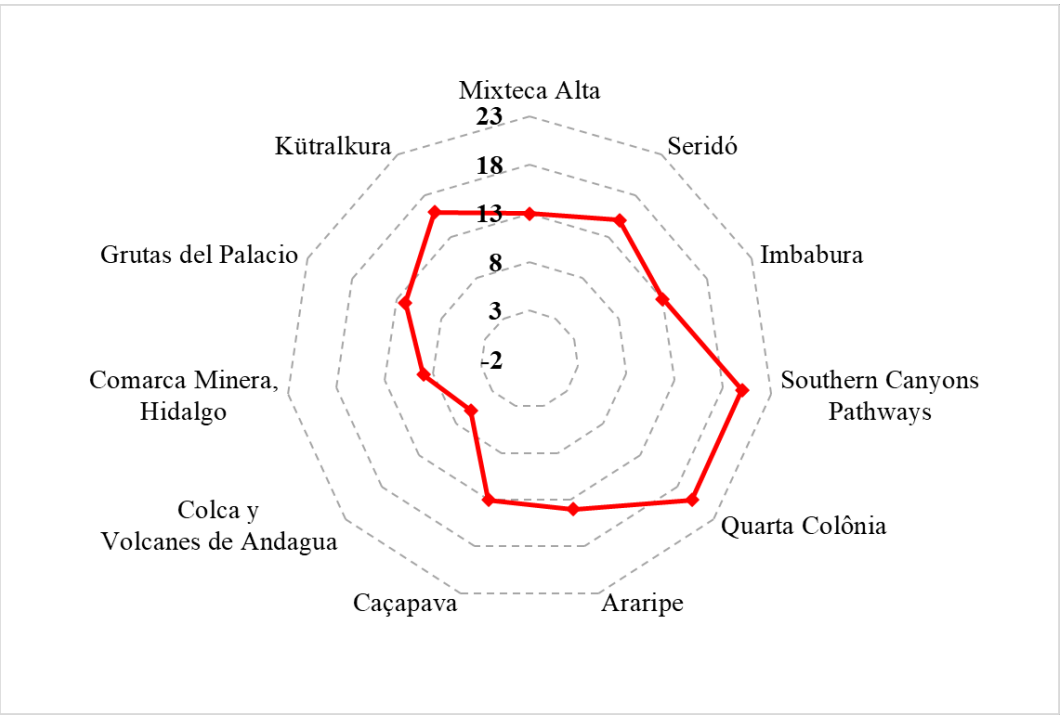
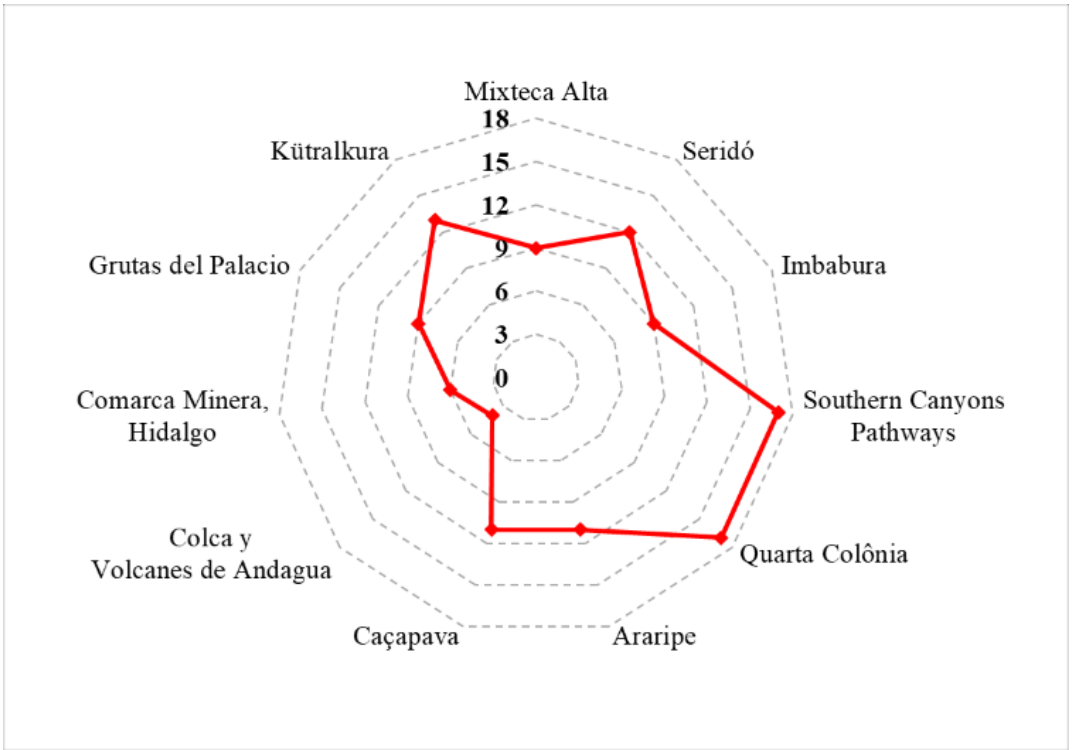


Figure 4. Total results for general visitor geotourist profile



TABLES

Table 1. Indicators by visitor profile.

No.	Indicator	Geospecialist	Interested visitor	General visitor
1	Scientific papers	X		
2	Information of Biotic Natural elements	X	X	X
3	Tangible Cultural elements	X	X	X
4	Intangible Cultural elements	X	X	X
5	Social Networks	X	X	X
6	Accomodation	X	X	X
7	Restaurants		X	X
8	Leaflets	X	X	X
9	Maps	X	X	X
10	Risks and Climate Change	X		
11	Sustainability	X		
12	News		X	
13	Geoproducts	X	X	X
14	Guided tours		X	X
15	Georoutes & Geotouristic trails	X		
16	Geosites (Inventory, General Specs)	X		
17	Contact information	X	X	X
18	Newsletter	X	X	
19	Leisure & Sport activities		X	X
20	Transportation	X	X	X
21	UGGp Branding (Logos)	X	X	
22	Events	X	X	X
23	Tourist partners		X	X
24	Partnership visibility (Local and Regional)	X		
25	Geological description	X		
26	Main UGGp information (What is?, Mission and Objective)	X	X	
27	Languages (plus one language apart from native)	X	X	X
28	Museums	X	X	X
29	Social Participation Opportunities	X	X	
30	Information centers	X	X	X

Table 2. List of geoparks evaluated by this study. Remarks: *Designated year on Global Geoparks Network,**Designated year on UNESCO Global Geoparks Network

UGGp Official Name	Country	Year designation	Link to website
Araripe	Brazil	2006*/2015**	http://geoparkararipe.urca.br/
Caçapava	Brazil	2023	https://geoparquecacapava.com.br/
Colca y Volcanes de Andagua	Peru	2019	http://www.geoparquecolcayvolcanesdeandagua.com/
Comarca Minera, Hidalgo	Mexico	2017	https://geoparquecomarcaminera.mx/
Grutas del Palacio	Uruguay	2013*/2015**	https://www.geoparque.uy/
Kütralkura	Chile	2019	https://kutralkura.cl/
Mixteca Alta	Mexico	2017	https://geoparquemixtecaalta.org/
Seridó	Brazil	2022	https://geoparqueserido.com.br/
Imbabura	Ecuador	2019	https://geoparque.imbabura.gob.ec/
Southern Canyons Pathways	Brazil	2022	https://canionsdosul.org/
Quarta Colônia	Brazil	2023	https://www.geoparquequartacolonia.com.br/home

Table 3. Evaluation results by geopark and profile

UGGp Official Name	Geospecialist (out of 25)	Interested visitor (out of 23)	General visitor (out of 18)
Araripe	14	14	11
Caçapava	13	13	11
Colca y Volcanes de Andagua	6	6	4
Comarca Minera, Hidalgo	10	9	6
Grutas del Palacio	13	12	9
Kütralkura	15	16	13
Mixteca Alta	15	13	9
Seridó	17	15	12
Imbabura	14	13	9
Southern Canyons Pathways	20	20	17
Quarta Colônia	20	20	17

TRACK 8
Social foundations of sustainability

8c. Just transition

Abstracts

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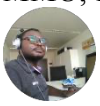
Reconceptualizing sustainability transitions in the context of capitalism

Dr. Bosco Bwambale
MMU, Fort Portal, Uganda



D R . B O S C O B W A M B A L E

Abstract

By portraying the dominant capitalist mode of (re)production as unstainable or destructive and proposing a transition from it to sustainable ways, sustainability transition mirrors Marxism. Marx(ism), though with occasional success, questioned capitalism and proposed a transition via scientific socialism upon which the proletarian consciousness facilitate the overthrow of the bourgeoisie to centralize means of production to society. It, thus, provides a suitable framework against which to gauge the success of sustainable transition as an anthesis to destructive capitalism. Here, one would expect a synthesis between capitalism and sustainability to hybrid, socio-ecologically sensitive, modes of production. From a triparted comparative analysis of sustainability, capitalism, and Marxism, sustainability discourse is noted to elaborate and justify content-wise that the political economy is necessarily socioecological and so modes of production should counteract destructive capitalism. Yet, there is hardly a clear theorized process to drive the pathway to that effect; moreover, sustainability transition debates barely elaborate on the epistemic foundation(s) required to counteract capitalism. Sustainability transition discourses are thus neither comparable to Marxism nor committed to alternatively engaging capitalism to systematically evolve hybrid modes of production; rather, they present a step, awaiting an epistemic methodology required to theorize strategies to counteract socio-ecologically destructive modes of production.

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Greenwashing in financing just transition: Potential solutions from an Islamic law perspective in Malaysia

NUR MOHD IQZUAN SAMSUDIN, Asma Hakimah Ab Halim, Rasyikah Khalid
UNIVERSITI KEBANGSAAN MALAYSIA, BANGI, Malaysia

Abstract

One of the most important strategies to fight climate change on a global scale is to finance 'just transition'. Insufficient holistic legislation framework and reckless green market participant conduct had rendered the plan problematic in light of the escalating greenwashing phenomenon. Since the Muslim world also plays a crucial role in this transition, this paper seeks to explore potential solutions through a critical legal analysis based on Islamic jurisprudence within the Malaysian federalism framework to combat greenwashing. All three levels of legal sources, which had arguably been successfully integrated with Islamic jurisprudence despite the need for further refinement, will be critically examined. Islamic jurisprudence refers to the theologico-ethico-legal (kalam-tasawuf-fiqh) tradition as interpreted within the Shafiite-Ghazalian school of jurisprudence (usul fiqh). This jurisprudential framework provides not only potential solutions for greenwashing through top-down 'hard law' instruments but also bottom-up 'soft law' instruments that provide profound theological and ethical principles that serve as a stable foundation for both Islamic environmental and financial law. Specifically, its broad legal structure in regard to the relationship of federal and state power includes feasible potential solutions. At the federal level, Islamic jurisprudence had already been integrated into civil court decisions in cases involving Islamic banking and financial markets via Syariah Advisory Council resolutions. At the state level, the same jurisprudence through gazetted fatwas in each state could empower the Syariah Court to liberalize its jurisdiction to include public matters pertaining to environmental issues and related financial or non-financial assets under state administration. In light of this, it is evident that the existing Islamic legal system has the potential to serve as one of several viable strategies to combat greenwashing phenomena that may undermine a just transition. Even though none of the SDG goals or indicators are directly related to the topic of this study, there are a few that are relevant, such as SDG+targets: 11.3, 11.a., 12.8., and 13.2. This article suggests potential solutions to the challenges that are hampering efforts to achieve the SDGs in the 5P context by examining alternative legal means for combating greenwashing.

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A critical discourse analysis of the just transition in South Africa

Dr Mbali Pewa[1], Professor Pauline Deutz[2]
[1]University of South Africa, Johannesburg, South Africa. [2]University of Hull, Hull, United Kingdom

Abstract

Recent studies have analysed the scope for a just transition toward a low carbon and climate resilient future in the context of the Global South. The idea of a 'just' transition is becoming more prevalent in policy text and political discourse; it calls for the distribution of societal risks in a way that is thought to be fair. This approach is particularly complicated and multifaceted for a nation like South Africa that is hugely dependant on a fossil fuel economy while most of the population live in energy poverty resulting from inequalities under apartheid. Therefore, pursuing a just transition in South Africa, means ensuring that those most affected by apartheid policies particularly women, children and poor are not disproportionality burdened by the negative impact of the shift towards a low carbon economy. The paper aims to deepen understanding of problems relating to the just transition, focusing on competing priorities that tend to marginalise non dominant groups. It uses critical discourse analysis to examine how government policy addresses the questions about historical responsibility and social justice. Neoliberal discourses linked to the political economy, nature, and top-down planning objectives as barriers to public participation and unequal power distributions emerged. This analysis demonstrates that despite drawing upon a transformative discourse to justify its vision, government policy serves to camouflage local development disparities, further exacerbating exiting forms of inequalities and injustices. Hence, the just transition policy needs to incorporate these critical perspectives in order to management potential social ill emanating from the envisioned transition. We recommend social protection policies as means of enhancing the shift while also helping to mitigate negative impacts such as high poverty levels and inequalities. In conclusion, intentional strategies that engage with inclusion, especially in relation to marginalised experiences of women's must be enacted for a just transition to be achieved.

Keywords: just transition, social justice, public participation

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Let Communities Lead: Stories and lessons on grassroots energy initiatives for sustainable futures

Dr Saurabh Biswas[1], Dr Davi François[2], Dr Clark Miller[3], Dr Mary Jane Parmentier[3], Dr Netra Chettri[3], Dr Witold-Roger Poganietz[2]
[1]Pacific Northwest National Laboratory, Richland, USA. [2]Karlsruhe Institute of Technology, Karlsruhe, Germany. [3]Arizona State University, Tempe, USA

Abstract

A sustainable planet will not be a reality unless millions of poor and vulnerable people in marginalized communities around the world are capable of pursuing sustainable development goals locally. Such a pursuit is possible by leveraging shared knowledge, infrastructure, and resources, including energy systems, in environmentally benign ways. The sustenance of high quality and productive energy systems, on the other hand, is conditional to the communities deriving a high degree of social and economic value from energy services, making them invested in the system's success. Ignoring and sidestepping this critical complementarity prevents thousands of vulnerable and poor communities from adopting clean energy systems and successfully pursuing sustainable development. Drawing from narratives from sixteen community energy systems from around the globe, the Let Communities Lead[1] initiative showcases how locally planned, clean energy investments in communities can be long-term investments in food security, socioeconomic opportunities, health and shelter, climate adaptation, community resilience, security, human rights, and democracy. Realizing such co-benefits of clean energy system are outcomes of a localized and bottom-up design which: (a) create new financial models that attribute significant value to community co-benefits, (b) build situated knowledge and coordination capacities within and around vulnerable communities, and (c) unleash the creativity and innovation of communities to lead the fight against climate change and the transition to a sustainable energy futures.Lessons from the Let Communities Lead case studies offer ways of knowing to transcend the poor understanding of local sustainability aspirations by top-down approaches to projects and policy. They draw attention to the importance of nuanced and explicit approaches to address the social, economic, cultural, infrastructural and governance attributes of resilient and sustainable futures in vulnerable places. The cases contrast how most institutional clean energy transition strategies are geared towards mitigation goals at the global scale but ill equipped to address urgent adaptations to climate vulnerabilities and enduring poverty at local levels. This report argues for filling this key gap in pursuing local clean energy transitions and sustainable development by putting communities at the center of the solutions to intersecting challenges (SDG) and enabling them to creatively imagine and build participatory and inclusive energy systems for resilient futures.

The paper highlights examples of intentional design of community energy systems linking SDG 7 with SDG 1 (targets 1.1, 1.4,1.5), SDG 2(targets 2.1,2.3, 2.4), SDG 3 (target 3.7), SDG 13 (targets 13.1, 13.3), SDG 11 (target 11. 1), SDG 16 (target 16. 7). It illustrates the options for filling the key gap in achieving universal SDG 7 by 2030, through programmatic approaches leveraging the 5P's of SDG.

[1]Biswas S., François D.E., Miller C.A., Parmentier M.J., Chettri N., and Poganietz W.R., (Eds.) (2021). Let Communities Lead: Stories and lessons on grassroots energy initiatives for sustainable futures. Center for Energy and Society, Arizona State University. https://letcommunitieslead.wordpress.com/

TRACK 9
Governance. Power and institutions

9a. Peace and sustainable development

Abstracts

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A REVIEW OF THE ROLE OF ANTI-CORRUPTION AGENCIES IN THE IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOALS (SDG)

Dr. Asmidar Lokman[1], Mr Mohd Idham Mohd Yusof[1], Mrs Shamsinar Rahman[2], Dr. Nurul Hidayana Mohd Noor[1], Mr. Mohtar Sani[3]

[1]UiTM, Seremban, Malaysia. [2]UiTM, Raub, Malaysia. [3]YARM, Seremban, Malaysia

DR. ASMIDAR LOKMAN

Abstract

The United Nations (UN) release of the 2030 Agenda for Sustainable Development in 2015 was the blueprint for peace, security, and prosperity for all in the world. The heart of the operation is the Sustainable Development Goals (SDG), built over decades of work by countries and the UN. Based on their strong institutions and the peace and justice principle, government institutions are the primary mechanism for mobilising the SDG at the country level. However, public institutions, including the anti-corruption agency, have been riddled with corruption problems. Corruption affects all SDG-related sectors, undermines development outcomes, and severely compromises efforts to achieve the SDG. The previous study, even though limited, discussed the roles of supervising and auditing agencies, such as anti-corruption agencies (ACA), in assisting SDG progression. This study looks at the roles that anti-corruption agencies in Singapore, Hong Kong, Indonesia, South Korea, Thailand, and Malaysia have played in moving the SDG16 forward. The review highlights the ACA's responsibilities in battling corruption and their intervention in the SDG implementation, which is relevant to SDG 16. Based on pre-determined criteria, journal articles portraying the ACA roles in the selected Asian countries were retrieved from the WOS and SCOPUS databases. The review also involved the SDG reports, mainly the Voluntary National Review (VNR), to identify the mention of ACA roles in the respective country's SDG implementation. The analysis focuses on the structure of the ACAs, roles, and functions. Several themes have emerged from this review in declaring the ACA roles in the SDG16 implementation: law enforcement, implementor and supervisory oversight, auditing, and administration. This paper is relevant for SDG 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. In particular, it focuses on SDG Targets 16.5, which is to "substantially reduce corruption and bribery," and 16.6, which is to "develop institutions that are effective, accountable, and transparent." This paper sheds light on the current state of ACA interventions for achieving the SDGs by using information from previous research and SDG reports. This paper suggests that ACA should be part of the National SDG governance structure and supervise SDG-related initiatives at the multi-governmental level as part of its accountability measures. Since 2030 is approaching, this paper could fill the dearth of literature, particularly in institutional capacities towards contributing to the "Prosperity, Peace and Partnership" of the SDGs.

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Adopting Agile Governance in Malaysia's Public Agencies: A Path to Achieving SDG 16

Mrs. Nor Hafizah Ibrahim[1], Prof. Dr. Zafir Khan Mohamed Makhbul[2]

[1]Faculty of Economics and Management, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia. [2]Graduate School of Business, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia

MRS. NOR HAFIZAH IBRAHIM

PROF. DR. ZAFIR KHAN MOHAMED MAKHBUL

Abstract

The Sustainable Development Goals (SDG) 16, also known as "Peace, Justice, and Strong Institutions," is a crucial agenda in promoting peaceful and inclusive societies, justice for all, and establishing effective, accountable, and inclusive institutions. To achieve these goals, public agencies play a crucial role in implementing policies and programs that promote sustainable development while ensuring that they are effective, transparent, and inclusive. However, public agencies in Malaysia face a range of challenges that impede their ability to achieve these goals. One of the main challenges facing public agencies in Malaysia is their inefficiency in service delivery and decision-making processes, leading to criticism and complaints from citizens. Moreover, the lack of transparency and accountability in traditional governance approaches can breed corruption, erode public trust, and disengage citizens from the governance process. This further undermines efforts to promote peace, justice, and strong institutions in Malaysia. Additionally, the rigid and bureaucratic traditional governance and the slow pace of digitalisation also contribute to the inefficiencies of public agencies, resulting in an inability to adapt to changing circumstances quickly. The paper advocates for the adoption of Agile Governance to overcome these challenges. Agile Governance is an approach that emphasises flexibility, collaboration, and continuous improvement. Adopting Agile Governance can bring numerous benefits to public agencies in Malaysia, including better decision-making processes, increased efficiency, and the ability to respond quickly to changing circumstances. Moreover, Agile Governance fosters transparency, accountability, and civic engagement, promoting public trust in the governance process. By adopting Agile Governance, public agencies in Malaysia can contribute to the achievement of SDG 16, thus promoting peaceful and inclusive societies, justice for all, and responsive and accountable institutions. This paper highlights the principles and practices of Agile Governance in promoting SDG 16 and provides a practical reference for development. Transforming public agencies to adopt Agile Governance is a promising solution to the challenges faced in achieving SDG 16 in Malaysia.

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Lending Your Ears to Parties in Community Mediation: Active vs. Passive Listening

Assoc. Prof. Dr. Rizal Rahman, Dr. Nur Khalidah Dahlan, Dr. Suhaizad Saifuddin
Faculty of Law, Universiti Kebangsaan Malaysia, Bangi, Malaysia

ASSOC. PROF. DR. RIZAL RAHMAN

DR. NUR KHALIDAH DAHLAN

DR. SUHAIZAD SAIFUDDIN

Abstract

Community mediation is a dispute resolution method that is increasingly being used in many countries, especially in Asia. It is a process where the parties involved in the dispute come together and work out an agreement with the help of a mediator. This mediator facilitates communication, encourages understanding between the parties, and helps them reach an agreement that everyone can live with. Community mediation has been found to be effective in resolving disputes quickly, efficiently and cost-effectively, while also preserving relationships between the parties involved. When a conflict arises, it is important to have a middle person who can be trusted to assist the parties in managing and settling the dispute. Such a person should be able to provide impartial advice and help in finding solutions that are beneficial for all involved. This requires a great deal of skill and experience, which is why it is often wise to resort to an experienced third-party mediator when conflicts arise within a community. More often, such a person will play the role of a mediator, be it formally or informally. One of the key skills that a mediator must possess is listening. While it is something that can be commonly applied in numerous conditions, the use of such a skill in a mediation process requires more engagement from the mediator. This article seeks to establish the need for a mediator in every single community mediation process to impart in active listening rather than passive in order to achieve positive results in mediation.

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"Closing the Gap: The Need for Military Prosecution Appeal Right to Ensure Exclusive Accessibility to Justice"

Ms Haslida Isamail, Assoc. Prof. Dr. Rizal Rahman, Dr. Muhamad Sayuti Hassan
National University of Malaysia, Bangi, Malaysia

Abstract

The military justice system in Malaysia differs from the ordinary criminal justice system in several aspects, including the availability of appeals. While the Public Prosecutor has the right to appeal against a court's decision, the right to appeal for the prosecution in a court-martial is absent. This paper aims to examine the absence of the military prosecution appeal right in Malaysia. This paper uses a doctrinal research methodology to explore and highlight the gaps in the current legal framework and compares it with the right of appeal available to the prosecution in the civil court system. The study found that the Malaysian military justice system does not provide the prosecution with the right to appeal against a court-martial decision. This absence of the prosecution's right to appeal hinders their ability to seek justice in the military justice system and goes against SDG Goal 16, which promotes peaceful and inclusive societies for sustainable development, provides access to justice for all, and builds effective, accountable, and inclusive institutions at all levels. This paper argues for the need to introduce a robust prosecution appeal right in Malaysia's military justice system that would help promote peace, justice, and strong institution.

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Securitization of the Blue Economy

Ms Irja Malmio[1], Dr Sebastian Thomas[2]
[1]Swedish Defence University, Stockholm, Sweden. [2]Curtin University, Melbourne, Australia

Abstract

The relationship between climate change and security has been identified as an important aspect of sustainability and sustainable development. Previous research highlights the close relationship between climate-related natural disasters and outbreaks of armed conflict and the fact that competing claims for natural resources can catalyze new clashes and deepen existing conflicts. The environment can be understood as a policy arena with compounding stressors – climate change, for example, has been described as a 'threat multiplier'. The ocean is arguably the most significant yet under-represented environmental domain in mainstream discussions of geopolitical security issues. The ocean contains 80% of all life on Earth and produces more than half of the oxygen we breathe. The ocean is also the dominant factor in the climate system, absorbing 90% of excess heat in the atmosphere. The global ocean economy is valued at more than USD 1.5 trillion per year. 90% of global trade by volume is carried by sea and 350 million jobs world-wide are linked to fisheries. Aquaculture is the fastest growing food sector and provides about 50% of fish for human consumption. The ocean is the primary source of protein for 3.5 billion people. 'Securitization' refers to the reformulation of societal issues as security concerns. This can legitimize undemocratic actions as responses to exceptional political circumstance. In this paper, we examine the securitization of the ocean realm, where impacts of climate change including sea level rise, acidification, deoxygenation, and pollution are interacting with economic, cultural, strategic, and political priorities. Economic activities and interests in economic development in the ocean have accelerated in the last decade, referred to as the blue acceleration or the blue economy. Subsequent initiatives, such as the UN Ocean Decade, have brought the ocean and its open nature to the forefront. Related to understanding international conflicts, the blue economy has also been moving from state-centric conceptions to a global understanding, further epitomized by the Ocean Treaty ratified on 4 March 2023. This treaty demonstrates an international recognition to take action on the existential risk presented by and protect the ocean and coastal ecosystems. The connection between security issues in the context of the blue economy has not been sufficiently covered in an academic context. Accordingly, this study explores security issues and sustainability in the emerging blue economy. The planetary and human risks that result from blue economy security dynamics, specifically conflicts between state and non-state actors, need to be better understood and discussed in international arenas. Considering security issues in an ocean context - described as securitization of the blue economy - includes critical questions about the relations between ocean industries, political boundaries, and jurisdictions while highlighting resource accessibility and governance that epitomizes questions of accountability and social equity. This study has direct and particular relevance to SDGs 7, 8, 9, 13, 14, and 16. We develop and present a conceptual framework with which to assess and understand securitization of the blue economy, consider existing threats and potential future crisis points, and identify a research agenda for future work.

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The Application of Futures Methodology in Understanding International Law and Emerging Issues in Peace and Conflict Resolution in the Muslim World

Associate Professor Norfadhilah Mohamad Ali, Dr Hendun Abd Rahman Shah, Dr Adibah Sulaiman @ Mohamad, Dr Baidar Mohammed Mohammed Hasan
Universiti Sains Islam Malaysia (USIM), Nilai, Negeri Sembilan, Malaysia

ASSOCIATE PROFESSOR NORFADHILAH MOHAMAD ALI

DR HENDUN ABD RAHMAN SHAH

DR ADIBAH SULAIMAN @ MOHAMAD

DR BAIDAR MOHAMMED MOHAMMED HASAN

Abstract

The Muslim world faces various conflicts that often impede its growth and prosperity. These conflicts have been resolved through the use of international law and peace conflict resolution, but it is frequently difficult to find long-term solutions due to the complexity of the problems. The article explores the application of futures methodology as a tool for understanding issues in international law and peace conflict resolution in the Muslim world. It examines the state of international law and peaceful conflict resolution in the Muslim world today and emphasises the difficulties encountered in resolving intricate conflicts. The methodology applied is based on futures methodology developed by renowned UNESCO futurist Professor Sohail Inayatullah. It includes the six foundational concepts (the used future, the disowned future, alternative futures, alignment, models of social change, and uses of the future) and six pillars (mapping, anticipating, timing, deepening, creating alternatives, and transforming) of futures studies. It also applies the futures wheel methodology to explore the impacts of emerging issues. The article presents case studies that illustrate the application of futures methodology in understanding conflicts in the Muslim world and marking its different futures scenario. It draws attention to the fundamental problems that underlie conflicts and the potentials for creating long-term solutions and the inter-connectedness with the dynamic development of international law. The article concludes that futures literacy offers a valuable approach for the Muslim world for anticipating future outcomes and developing innovative and sustainable solutions to complex conflicts. The case studies presented in the article demonstrate the possible contribution of this approach for the community and international peace.

Keywords: Futures methodology, International law, Peace conflict resolution, Muslim world.

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Futures Methodology for Mediators in Sulh and Mediation Conflict Resolution Practice

Associate Professor Dr Norfadhilah Mohamad Ali, Dr Hendun Abd Rahman Shah, Dr Mustafa 'Afifi Abdul Halim, Dr Norsuhaida Che Musa, Dr Adzidah Yaakob
Universiti Sains Islam Malaysia (USIM), Nilai Negeri Sembilan, Malaysia

ASSOCIATE PROFESSOR DR NORFADHILAH MOHAMAD ALI

DR HENDUN ABD RAHMAN SHAH

DR MUSTAFA 'AFIFI ABDUL HALIM

DR NORSUHAIDA CHE MUSA

DR ADZIDAH YAAKOB

Abstract

Mediation and Sulh are increasingly being used in conflict resolution practises, and mediators play an important role in assisting the parties involved in reaching mutually acceptable solutions. In order to help the parties come up with their own solutions during mediation, the mediator must act quickly, thoroughly comprehend the circumstances, and develop relevant questions. The article explores the use of futures methodology in mediation and Sulh in this context to assist mediators in foreseeing potential outcomes and preparing for possible obstacles to conflict resolution. The article illustrates samples of the application in Sulh-Mediation certification trainings conducted in Malaysia in different case studies. The methodology includes the use of various futures tools, including scenario building and futures wheel analysis to encourage parties' innovative solutions to resolve conflicts. These case studies demonstrate the effectiveness of futures methodology in understanding the underlying issues that cause conflicts and highlight its potential for creating long-term solutions that address these issues. The use of futures methodology in peace and conflict studies can help mediators navigate the complex landscape of conflict resolution and contribute to the creation of long-term sustainable peaceful resolution.

Keywords: Futures methodology, Mediation, Sulh, Conflict resolution, Peace studies.

Full Papers

"Closing the Gap: The Need for Military Prosecution Appeal Right to Ensure Exclusive Accessibility to Justice"

Haslida Isamail [1], Rizal Rahman [2] and Muhamad Sayuti Hassan[3] [4]

[1]Faculty of Law, Universiti Kebangsaan Malaysia.
[2]Associate Professor, Faculty of Law, Universiti Kebangsaan Malaysia.
[3] Senior Lecturer, Faculty of Law, Universiti Kebangsaan Malaysia.

[4] Corresponding author's e-mail address: P118130@siswa.ukm.edu.my

Abstract. *The military justice system in Malaysia differs from the ordinary criminal justice system in several aspects, including the availability of appeals. While the Public Prosecutor has the right to appeal against a court's decision, the right to appeal for the prosecution in a court-martial is absent. This paper aims to examine the absence of the military prosecution appeal right in Malaysia. This paper uses a doctrinal research methodology to explore and highlight the gaps in the current legal framework and compares it with the right of appeal available to the prosecution in the civil court system. The study found that the Malaysian military justice system does not provide the prosecution with the right to appeal against a court-martial decision. This absence of the prosecution's right to appeal hinders their ability to seek justice in the military justice system and goes against SDG Goal 16, which promotes peaceful and inclusive societies for sustainable development, provides access to justice for all, and builds effective, accountable, and inclusive institutions at all levels. This paper argues for the need to introduce a robust prosecution appeal right in Malaysia's military justice system that would help promote peace, justice, and strong institution.*

1. Introduction

The military justice system in Malaysia deviates from the conventional criminal justice system in several significant ways, notably in terms of the availability of appeals. While the ordinary criminal justice system allows the Public Prosecutor to appeal a court's decision, such a right is noticeably absent within the realm of court-martial proceedings. Based on observation by Eng and Jaafar (2009, p. 3), the military legal system is a separate and unique legal system created to enforce certain standards of behaviour and maintain discipline in the armed forces. This paper aims to critically analyse the absence of the prosecution's right to appeal under Malaysia's military justice system. It also aims to consider the broader context of SDG Goal 16, which emphasizes the establishment of peaceful and inclusive societies, ensuring access to justice for all, and building effective, accountable, and inclusive institutions at every level. By examining the limitations of the military justice system in relation to this goal, a better understanding can be attained regarding the implications of the absence of a prosecution appeal right.

In light of these considerations, the introduction of a robust prosecution appeal right within Malaysia's military justice system becomes essential. Such a reform would align with the principles of SDG Goal 16 and contribute to the promotion of peace, justice, and strong institutions. Addressing the absence of this right is crucial to maintain the integrity of the military justice system, as it helps prevent potential impunity for military personnel involved in wrongful acts.

2. Literature Reviews

Without literature reviews, one would fail to grasp the subject matter, the existing research, the methodologies employed, and the crucial matters pertaining to the topic (Hart, 1998, p. 1). In Malaysia, the available references on military law are limited compared to international literature. The conducted analysis revealed a significant scarcity in the writings and studies about military law itself, especially those focusing on the needs of the appellate system within the military justice system in Malaysia. Based

on the suggestion put forward by Lt. Kol Syed Ismail bin Syed Omar (1996, pp. 80-81) it is essential to create a Court-Martial Appeal Court that handles appeals from both the accused and the prosecutors. He further added that a potential approach for its structure and operations could draw inspiration from another country as a working model. Furthermore, as indicated by Aziz (2019, p. 4), there is a strong endorsement for the serious discussion of various issues, particularly the matters concerning human rights and the appeals system in military courts, which have been debated extensively in numerous countries. According to Lt. Kol Syed Ismail bin Syed Omar (1996, p. 65), in contrast to the United Kingdom, Singapore, Australia, and the United States, which each have its own Court Martial Appeals Court, the Malaysian military legal system has none, despite efforts in the late 1980s to establish one.

To summarise, the limited availability of literature on military law in Malaysia, particularly regarding the appellate system within the military justice system highlights the need for the establishment of a Court Martial Appeal Court, as earlier suggested by Lt. Kol Syed Ismail bin Syed Omar. This would address crucial issues such as human rights including the right of appeal and the appeals process in court martial, aligning with the international discourse such as principles of SDG Goal 16 on these matters.

3. Methodology

Using a doctrinal research methodology, this study delves into the legal framework governing the prosecution's appeal rights within the Malaysian military justice system. By highlighting the existing gaps in the legal provisions, this research draws comparisons with the prosecutorial appeal rights granted in the civil court system. The primary sources referred to in this study include relevant statutes, legal regulations, and reported cases. These encompass the Armed Forces Act of 1972, the Armed Forces (Court Martial) Rules of Procedure 1976, the Armed Forces (Summary Jurisdiction) Regulation of 1976, and the Criminal Procedure Code (Act 593). Secondary sources such as books, journals, articles, thesis, conference papers, and project papers were also utilized as references. Additionally, library research was conducted using databases such as Web of Science (WOS), Scopus, HeinOnline, CLJ, Lexis Advance Malaysia, and Westlaw Asia, which are accessible through UKM's EResources@PTSL.

4. Results and Discussion

Ensuring exclusive accessibility to justice to all is important, it is no less insignificant within the military justice system. In this discussion, we examine the military justice system in Malaysia, the definition of appeal and its rationale, elaborate on the appeal by public prosecutors in the common criminal court, have a brief insight from an international perspective, and finally discuss the context from SDG 16.

4.1 The Military Justice System in Malaysia

In the context of the military justice system in Malaysia, it is important to note that the right to appeal is not available to either the prosecution or the accused. Nevertheless, under Section 123 of the Armed Forces Act 1972 (Act 77), the word petition is used to give the right to the accused to present a petition against the finding or sentence or both. At first glance, the word petition may signify that the accused is appealing his case to a reviewing or higher authority and that an appeal is in place. Moreover, the procedure prescribed by the Armed Forces (Court Martial) Rules and Procedures 1976, Rule 101(2) also used the word petition which provides that an accused sentenced by a court martial can submit a petition within six months of promulgation against the sentence to a reviewing authority or an officer authorised to reconsider court-martial sentences.

The usage of the word "petition" triggers some confusion regarding the availability of the appeal's right in a court martial. The Court of Appeal's case decided in 1997 was best to demonstrate the confusion concerning the word "petition" used in Malaysia's military justice system's post-trial mechanism. According to the judgment made by the learned Court of Appeal judges in the case of Lt Kol Yusof bin Abdul Rahman v Kol Anuar bin Md Amin & Anor [1997] 1 MLJ 562, "Rule 101 of the Rules provides the accused with a right of appeal." The judges further elaborate, in which the exact wording is reproduced as follows;

> "As we indicated earlier, the appeal period under r 101(2) has long since expired. If a court did err in applying the wrong yardstick on the burden of proof, or wrongly admitted inadmissible evidence or committed some other procedural error, it is always open to the appellate court to rectify the matter. Appeals are by way of rehearing and the appellate

> court can therefore determine what the result ought to have been if the proper tests had been applied. It will not interfere unless there has been a miscarriage of justice."

However, with all due respect, it is crucial to clarify that the word "petition" used above is not attributed to the appeal but to the process of review only. These have been voiced out by Lt. Kol Syed Ismail bin Syed Omar (1996, pp. 69-70) as he argued that the term "petition" used in military legislation is a result of the British legacy where it represented a formal request for relief and remedy against alleged wrong of the court-martial. There is no re-hearing or relitigation on matters of facts but only to the extent of the legal conclusions arrived at by the court-martial. By virtue of Section 128 Armed Forces Act 1972, the principles applicable in considering a petition are similar to those applicable in review. Therefore the significance of the term "petition" lies in the fact that unlike an "appeal", the petitioner is deprived of a right for a re-hearing against his convictions on questions of facts. In arriving at these inferences, Lt. Kol Syed Ismail referred the word petition to the old English law since there is no statutory definition of the word petition. Thus, the judgment cited in the above case saying that Rule 101 of the Rules provides the accused with a right of appeal may be misled by the word "petition" used and it was inaccurate. It is hoped that this clarifies the confusion or any misunderstandings anyone may have had and all are clear about the absence of the right of appeal under the military justice system in Malaysia.

4.1.1 Accused right to seek redress. Nonetheless, based on the above discussion, it is crucial to highlight that the accused does possess alternative avenues to seek redress. Specifically, they have the opportunity to submit applications for review to reviewing authorities or pursue a judicial review to the High Court. These mechanisms serve as essential means by which the accused may seek an assessment of their cases, ensuring fairness and justice within the military justice system. According to Suppiah (1984, p. 156), the court martial is largely subject to the control and supervision of the civil court. However, the High Court is bound not to interfere with the findings of the court-martial. The established legal principle is clear that the High Court does not serve as an appellate court. In the case of Kolonel Dr. Faiz Azraai Bin Abdul Aziz v Mahkamah Tentera [2019] MLJU 1175, the applicant sought a certiorari order to set aside the decision made by the court-martial. The respondents on the other hand argued that the High Court does not have the power to interfere with matters related to military actions and military laws governing the control and discipline of military officers. The High Court can only intervene when the actions of the military affect the civil rights of the military personnel concerned. The learned Judge Nordin bin Hassan ruled that the law is clear that judicial review can be sought when a decision is tainted by illegality, irrationality, or procedural impropriety. In the absence of these elements, the High Court dismissed the judicial review application. It is evident that the High Court, as a civil court, will not arbitrarily interfere with the findings or decisions of the court-martial in carrying out its role during judicial reviews. In another case of Lt Kol Yusof bin Abdul Rahman v Kol Anuar bin Md Amin & Anor [1997] 1 MLJ 562, the Court of Appeal in Kuala Lumpur ruled that the civil court should exercise caution to ensure that applications masked as certiorari applications do not turn into appeals. The civil court should only intervene in exceptional circumstances. Recently, as reported on September 7, 2022, by (FMT Reporters, 2022), the Malacca High Court granted a judicial review application by military personnel Fazli Fadzil, as the High Court Judge found procedural irregularities that rendered the challenged order invalid. Furthermore, as (FMT Reporters, 2023) reported on January 12, 2023, the Kuala Lumpur High Court rejected a judicial review application filed by former sergeant Wan Ramli Wan Seman, who was discharged from service for refusing to comply with the COVID-19 vaccination directive. Judge Ahmad Kamal Shahid stated that there was no legal wrongdoing or irrational action on the part of the military in terminating his service.

4.1.2 Military Prosecution Right to Appeal. The foregoing discussion indicates that the accused has the right to seek redress under the current system. Nonetheless, this privilege does not apply to the prosecution. The prosecutor in a court-martial is not entitled to apply for a review to reverse an acquittal ordered by a court martial nor can the prosecutor apply to enhance the sentence passed. A review is only with regard to a conviction and not against acquittal. Where a court martial acquits an accused having found the prosecution failing to establish a prima facie case, the matter is res judicata and the reviewing authority is not empowered by law to direct the court-martial to reassemble and call the accused to enter his defence. This scenario indicates that the prosecution's post-trial right under the military justice system

is limited compared to the right enjoyed by the accused. In other words, there is no right given to the prosecution to challenge a decision that is not in its favour. Thus, the prosecution should strive to present its case as effectively as possible without the opportunity for a second chance.

There is no definition given by Act 77 regarding the word "prosecutor". Nonetheless, Rule 2 of the Armed Forces (Court-Martial) Rules of Procedure 1976 defined "prosecutor" as "a legal officer of the Ministry of Defence and includes a service prosecuting officer appointed in writing by the convening authority". Convening authority is a qualified officer who either was given a Warrant by His Majesty or delegated by a qualified officer who has the said Warrant to convene a court-martial. The qualified officer can be the Chief of the Armed Forces Staff, the Chief of the Army, the Chief of the Navy, the Chief of the Air Force, and any officer not below the rank of colonel or its equivalent who is in command of a body of troops or of a naval command or of a body of the air force. However, Rule 51 (4) of the Armed Forces (Court-Martial) Rules of Procedure 1976 specified that if the prosecution is to be undertaken by a legally qualified prosecutor, the accused shall be notified of this fact in sufficient time to enable him, if he so wishes and it is practicable, to make arrangements for an advocate and solicitor to defend him.

Military law operates under the command of a commanding officer (CO). Based on Section 97 Act 77 and Regulation 12 of the Armed Forces (Summary Jurisdiction) Regulation 1976, CO is an officer who has powers of command over a person charged with an offence and the jurisdiction to deal summarily with certain offences against certain categories of accused. According to Lt Kol Syed Ismail bin Syed Omar (1997, p. 9) the power given to the CO is like those of the Attorney General. As such, the law confers on the CO of an accused the power of prosecutorial discretion, in which the CO alone is empowered by law to decide whether a particular case should be tried by court-martial or dealt with summarily by him or even condoned by him.

4.2 Definition of Appeal

Appeal according to Garner (2004, p. 105) in Black's Law Dictionary "is a proceeding undertaken to have a decision reconsidered by a higher authority; esp., the submission of a lower court's or agency's decision to a higher court for review and possible reversal." Dahl and Whelan (1960, p. 18) define an appeal in their military law dictionary as a proceeding by which a cause is brought from an inferior to a superior court for re-examination or review and reversal, retrial, or modification. Further elaboration specifically referred to the United States context is provided that the provision is made by the statutes of the United States and of the various states for taking appeals in criminal cases from the courts of original jurisdiction to a higher court for review. Thus, convicted persons are afforded every opportunity to rectify any errors that may have been made. The defence must file the application for appeal with reasons, within the short time after conviction. From this definition, Dahl & Whelan defined the term appeal as a broader concept that may include various post-trial mechanisms.

According to Marshall (2011, p. 1), criminal appeals are a crucial feature of the modern criminal justice process. A conviction cannot be considered final until the right of appeal has been either exercised up to the highest level or waived. Marshall further argues that the right to appeal is expanding. The right to appeal against convictions and sentences, in most jurisdictions, is considered a fundamental right, whether based on statutory provisions or enshrined in the Constitution. Taking into account the viewpoints of Nobles and Schiff (2022, p. 676), the system of appeals is generally understood as a means of supervising decisions made by lower authorities through higher authorities, to ensure accuracy, fairness, consistency, and providing a mechanism for setting precedents. This system is typically implemented hierarchically, with appeals serving as a tool for superiors to correct decisions or oversee subordinates. As Dalton (1985, p. 69) suggests that appellate courts exist to rectify errors, develop legal principles, and bring geographically dispersed lower courts into a unified and authoritative legal system. The appellate courts are considered best positioned to determine when, where, and how the law requires clarification or review. As such, there is a need for the intervention of appellate courts to provide interpretations of the law that may sometimes be vague or unclear.

In the words of Alagan (2018, p. 487), an appeal is a continuation of the trial. Based on the decision in the case of Balasingam v PP [1959] 1 MLJ 193, it is solely a continuation in the form of a rehearing, where the parties involved, including the appellate court, have the right to examine the reasons behind the findings. In the case of Edlesten v LLC [1981] 1 KB 18, it was decided that an appeal is a transfer of

a case from a lower court to a higher tribunal with the hope of reversing or modifying the previous decision. Based on Shavell (1995, p. 379), the appeals process whereby a litigant disappointed with the decision of a first-order tribunal can seek reconsideration before a higher tribunal is a widely observed feature of adjudication.

Based on the above definitions, an appeal is exclusively a continuation through a rehearing process wherein all parties involved including the appellate court have the right to scrutinize the rationale behind the finding of the lower court.

4.2.1 The rationale for the appeal. The fact that only the accused has the right to seek redress while the prosecution does not introduce a potential element of bias and unequal treatment within the legal system. This unequal treatment arises from the disparity in the ability to challenge or contest a court‘s decision. By granting the accused the right to file a review, the legal system acknowledges that individuals facing criminal charges should have the opportunity to seek a review of their cases if they believe that errors or injustices occurred during the trial. This recognition aligns with the fundamental principle of ensuring fair and impartial proceedings. However, when the prosecution is excluded from the same process, it creates an imbalance in the system. The prosecution represents the interests of the services and has a vested interest in seeking justice. By denying the prosecution the ability to file a review or appeal, there is a potential limitation on their ability to rectify any perceived errors or address instances where they believe the court‘s decision may be flawed. As has been highlighted by Shavell (1995, p. 381), the correction of errors is the social justification for examining the appeals procedure. Ideally, a balanced and fair legal system should provide avenues for both the accused and the prosecution to seek review and appeal if they believe that errors or injustices have occurred during the trial. This approach promotes equality, transparency, and the pursuit of justice for all parties involved.

According to the concept of "equality of arms" as outlined in domestic and international law, it is the principle that both parties should enjoy equal treatment and equal procedural rights throughout the trial process (Stefania Negri, 2007, p. 13). Article 6 of the European Court of Human Rights established the equality of arms concept in the context of the right to a fair trial. Whereas Article 14 of the International Covenant on Civil and Political Rights provided that all persons shall be equal before the courts and tribunals. This means that both the prosecution and the defence should have an equal opportunity to present their case, access relevant information, call witnesses, and challenge evidence. The principle of equality of arms aims to ensure a fair and balanced trial where neither party is disadvantaged in terms of their rights or the resources available to them.

As Fidell (2016, p. 55) has highlighted, in the United States, the prosecution has the right to seek review by the highest court of the military justice system in any case, while the accused must show "good cause" to obtain a review, which denies equality of arms. Both the prosecution and the defence should have equal access to permissible procedures. However, in Malaysia, not only the prosecution been denied the right to appeal but they have also been deprived of the same right to review or reconsideration of cases enjoyed by the accused. According to Jerry Kronenberg (1958-1959, p. 473), allowing the prosecution to appeal is crucial as it materially contributes to the development of proper legal principles. The practice of bringing cases to the higher court for review is predominantly initiated by convicted or unfavourable parties. As rightly pointed out by Major John B. Adams (1975, p. 5), the accused cannot and certainly will not appeal for favourable decisions. Without this right in the military criminal justice system in Malaysia, there is a lack of visible legal development, which is a crucial aspect.

Further, Article 7(2) of the Federal Constitution stated that a person who has been acquitted or convicted of an offence shall not be tried again for the same offence. This *autrefois convict* and *autrefois acquit* protect the accused from repeated prosecutions for the same offences. Justice Black, in his dissenting opinion in Bartkus v. Illinois, 359 U.S. 121, 151-155 (1959), described the principle that a defendant cannot be tried twice for the same offence as "one of the oldest ideas found in Western civilization" with roots in early Greek, Roman, and canon law. Under Rule 94 the Armed Forces (Court Martial) Rules of Procedure 1976 also stated that a person is not to be tried twice for the same offence. The basic question that arises in this particular context of double jeopardy is whether the prosecution may appeal against a sentence imposed on a convicted person. According to Louise (1999, p. 5) the prosecution‘s appeal of the same cause of action is merely a continuation of the trial court‘s proceedings, and thus cannot be regarded as a violation of double jeopardy principles. A defendant is not exonerated of a crime until his case has been resolved by the court with the most authority. The double jeopardy

principle only applies after the defendant has been acquitted or convicted by the highest hierarchically empowered tribunal. Thus, granting the right to appeal to military prosecution is not amount to a violation of double jeopardy protection.

4.3 Appeal Under the Malaysian Legal System in Malaysia

Appeals play a crucial role in the Malaysian legal system, allowing either the accused or the prosecution to challenge a court‘s decision. In Malaysia, the right to appeal is not specifically guaranteed by the Federal Constitution, unlike other rights such as the right to freedom of speech, freedom of religion, and the right to legal representation. It is a well-established legal principle that the right to appeal exists only if provided by the relevant statute. In the case of Dato Seri Anwar Ibrahim v PP [1999] 1 CLJ 537, the Honorable NH Chan JCA ruled that "[1] There is no right of appeal at law from a decision of a court to any other court unless there is a statutory provision which gives a right to appeal." In Khor Ewe Suan & Anor v PP (1964) MLJ 220, the court decided that there is no general right of appeal. In the case of Koay Ban Siew v PP (1948) MLJ 54, it was decided that appellate jurisdiction is only a creation of statute, and it extends only as far as the words of the statute necessarily require. According to Backer (2014, p. 712), notwithstanding the above decision, it must be emphasised that the appellate jurisdiction is not only a creation of statute but also part of constitutional guarantees.

The highest-ranking prosecutor in Malaysia is the Attorney General who is also referred to as the Public Prosecutor. Article 145 (3) of the Federal Constitution provided that “The Attorney General shall have power, exercisable at his discretion, to institute, conduct or discontinue any proceedings for an offence, other than proceedings before a Syariah court, a native court or a court-martial”. Whereas Section 376 (1) of Act 593 clearly mentioned that the Attorney General shall be the Public Prosecutor who has the control and direction of all criminal prosecutions and proceedings under the Criminal Procedure Code (Act 593). From these Article 145(3), it is evident that even the Public Prosecutor holds discretionary power to institute, conduct or discontinue any criminal proceedings, but he has no power in court martials. By virtue of Section 376 (3) and (3A), the Public Prosecutor may appoint fit and proper persons to be Deputy Public Prosecutors who shall be under the general control and direction of the Public Prosecutor and may exercise all or any of the rights and powers vested in or exercisable by the Public Prosecutor, and may also appoint fit and proper persons to be Assistant Public Prosecutors who shall be under the general control and direction of the Public Prosecutor. With respect to a criminal appeal, Section 378 of Act 593 provided that no person shall appear on behalf of the Public Prosecutor on any criminal appeal other than the Public Prosecutor, a Senior Deputy Public Prosecutor or a Deputy Public Prosecutor.

Due to the absence of a constitutional guarantee, the right of appeal can only be exercised when explicitly enshrined in the relevant legislation. The laws which govern the appeal process in the criminal justice system in Malaysia are Act 593, and the Courts of Judicature Act 1964 (Act 91). Nevertheless, it should be noted that since Act 593 exclusively applies to civilian courts in Malaysia, both the prosecution and members of the military are unlikely to benefit from the same rights under the Armed Forces Act 1972. (Saman & Dahari, 2021, p. 69). Act 593 is an act relating to criminal procedure with the object to set out a body of rules, which must be followed in the investigation, inquiry, and trial of offences under the Penal Code and other Acts. Act 593 will not apply to offences under other Acts if there is a special procedure prescribed under the other Acts as expressed by the maxim *generalia specialibus non-derogant*. Section 307 of Act 593 provides the right of appeal to any person who is dissatisfied with any judgment, sentence, or order by any Magistrate Court to the High Court.

According to Act 593, Chapter XXX states that any mention of a Magistrate and Magistrates‘ Court should be interpreted to include a reference to a Sessions Court judge or a Sessions Court, as applicable. However, it is important to note that there are differences in the right to appeal between Magistrates‘ Courts and Sessions Courts. In the case of a criminal matter decided by a Magistrates‘ Court, the appeal process begins with the High Court exercising its appellate criminal jurisdiction under Section 26 of Act 91. Subsequently, the appeal can be pursued to the Court of Appeal, but only with the leave of the Court of Appeal. Additionally, such an appeal is limited to questions of law that have arisen during the appeal or revision, and the determination of these questions by the High Court must have affected the outcome of the appeal or revision. This was demonstrated in the case of Ishak bin Haji Shaari v PP [2006] 3 MLJ 405, CA, where an application for leave to appeal was dismissed because the raised questions were matters of fact rather than law. Regarding a criminal appeal originating from a Sessions Court, the initial appeal is made to the High Court, in accordance with Section 26 of Act 91. Subsequently, the appeal can

be pursued to the Court of Appeal under Section 50(1)(b) of Act 91. In such cases, there is no requirement to obtain prior leave from the Court of Appeal. Section 87 of Act 91 however prohibits an appeal from the Session Courts to the Federal Court. All decisions of the High Court of its original jurisdiction are appealable to the Court of Appeal and up to Federal Court, except for habeas corpus in which the appeal is straight to the Federal Court.

4.4 International perspective.

Based on the report provided by the United Nations High Commissioner for Human Rights (UNHCHR) *United Nations A/HCR/28/32* regarding the summary of discussions held during expert consultations on the administration of justice through military tribunals and the integral role of the justice system in combating human rights violations, the UNHCHR has made the following recommendations:

> "The experts' presentations showed that, in some States, there were significant gaps in implementing the right to a fair trial. Questions were raised concerning the practice of summary proceedings for lesser offences, which in some States did not allow for the presence of legal counsel or the right of appeal. States were invited to take appropriate measures to ensure that the right to fair trial in military tribunals was in full conformity with the International Covenant on Civil and Political Rights."

Considering the above recommendations put forward by the UNHCHR, it is crucial to thoroughly examine the military criminal justice system in Malaysia to establish specific provisions that allow for appeals by both the accused and the prosecution. Various international conventions have emphasized the importance of fair procedures and equal rights for all citizens. Malaysia is currently working towards ratifying several international conventions pertaining to human rights and the criminal justice system.

Referring to the procedure of allowing appeals by the prosecution, several countries have implemented such practices. In the UK, there is The Court Martial (Prosecution Appeals) Order 2009, which grants the prosecution the right to appeal to the Court Martial Appeal Court against rulings made in military court proceedings where, if the ruling is not set aside, the accused would be acquitted. This power and procedure closely align with the civilian court system. Furthermore, in the United States, appeals filed by the United States Government itself are permitted under Art. 62 of The Uniform Code of Military Justice (UCMJ), known as "Appeal by the United States."

4.5 Action to promote peace, justice, and strong institutions under SDG 16.

Under SDG 16, there are twelve targets for promoting peace, justice, and strong institutions through action. The very least we can do to assist in achieving SDG 16 is to place an emphasis on Target 16.3, which is to promote the rule of law both at the national and international levels and ensure equal access to justice for all. Given that the global goal is to ensure equal access to justice for all, the proposal for the military prosecution appeal right is not only long overdue but also fully aligned with the inherent objectives of SDG 16. Granting the military prosecution, the right to appeal will ensure exclusive accessibility to justice, particularly within the military justice system and the Malaysian criminal justice system as a whole. This would ensure that everyone has equal access to justice-seeking opportunities and eliminates any superfluous exclusions.

5. Conclusion

The findings underscore the fact that the current Malaysian military justice system fails to grant the military prosecution the right to appeal against a court-martial decision. This deficiency significantly impedes the prosecution's ability to seek justice within the military justice system, thereby contravening the principles outlined in SDG Goal 16. Considering the discussion, it is evident that few countries have taken proactive measures to reform their military criminal justice systems for quite some time. It is now time for Malaysia to follow suit and initiate similar steps to modernize its military justice system, focusing on enhancing the rights of not only the accused but also the prosecution. Drawing on insights from (Mindia Vashakmadze, 2018, p. 3), the objective of reforming the military criminal justice system is to improve its effectiveness, ensure the delivery of high-quality justice by military courts, and align it with changes in domestic laws, international human rights standards, or the specific needs of the relevant military institution.

In conclusion, the time has come for Malaysia to embark on a comprehensive overhaul of its military criminal justice system, taking inspiration from the practices of other countries. By undertaking this

reform, Malaysia can demonstrate its commitment to upholding the principles of fairness, equality, and accountability within its military justice system. This step would align the country with international practices and standards, while also enhancing its reputation as a responsible member of the international bodies. Moreover, a reformed military justice system that allows for appeals by the prosecution would foster a more balanced and equitable legal framework, where both the accused and the prosecution have equal opportunities to seek justice and ensure that the rule of law prevails. By putting light on the absence of the prosecution‘s right to appeal and its significant consequences for SDG Goal 16, it is hoped that this article will contribute to the ongoing discussion around Malaysia‘s military justice system. The recommendations made in this study seek to improve the military justice system‘s effectiveness while promoting peace and justice for all military members, both of which are essential for accomplishing the goals specified in SDG Goal 16.

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Lending Your Ears to Parties in Community Mediation: Active vs. Passive Listening

Rizal Rahman[1], Nur Khalidah Dahlan,[2] Suhaizad Saifuddin[3]

[1]Faculty of Law, Universiti Kebangsaan Malaysia
[2] Faculty of Law, Universiti Kebangsaan Malaysia
[3] Faculty of Law, Universiti Kebangsaan Malaysia

[1] noryn@ukm.edu.my

Abstract. Community mediation is a neutral dispute resolution method where the parties involved in the dispute come together and work out an agreement with the help of a mediator. It has been found to be effective in resolving disputes quickly, efficiently and cost-effectively, while also preserving relationships between the parties involved. When a conflict arises, it is important to have a middle person i.e. mediator who can be trusted to assist the parties in managing and settling the dispute. Such a person should be able to provide impartial advice and help in finding solutions that are beneficial for all involved. This requires a great deal of skill and experience, which is why it is often wise to resort to an experienced third-party mediator when conflicts arise within a community. One of the key skills that a mediator must possess is listening. While it is something that can be commonly applied in numerous conditions, the use of such a skill in a mediation process requires more engagement from the mediator. This paper seeks to establish the need for a mediator in every single community mediation process to impart in active listening rather than passive in order to achieve positive results in mediation.

1. Introduction

Disputes between family members and within the community can be incredibly difficult to resolve. Fortunately, community mediation has been proven to be effective in resolving such disputes at the family level and community level. This method involves understanding the underlying issues, identifying common interests, and working together to find a mutually beneficial solution. By employing this approach, families and communities can work together to find solutions that are satisfactory for all parties involved.

The purpose of this type of mediation is similar like other types of dispute resolutions which prioritize to maintain harmony in the family and among the community. History tracked that the Asians prefer conciliation, mediation and non-litigious ways of solving their problems. The practices of some countries are discussed in brief to look at the applications of the traditional community mediation.

The methods might not be called community mediation, but that was exactly what they were practising. Their method has been used as a platform and foundation in institutionalizing alternative dispute resolutions (H. A. Khan & N.A. Hak, 2018). Hedeen (2004), explains that the non-litigious means of dispute resolution were practised long before the advent of nation states in Asia, Africa and the Far East after which the court system later emerged and took over in those nation states.

For instance, Japan is one of the Asian countries that practised mediation and conciliation in solving their problems. The Japanese society is non-litigious society oriented. According to Davis (1996), there is a Japanese proverb that reflected the Japanese attitude towards conflict. It says ‘in a quarrel both parties are to be blamed’. It is the Japanese expectation to have tolerance and empathy for others; and the duty to save and give face. In other words, ‘empathy’ is an important element in resolving dispute.

As for in Malaysia, traditional community mediation can be found practised by the Aboriginal Tribes especially in the Peninsular Malaysia which settled in large numbers in groups or tribesthat are led by the tribe leaders. Khan and Hak (2018) described that most of the aboriginal tribes in Peninsular Malaysia shared a similar method in resolving disputes among themselves. Any neighbourhood problems will be brought to the attention of the Headman called *Tok Batin* or *Penghulu*. Nevertheless, when they need to

make a decision, the leader's opinion will be taken into account but the decision is done by means of a consensus. The problem is settled amicably in order to maintain good relations between the parties in dispute.

Historically it is proved that the community mediation method is still widely accepted and practised in Japan and Malaysia even though they live in modern societies. It goes to show that the non-litigious method of resolving dispute is still being continued practised, yet called by another modern name.

2. Literature Reviews

Community mediation is an effective dispute resolution process that can help parties involved in a conflict to reach an agreement without the need for a court hearing. It is a voluntary process, which involves the use of trained mediators to facilitate communication and negotiation between the parties. The goal of community mediation is to help both sides come to a mutually beneficial solution that meets their needs and interests. This method of dispute resolution can be used in a variety of situations, such as family disputes, landlord-tenant disputes, neighborhood disputes, and workplace disputes. Community mediation provides an alternative to costly litigation and allows the parties involved to maintain control over the outcome of their dispute.

The formal structure of mediation is based on the mechanism provided by the judiciary, by way of court-annexed mediation, or *sulh* in Islamic family matters. It can also be in a form created by a community engagement program, either pioneered by a particular non-profit neighbourhood organisation or a structure funded by the government. This structure ensures that all parties involved are given equal opportunity for their voices to be heard and for their rights to be respected. It also ensures that the mediator remains impartial throughout the process so as not to bias any party's opinion or outcome.

Conflicts are an unavoidable part of life, and when they arise in a community, it is important to handle them in a peaceful way. This is where mediation comes in. Mediation is a process that involves the assistance of a third party, known as the mediator, to help disputing parties come to an agreement on how to resolve their conflicts. The mediator acts as an impartial and unbiased person who helps guide the parties towards finding a solution that both sides can agree upon. With the help of a mediator, conflicts can be managed and settled without resorting to violence or other forms of aggression. The disputing parties will determine on the terms of their agreement if they managed to compromise in the mediation session or if the mediation succeed. The mediation process has an emphasis on the future, and not on the past or what has happened. It focuses on what could be done in the future for the benefit of both parties (Liebmann, 1998).

As far as Malaysia is concerned, the law governing the practice of mediation is the Mediation Act 2012. Section 3 of the Act states that "mediation" means:

> "A voluntary process in which a mediator facilitates communication and negotiation between parties to assist the parties in reaching an agreement regarding a dispute."

In addition to the Act, there are also mediation conducted by a judge, magistrate or officer of the court pursuant to any civil action that has been filed in court, and also mediation conducted by the Legal Aid Department (Section 2, Mediation Act 2012). It shall also be noted that the Act is not applicable to any dispute on the following matters (Schedule [Paragraph 2(a)], Mediation Act 2012).

1. Proceedings involving a question which arises as to the effect of any provision of the Federal Constitution.
2. Suits involving prerogative writs, as set out in the Schedule to the Courts of Judicature Act 1964 [Act 91].
3. Proceedings involving the remedy of temporary or permanent injunctions.
4. Election petitions under the Election Offences Act 1954 [Act 5].
5. Proceedings under the Land Acquisition Act 1960 [Act 486].
6. Proceedings involving the exercise of the original jurisdiction of the Federal Court under Article 128 of the Federal Constitution.
7. Judicial review.
8. Appeals.
9. Revision.
10. Any proceedings before a native court.
11. Any criminal matter.

When mediating parties in a conflict, the most important goal that a mediator has to achieve is for them to start listening to one another and work together towards finding a mutually acceptable solution. It is only through listening and open dialogue that disputes can be resolved in an amicable manner, and only by mutual listening would parties be able to understand each other's needs and concerns. Parties will not be able to decide about the solid parts of the conflict, unless and until the mediator manages their vented emotions and gets them listening to one another (Butler, 2004). This however would require the mediator to start the ball rolling by demonstrating the role of a listener.

It shall be noted that one of the major gaps in mediation process is the lack of proper listening skills, as this would hinder parties from achieving results favourable to them. Mediators need to be able to listen carefully and attentively to both sides of the dispute and understand their perspectives before coming up with solutions that are acceptable to all involved parties. This requires them to have an open mind, patience and empathy towards both sides of the dispute. With these qualities, mediators can bridge the gap between conflicting parties by helping them reach an agreement that is beneficial for everyone involved. Therefore, it is vital for every mediator to fully understand how listening in mediation should be done.

Although listening is related to the act of hearing, the latter is simply a precondition to the former. Hearing is a part of the natural senses, while listening is the focus geared in the hearing process. Nobody has to learn how to hear, as it comes naturally. Listening, on the other hand is a learnable skill, and should never be treated the same as hearing (Bullen, 2012). It requires patience, empathy and the ability to discern between fact and opinion. By having a third-party mediator who has these skills, the parties involved can work together towards a resolution that works best for everyone.

Listening is an essential part of communication, and different styles of listening can lead to different outcomes. Whether it is active listening, reflective listening or empathic listening, each style has its own advantages and disadvantages. Active listening involves showing that you are paying attention to the speaker by providing verbal and nonverbal cues. Reflective listening involves repeating back what the speaker has said in order to confirm understanding. Finally, empathic listening requires an understanding of the speaker's feelings in order to provide appropriate feedback. Each style of listening will result in a different outcome depending on the situation at hand.

3. Methodology

The methodology used is library research, where 'content analysis' is done through the application of a qualitative approach, as well referred to as conventional or legalistic studies. The analysis is carried out by applying current legal theory and principles to data collected from primary and secondary sources. Preliminary results help to set the goals, scope and research questions and to refine them.

To identify potential spaces and opportunities to ensure the sustainability of community mediation in providing access to justice, the analysis focused on the current legal mechanism in the Mediation Act 2012 and current standards by the relevant parties.

4. Results and Discussion

Mediation process intends to resolve disputes and maintain good relationship between parties. The role of the mediator is to support the parties for an attempt to arrive at an agreed resolution of their dispute. The mediator has no authority to make any decisions that are binding, but uses certain procedures, techniques and skills to benefit the parties to negotiate for an agreed resolution of their dispute without adjudication (Brown & Marriot, 1999).

Listening is vital since it is a means for a mediator to convince the parties that s/he is attending and paying them her/his utmost attention (Strasser & Randolph, 2004). However, it is not an easy task since the parties may come up with stories beyond the comfort zone of the mediator. It shall always be borne in mind that mediators come from diverse backgrounds and cultures; hence they may have different ways of looking at things compared to one or other party. Walker and Hayes (2006) made the following comparison when observing lawyer mediators and non-lawyer mediators:

> "Lawyer mediators were more likely than non-lawyer mediators to offer overt direction during mediation, direct advice, and direction in respect of settlements. By contrast, non-lawyer mediators encouraged greater levels of client participation and required more input from disputants during mediation. Non-lawyer mediators were also more focused on client ownership of outcomes. Lawyers

and non-lawyer mediators used different types of language with clients, with non-lawyers more likely to use the language of needs, responsibilities, and preferences, while lawyer mediators used the language of rights."

Hence, a mediator definitely has to leave his own personal thoughts behind when listening to the parties. Therefore, an open mind is required when the mediator listens to their stories. It is very important that the mediator should not be judgmental while listening to them, but should always think outside the box. Judgmental listening occurs when the mediator artificially listens to the party while at the same time s/he focused on their own particular musings and words that s/he is going to state after the party finishes talking. This is indeed a bad practice since non-judgmental listening would result in non-judgmental responses (Haynes, 2004). Only by being open-minded the mediator would be able to be seen neutral in their perception.

However, to the respectful mind of the mediator, feeling that s/he is hundred percent neutral is a very difficult conviction to achieve. Human beings have the natural tendency to take sides. Nevertheless, Haynes (2004) is of the view that it is sufficient if the mediator retains a balance between the parties and their stories, since it is unachievable to be strictly neutral. What is important is that the mediator is seen to be neutral by the parties, while s/he might not feel hundred percent neutral as far as their own conviction is concerned.

This can only be seen in any mediation process. It allows direct communication between the opposing parties (without the interference by the mediator) where both parties are open to negotiate and get a clear understanding of each other's concerns and needs. This process helps to achieve the objective of a just, expeditious and economical disposal of the dispute as the parties involved in the decision can structure the settlement to their needs and practicality. Upon achieving a mutual agreement, there is an increased likelihood of the parties having greater fulfilment and compliance when compared with other involuntary processes (N. K. Dahlan, M. H. Md. Said & R. Rajamanickam, 2021).

In order to gain the trust of the parties, listening must always include the element of acknowledgement (Haynes, 2004). Therefore, there is a need for the mediator to engage in active listening mode.

Being a passive listener is definitely a no-no practice to the mediator. No one would believe a mediator who appears passive throughout the session, without any indication as to whether the mediator is actually listening or day-dreaming. This is because listening is only effective when it is done actively, compared to being passive where the listener will be much like a tape recorder, where information is absorbed but not seen as such by the parties (Bhardwaj, 2008).

4.1 Passive Listening

According to the SAGE Glossary of the Social and Behavioral Sciences (2009), passive listening is the act of hearing another party with no comments or reactions, where there is no response to the emotion or core communication, and no expression of the listener's perception.

Passive listening is an effective dispute resolution technique that has been gaining traction in recent years. It involves allowing both parties to express their opinions and feelings without interruption or judgement. This allows each party to have their say, while also giving the other person a chance to understand the other's point of view.

Passive listening can be used in a variety of situations, from resolving business disputes to settling personal differences. It is especially useful when emotions are running high, as it allows people to express themselves without fear of criticism or judgement. By using this technique, parties can come to an agreement more quickly and amicably than if they were trying to debate the issue head-on.

As far as mediation is concerned, passive listening happens when the mediator listens in silence and responds passively, by giving nonverbal signs (nodding and making eye contact) or short verbal signs of non-committal affirmations like "oh" or "interesting" (Abramson, 2004) or "I see" or "mmmmm." (Charlton & Dewdney, 2004). It also occurs through the act of inclining forward, for the most part being casual, engaged and cautious, and does not look uninterested (Charlton & Dewdney, 2004).

Gray (2016) did not agree with the above observation, and claimed that passive listening is a misnomer. He suggests that it is more appropriate for passive listening to be renamed "silent-receptive" listening.

However, is it actually necessary to rename passive listening? Since it is always possible for a mediator to engage in active listening, why should a mediator be bothered with the need of a new name for passive listening when it is actually active listening? This would result in confusion and definitely would do more

harm than good to the success of the mediation process. Of course, there are moments when a mediator appears to be listening passively, prior to the verbal and non-verbal signals, but s/he is actually at the initial stage of absorbing and identifying the issues raised by the parties. However, it shall always be borne in mind that as long as the conscience of the mediator of the needs and concerns of the parties is noticeable to them, the mediator has indeed been practising active listening.

It is to be noted that passive listening happens when A is present when B is talking, but there is no evidence to show that A is listening to B; and even a third party who observes the conversation will not be able to tell whether A has actually listened to B (Hope, 2014).

Now, if hypothetically an observer (present in a mediation process for example to keep a party company) cannot tell whether the mediator is listening or not, what is more to be expected from the party himself? Indeed, the whole process will just lead to failure. Remember that the mediator is there to facilitate the parties, and they must be able to see him engage in that role. Listening is not only to be done, but seen to be done.Indent the second paragraphs onwards.

4.2 Active Listening

As opposed to passive listening, active listening is an act of listening that demonstrates an intention to comprehend the proposed message (Domenici & Littlejohn, 2001). It is also known as emphatic or reflective listening. It empowers the listener to get and precisely translate the speaker's message, and afterward gives a suitable reaction (Bullen, 2012).

Active listening is an important skill for dispute resolution. It involves focusing on what the other person is saying, understanding their feelings and emotions, and responding in a way that shows you understand them. By actively listening to the other person, you can identify the root cause of the dispute and come up with a solution that is beneficial for both parties. Active listening can also help to de-escalate conflicts, as it allows people to express themselves without feeling judged or unheard. With active listening, both parties can come together to find an agreeable resolution that works best for everyone.

The act of active listening entails the act of keeping eye contact, nodding, and expressing words of empathy which assists in making the parties confident to place their trust on the mediator, while at the same time helps towards the recognition of their non-verbal signals (Strasser & Randolph, 2004).

However, it shall be noted that maintaining eye contact might be a sensitive to some cultures (Spencer & Brogan, 2006). Not only that, the interpretation of what the mediator has listened must also be tailored to the "cultural orientation" of the parties (Domenici & Littlejohn, 2001). In this situation, just look at the party's forehead or anywhere close just to show that the person has your fullest attention. One act that must not be done by any mediator is to have roving eyes or wandering eyes. According to Seumas Tan (2012), it will create nervousness for the parties and the mediator should not risk the breakdown of rapport and trust which have been build up so far.

While listening, the conscience of the mediator must be very clear, that is he listens emphatically rather than sympathetically. Empathy occurs when a mediator imparts to the parties that they will be acknowledged and listened to in a period of agony, dissatisfaction, and outrage, and that the mediator comprehends their worries (Meierding, 2004). This will be reflected by the mediator's act of repeating, whenever necessary, the words of the parties; or by rephrasing the original words but still reflecting the intended message from the party. Sympathy on the other hand demonstrates a mediator's own feeling that s/he personally connects with the emotion of a party, thus leading to the possible misjudgement by another party. (Meierding, 2004)

Although the mediator only imparts empathy, s/he has to let the parties engage in a catharsis (Steil, 1981). Only by venting out their emotions, in an environment controlled by the mediator would the parties reveal their real needs and concerns. Remember, a mediator only facilitates; he never takes over the roles of the parties.

It should always be borne in mind that while active listening is a must, overdoing it would definitely destroy the whole process. Parties would be disturbed by constant interjections from the mediator, and this will eventually affect their mood in sharing their needs. Thus, the rule of prudence requires moderation if a mediator wishes to reach perfection. At the same time, a hyperbolic mediator would be

seen as fake and not sincere, and this definitely would affect the trust and confidence of the parties as to whether the mediator is neutral or not.

4.3 Active Listening and Natural Justice

The term "Jus Natural," which became well-known during Roman law and later became a part of the Common law system, is where the idea of Natural Justice originates. It should be highlighted that since this concept is a rule of nature and not a result of any legislation, it holds true regardless of whether or not there is written laws. This principle is renamed "due process" in the United States (Schwartz, 1953). In the case of *Board of Education v. Rice* (1911), Lord Loreburn argued that any administrative authority must operate in good faith and give all parties a fair hearing.

Natural justice or procedural fairness or due process (depending on the preferred name by a particular jurisdiction) is considered one of the bases of human rights. Natural justice is a fundamental principle of fairness that is deeply embedded in the legal systems of many countries. It refers to the idea that all people should be treated equally and fairly under the law, regardless of their race, gender, or other personal characteristics. Natural justice has been used as a basis for judicial decisions since ancient times, and it continues to be an important concept in today's legal system. It ensures that everyone has access to justice and is protected from arbitrary decision-making by those in power.

It is also important to note that equality is also stated under Article 7 of the Universal Declaration of Human Rights 1948 and Article 8 of the Malaysian Federal Constitution which states:

(1) All persons are equal before the law and entitled to the equal protection of the law.

(2) Except as expressly authorised by this Constitution, there shall be no discrimination against citizens on the ground only of religion, race, descent, place of birth or gender 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.

The parties in mediation shall not be denied the right to natural justice. Natural justice consists of the right to be heard (*audi alteram partem*) and the rule against bias (*nemo iudex in causa sua*).

Everyone has the right to be heard, as enshrined in the legal maxim *audi alteram par*tem. Audi alteram partem is a Latin phrase which reflects the rule of "listening to the other side" and "no one shall be condemned unheard", and it is a fundamental principle of justice that requires each party in a dispute to be given an opportunity to present their case. It is an important right that has been recognized by courts and tribunal around the world and is essential for ensuring fairness in legal proceedings.

This right to be heard is also important in everyday life. It allows people to express their opinions and have them taken seriously, even if they are not popular or agreed with by everyone else. It gives individuals a chance to make their voices heard, which can lead to meaningful dialogue and understanding between different people and groups.

As for the Latin proverb *nemo iudex in causa sua*, it reflects the rule that "no-one should be a judge in his own cause." This proverb is an important reminder that bias has no place in the decision-making process. It is essential for any organization to ensure that decisions are made objectively and without any personal or organizational prejudice. Organizations must create rules against bias and implement procedures that allow for objective decision-making. This includes making sure that everyone involved in the decision-making process have access to the same information and resources, as well as taking steps to prevent individual biases from influencing decisions. By following these practices, organizations can ensure that their decisions are fair and impartial, allowing them to make the best possible choices for their organization's future.

Although a mediator is not actually biased, the rule is still not adhered to if there is any indication of a potential bias. This is because "justice must not only be done, but must be seen to be done" (*R v Sussex Justices* [1924]).

For example, A has been appointed by B and C as their mediator. However, A and B actually have an ongoing fiduciary relationship. Although A has the ability to set aside his personal relationship with B while mediating for B and C, yet the fact that he and B has a relationship will ruin the neutrality of the process in the eyes of C. It would be more disastrous if either A or B has a dominant position over and above one another in that relationship and unduly influences each other's decision.

The first step towards the fulfilment of natural justice begins with an act of active listening by the mediator. Otherwise, the parties would lose hope and pray for other alternatives. Randolph (2016) has clearly illustrated the consequences:

> "The far-reaching consequences of not being heard are all too common: 'They are not listening. So I have no alternative but to fight (whether with armies of lawyers in court, or legions of soldiers on the battlefield) — that will make them listen."

5. Conclusion

A mediator would not have the ability to condense, elucidate, reframe, and recognise the need and concerns of the parties if effective listening has not been practised (Domenici & Littlejohn, 2001). Only by active listening would a mediator be able to pose questions so that the parties would contemplate conceivable choices for determining their settlement (Butler, 2004). Otherwise it would be quite difficult to comprehend what is actually the needs of the parties. Hence at times the mediator needs to be quite provocative albeit in a neutral tone just for the purpose of inciting the parties to open up and share their concerns

However, while it is crucial listening to what the parties would say in regards to their needs to be attended by the mediator, the choice about where to begin must rest with the mediation, and nothing more (Haynes & Charlesworth, 1996). It would be a disaster if parties and mediator are not focused to the current agenda before them as this would lead to an endless continuing conflict with a build-up of collateral problems not intended for the dispute resolution. Hence there is always a caution for every mediator to remember that every case has to be treated on its own merits. This does not mean that mediation is a confined choice, but it rather reflects the fact that for every dispense of justice (mediation included), the rule of prudence would require care and caution. Only by engaging in that manner and conduct the parties will manage to reach an amicable end, hence fulfilling the need that justice should be sustainably accessible and adequate to them.

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Posters

THE 29TH INTERNATIONAL SUSTAINABLE DEVELOPMENT RESEARCH SOCIETY Conference ISDRS

A REVIEW OF THE ROLE OF ANTI-CORRUPTION AGENCIES IN THE IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOALS (SDG)

INTRODUCTION

Government institutions are the main mechanism in mobilising the SDG at the country level (Coscun & Unalmis, 2022), in which the structure varies accordingly (Whaites, 2016). While the United Nations' 17 SDGs are designed to achieve a better and more sustainable future for all (UN, 2017), the challenges are diverse. Few nations designate central institutions to lead the SDGs, while others designate specific ministries. Nonetheless, there is an underlining need for other independent institutions, such as audit and anti-corruption authorities, to oversee, monitor, and ensure the government is responsible for the SDGs. This paper reviews the articles from WOS and SCOPUS databases to understand the followings: a) the structure of the anti-corruption agencies in supporting the SDG, and b) the roles and functions of anti-corruption agencies in supporting the SDG progression.

PROBLEM STATEMENT

SDG implementation requires government accountability, and by involving the ACA, a few concerns need to be addressed in sustaining their roles towards fighting corruption. Kapeli and Mohamed (2015) have raised the following issues: Lack of political will to continue the predecessor initiative in government reform, lack of proper assessment and overlapping institutional roles. There are also questions on the ACA's autonomy, restricted structure and shared/blurred functions that limit their exclusive roles in eradicating corruption

METHODOLOGY

The review in this paper adopted the approach of Reporting Standards for Systematic Evidence Syntheses (ROSES). Steps involved:

a) Formulation of the research question
b) Identification of potential journal articles
c) Screening the journal articles
d) Quality appraisal, and finally
e) Data abstraction and analysis

RESULT & DISCUSSIONS

Structure of the Anti-corruption Agencies in Supporting the SDG

ACA THAT HAS COMMENCED INSTITUTIONAL REFORM (IRf)	ACA THAT UPHOLDING GOOD GOVERNANCE PRINCIPLES (GG)	ACA STRUCTURE THAT OFFERING THE ANTI-CORRUPTION ADVOCACY (ACAD)
▪ ACA Establishment as an Independent Institution ▪ A Creation of Specific Departments/Units inside the ACA ▪ Creation of Specific Committee ▪ The Design of an Integrated System ▪ Improvement in the ACA Recruitment System	▪ Strong Political Will ▪ Partnership and Collaboration ▪ Upholding the Rule of Law	▪ Training Programmes/Skills Enhancement/Competencies Development ▪ Integrity/Anti-Corruption Education ▪ Integrity Assessment

Roles and Functions of Anti-Corruption Agencies in Supporting the SDG Progression.

CONCLUSION

The anti-corruption agency's role in assisting the SDG progression at the country level remains significant. The ACA, with other national institutions (parliament and audit agencies), monitor the SDGs. It ensures good governance and best practices of SDG implementor entities (ministries, government departments and agencies) while carrying out SDG-related policies, projects, and activities with public funds. A stringent governmental process, ethical regulations, and practises guiding the anti-corruption agencies in ensuring that public services and public goods are distributed by integrity norms.

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Asmidar Lokman, Mohd Idham Mohd Yusof, Shamsinar Rahman, Nurul Hidayana Mohd Noor, Mohtar Sani
Faculty of Administrative Science and Policy Studies, Universiti Teknologi MARA
Faculty of Administrative Science and Policy Studies, Raub Campus, Pahang
Yayasan Anti-Rasuah Malaysia, Negeri Sembilan
Track: Peace and Sustainable Development

THE 29TH INTERNATIONAL SUSTAINABLE DEVELOPMENT RESEARCH SOCIETY Conference ISDRS

ADOPTING AGILE GOVERNANCE IN MALAYSIA'S PUBLIC AGENCIES: A PATH TO ACHIEVING SDG 16

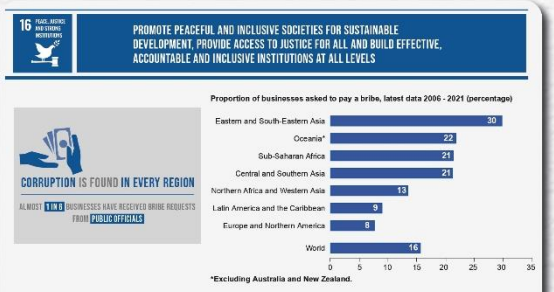
INTRODUCTION

The United Nations' Sustainable Development Goals (SDGs), launched in 2015, are a universal call to action for global sustainable development. SDG 16, "Peace, Justice and Strong Institutions," aims to foster inclusive societies, provide access to justice, and build effective institutions. It is vital for achieving overall sustainable development.

Public agencies play a critical role in promoting peace, justice, and strong institutions and, thus, in achieving SDG 16. They are responsible for implementing policies and programs aimed at promoting sustainable development and for ensuring that these policies and programs are effective, accountable, and inclusive.

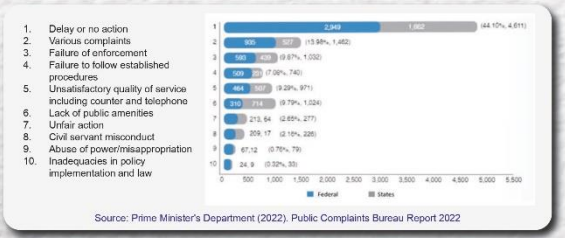
DRAWBACKS OF TRADITIONAL GOVERNANCE SYSTEMS

1. Despite the important role that public agencies play in achieving SDG 16, they often face a range of challenges that hinder their ability to achieve this goal.
2. These challenges include limited resources, misconduct (United Nations, 2021), inefficiencies in service delivery and decision-making processes, as well as traditional governance approaches that are rigid, bureaucratic, and slow to adapt (Barbier & Tengeh, 2022).



Source: United Nation (2022). The Sustainable Development Goals Report 2022

3. In Malaysia, public agencies also face resource constraints (Mohd et al., 2018) and encounter challenges with service delivery and misconduct among public officials (Prime Minister's Department, 2022; Ali et al., 2021).
4. Transparency and accountability issues further undermine public trust and can lead to corruption (Muhamad & Gani, 2020).
5. The traditional top-down governance approach, characterized by centralized decision-making and limited citizen and community input, results in inefficiencies (Ali et al., 2021).
6. The rigidity and bureaucracy inherent in traditional governance approaches hinder their capacity to adapt to changing circumstances and address the needs of citizens and communities in a timely manner (Ashok et al., 2021).
7. The slow pace of digitalisation can be identified as another factor contributing to the inefficiencies of public agencies (Ali et al., 2021).

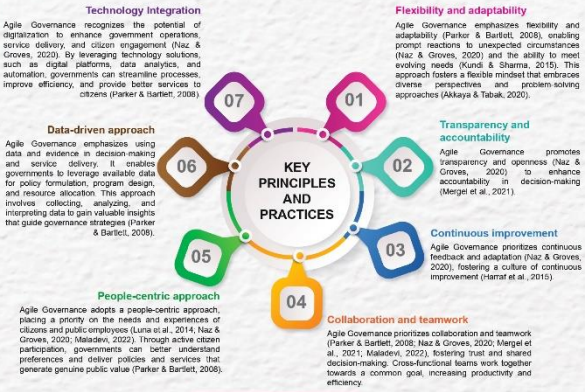


Source: Prime Minister's Department (2022). Public Complaints Bureau Report 2022

PROPOSED CONCEPTUAL MODEL

Agile Governance: Underlying Mechanism for Public Agencies to Achieve SDG 16

Agile Governance is a term used to describe an authority system that can quickly and effectively adjust to sudden changes in a positive way (Naz & Groves, 2020). It denotes an organisation's capability to detect, adjust and respond to changes in its surroundings rapidly and sustainably. This is achieved by the coordinated combination of agile and lean practices with governance capabilities, resulting in faster and better service delivery with added value (Luna et al., 2014).



CONCLUSION

01 The transformation of public agencies to adopt Agile Governance is of utmost importance in facing the BANI (Brittleness, Anxiety, Nonlinearity, Incomprehensibility) world.

02 The traditional governance models are slow and rigid, making it difficult for public agencies to respond quickly to changing circumstances.

03 By prioritising flexibility, collaboration, transparency, and continuous improvement, Agile Governance can improve decision-making processes, increase efficiency, promote quick response to changing circumstances, enhance transparency and accountability, encourage civic engagement and participation, and build trust with citizens.

04 Overall, Agile Governance is a promising approach that can help public agencies in Malaysia and beyond achieve the vision of SDG 16 of promoting peace, justice, and strong institutions for sustainable development.

05 Future research should focus on exploring the impact of Agile Governance on specific SDG 16 targets and evaluating its effectiveness in different cultural contexts.

06 However, there are still limitations that need to be addressed, such as the need for adequate resources (Mohd et al., 2018) and the need for cultural change within public agencies (Yee & van Thiel, 2021).

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TRACK 9
Governance. Power and institutions

9b. Collaboration and co-creation for sustainability, SDGs initiatives and scale of governance

Abstracts

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Gaps in Multi-level Governance toward Sustainability in the EU

Anıl Poyraz, Dr Mária Csete
Budapest University of Technology and Economics, Budapest, Hungary

A N I L P O Y R A Z

Abstract

Sustainability concerns different levels of government due to the nature of environmental, social and economic issues. Multi-level governance (MLG) features a research context to scrutinise the interplay between government tiers as well as an approach to governing itself. While some recent works focus on guiding MLG in sustainability-related issues, others point out the connections between MLG and Sustainable Development Goals (SDGs). For example, an OECD report (OECD, 2019) defines seven gaps regarding MLG: policy, administrative, funding, capacity, accountability, objective and information gaps. This work endeavours to disclose the sustainability-related interplays between the European Commission (EC) and national and subnational governmental bodies in the European Union. In the discussion of the interplays, we look at five aspects and explore the MLG-related gaps and evolving mechanisms in the Union concerning SDGs (Poyraz&Csete, 2022). The analysis reveals that as the Commission mainstreams SDGs by incorporating them into economic and social policies, the interplay between the EC and the Member States mainly occurs in the platforms in which these policies are shaped. Objective and accountability gaps persist in this aspect due to the differences between the Member States, non-binding policies and lack of policy coherence to some extent. Administrative and information gaps are noticeable regarding coordination and cooperation. These gaps can emerge because of a high number of stakeholders. Besides, the form of the coordination mechanism and the position of subnational governmental actors in the boards consisting of diverse stakeholder's matter. The responsibility and competence delegation aspect is where capacity, accountability and administrative gaps are experienced. Unclear and isolative role delegation can trigger these gaps along with the political-administrative structure of the countries. Funding and administrative gaps are prevalent in funding allocation for sustainability transitions. Political-administrative structure and level of political commitment have an impact on these gaps. Access to direct funding by subnational governmental bodies occupies a crucial place in the discussion. The assessment standardization aspect accommodates objective and information gaps. The lack of quantifiable and measurable objectives is a driver for lagging. There have been a set of actions to overcome the gaps that impede further mainstreaming SDGs via policy, regulation and research such as incorporating the SDGs into the European Semester, establishing the Committee of the Regions and Covenant of Mayors, joint and holistic planning, EU Green Deal Investment Plan, and supporting research projects on sustainability assessment. While this work concerns all of the SDGs, SDGs 11 and 17 are particularly relevant to the MLG approach and examined topics. Besides, the work highlights the gaps in MLG as a tool for fostering the 5Ps of SDGs with a focus on people and partnership.

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UniSus: The role of universities in sustainable development. Collaboration, academic freedom and cross-sectoral contributions

Professor Peter Dobers[1], Associate Professor Malin Gawell[1], Professor Gyula Zilahy[2], Professor Monika Kostera[1], PhD, Senior lecturer Anke Strauß[3]
[1]Södertörn University, Stockholm, Sweden. [2]Budapest University of Technology and Economics, Budapest, Hungary. [3]Eberswalde University for Sustainable Development, Berlin, Germany

PROFESSOR PETER DOBERS

Abstract

Sustainable development is widely accepted to be an all-embracing policy frame by United Nations (UN) for a social, economic, environmental and cultural frame for grand societal challenges. Next to organisations of the private and the not-for profit sector, universities, too, are increasingly asked to think about ways to directly address and contribute to the necessary sustainability leadership (Dobers, Linderström and Mobjörk, 2008) and sustainability transformation (Schneidewind 2016). The ability to foster transformative change, and the ability to directly challenge imbalances in power and empowering marginalised voices in civil society, culture, public sector and in business, is what universities do best when their research, education and collaboration is left untouched (Leitheiser, Vezzoni and Hakkarainen, 2022). While in many European countries university staff supported by public funding increasingly decides to make sustainable development a guiding principle for developing education (Kostera and Strauß 2022; Strauß, forthcoming), research, cross-sector collaboration and academic freedom increasingly come under attack in others. However, cross-sectoral collaboration with institutions and individuals in relational, transdisciplinary and collaborative practices is paramount to addressing grand challenges in ethical ways (Gawell, 2021; Keitsch 2021; Franklin, 2022).

The policy frame of the SDGs has in recent years been complemented by the action frame with many skills of the Inner Development Goals, IDGs (Jordan, 2021). In establishing such collaborative practices and skill sets, universities can take a leading role in facilitating collaborative network activities and supporting society with relevant education and research alike (Izak, Kostera and Zawadzki, 2017; Dobers and Stier, 2019; Strauß and Albrecht, forthcoming). Analysing regional sustainability initiatives, Zilahy and Huisingh et al. (2009) also come to the conclusion that both universities and other stakeholders may benefit from partnerships at the regional level, however, such potentials are currently underutilised.

In order to promote the leadership and entrepreneurship of universities in sustainability issues (Dobers, Linderström and Mobjörk, 2008), and to overcome barriers, the expanded and highly popular Triple Helix Model (Etzkowitz and Leydesdorff, 2000, Etzkowitz and Zhou, 2017) can serve as a suitable approach: the Quadruple Helix Model of innovation recognizes four major actors in the innovation system: academia, public sector, industry, and civil society. In keeping with this model, more and more governments are prioritizing greater public involvement in innovation processes, also because collaboration "allows multiple actors to share, scrutinize, and build on each other's ideas and work across established organizational and sectorial boundaries that tend to prevent both public hierarchies and private firms from tapping into the ideas and competences of external actors" (Torfing, 2016 p. 293, see also Torfing, 2019).

The project aims at a better understanding of barriers to collaboration for sustainable development in countries of Central and Eastern Europe with a special focus on universities. Expected conceptual outcomes include (i) a set of identified barriers and potential activities to overcome these barriers; (ii) a

general literature study of the emerging research and project outcome; including (iii) identified research questions.

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Governance of Pentahelix Collaborationas a Shared-Value Creation for Sustainability in the Waste Management and Processing as Circular Economy Project

Dr. Ratna Januarita[1], Indra Fajar Alamsyah, Ph.D[2], Dr. Mohamad Satori[1], Prof. Dr. Neni Sri Imaniyati[1]
[1]Universitas Islam Bandung (UNISBA), Bandung, Indonesia. [2]Universitas Islam Bandung (BANDUNG), Bandung, Indonesia

DR. RATNA JANUARITA

Abstract

Waste management and processing programs (WMP programs) are one way to reduce the adverse environmental impact of using materials that are difficult to recycle and move towards zero waste. To effectively contribute the earth and its environment preservation, the circular economy concept can create benefits and values for many parties. This is related to several Sustainable Development Goals (SDGs), including Affordable and Clean Energy (7); Decent Work and Economic Growth (8); Sustainable Cities and Communities (11); Responsible Consumption and Production (12); and Climate Action (13). These ideals, however, will be difficult to realize unless other potential parties contribute. The pentahelix model of a collaboration consisting of the government, community, business institutions, academics, and media is in line with the mutual cooperation values that have existed in Indonesia since ancient times.

The main objectives of this research are, first, within the scope of the parties at the project site, to formulate proportional order and justice in the WMP in the neighborhood. Second, within the scope of pentahelix collaboration, examine the supply chain values of each helix as a shared value created in the WMP activities to support the circular economy project.

This research employs a combined normative-empirical juridical method, meaning that to provide legal, policy, and governance aspects, it also flexibly considers other social variables that serve as influencing determinant factors and have been reflected in previously conducted research. By using this method, this study designed legal, policy and governance systems for the WMP programs as a circular economy model created in previous research. First, create a governance system that includes regulations and procedures. Second, map and place the governance structure as needed, and third, develop the governance process of WMP.

The pentahelix elements can play their roles and functions. However, it has not been supported by the community awareness and readiness. According to the 5Ps of SDGs (people, planet, prosperity, peace and partnership) this study views problems in urban and rural areas related to waste issues. Lack of understanding on the positive correlation between WMP with the potential benefit of a circular economy for them. Difficulties are still existed in conducting waste management which has the potential to damage the environment and disrupt economic growth. Meanwhile, the zero-waste program provides a circular economy which has a multiplier effect to potentially benefit the community. There is no meaningful economic growth without environmental improvement. Therefore, strengthening programs are needed through activities related to governance systems, structures, and processes, especially in the aspect of community culture, which is the most important aspect of pentahelix in the WMP program in the community.

The study concludes that the formulation of proportional order and justice in this WMP program can be useful for building community awareness and readiness. This formulation is outlined in the governance system, governance structure, and governance process in a series of WMP. The frameworks are expected

to create value from each supply chain in the community, and all elements of the pentahelix can create their own shared value in the WMP program.

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Partnership for Sustainability - Ukraine case in the context of global security and sustainable development

dr Katarzyna Cichos
Cardinal Stefan Wyszynski University in warsaw, Warszawa, Poland

DR KATARZYNA CICHOS

Abstract

Russia's aggression against Ukraine and the inability to take effective action by the United Nations have shown that the concept of maintaining global peace, developed in 1945, may be at danger. With the development and empowerment of states, the role of the so-called great powers is decreasing, which jeopardizes the possibility of using the security guarantees provided by the UN Charter and makes more difficult to maintain the development and prosperity of societies. The development of technology and access to resources cause that today, perhaps for the first time in the history of mankind, it is possible to ensure a dignified life and development for all people of our planet without the need to conduct wars for these resources.

The main purpose of the presenation is to present the concept of the new Partnership for Sustainability (P4S). It is an answer for the call for the Partnership expressed in the 2030 Agenda. But it is also an answer for the call of a new threat for UN collective security system, which is actually the fear of development. Development that can contribute to peace and prosperity is increasingly becoming a cause of fear and anxiety, which, as in the case of Russia and Ukraine, can turn into conflict. Partnership for Sustainability, has its roots in the UN Charter and human right.

The the main assumptions of the presenation will be the concept of building a global partnership for sustainable development. It will be presented based on a Ukraine war case and the lack of effective UN action in the situation of aggression on Ukraine of one the Security Council permanent member, Russia. It include such issues as the origin of state concept, the meaning of sustainability, the relation between the threat of the peace and sustainability, the UN Charter and legal base of potential P4S based on UN regulation regarding membership, and institutional structure, the right to collective self-defence and UN collective security, regulation regarding the prohibition of nuclear weapons.

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CO_2Uptake - A Taiwan Hackathon Project Devise the Collaboration and Co-Creation Model for a Net-Zero Future

PhD Student Dawei Wei-Jung HO, PhD Candidate Yun-Tsui Chang, Professor Shang-Hsien Hsieh
Department of Civil Engineering, National Taiwan University, Taipei, Taiwan

PHD STUDENT DAWEI WEI-JUNG HO

PHD CANDIDATE YUN-TSUI CHANG

PROFESSOR SHANG-HSIEN HSIEH

Abstract

Climate change is an urgent challenge that significantly threatens the modern world. According to the Intergovernmental Panel on Climate Change (IPCC), a net-zero carbon target must be achieved by 2050 to limit global warming to 1.5°C by the end of the 21st century. As a result, various countries have developed net-zero roadmaps to achieve this goal, including Taiwan's government. However, there is little discussion and exploration on how the public and private sectors can collaborate for a just and equitable transition to a low-carbon society, as many measures are still top-down approaches. Meanwhile, since 2018, Taiwan's government has held an annual Presidential Hackathon to promote innovation, citizen participation, and transparency in government. Participants, including software developers, data scientists, designers, and other experts, are invited to collaborate with government agencies to solve issues using open data and modern technologies.

CO_2Uptake is one of the winning teams for the Presidential Hackathon 2021. It aims to provide decarbonized solutions for public assets through "national assets inventory" and "matching carbon reduction measures" by engaging industry, government, and academic stakeholders. The project team has established a "dashboard of public assets query system" and a "decarbonize practice knowledge database" for reviewing relevant references and cases. The team also takes Da-an District (Taipei), Ji-an Township (Hualian), Shou-Feng Township (Hualian), Taoyuan and Tainan City as examples to showcase the synergy across "urban and rural regeneration and development" and "net-zero transition policies." Through in-depth interviews with the project teams and stakeholders, this paper aims to evaluate the outcomes and analyze the collaboration mechanisms between private and public sectors on different sites, along with their challenges, barriers, solutions, and potentials.

This paper is related to "SDG11-Make cities and human settlements inclusive, safe, resilient and sustainable (11.3, 11.4,11.7 & 11.a)", "SDG13-Take urgent action to combat climate change and its impacts (13.2)", "SDG15-Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss (15.2, 15.a & 15.b)", "SDG16-Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels (16.6 & 16.7)", and "SDG17-Strengthen the means of implementation and revitalize the global partnership for sustainable development (17.14 &17.18)". Moreover, this paper will contribute ISDRS 2023 through its novel Public-Private Partnership mechanism and local practice experience.

Keywords: Net-zero transition policies, Collaboration mechanisms, Decarbonized solutions, Climate governance, Public-private partnership, Urban and rural regeneration

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Photovoice, open data and Artificial Intelligence: implementation of a "participatory action research" methodology for social innovation and sustainable co-design processes

PhD Candidate Pietro Bova
Mediterranea University, Department of Architecture and Territory (dArTE) of Reggio Calabria (UNIRC), Reggio Calabria, Italy

PHD CANDIDATE PIETRO BOVA

Abstract

This contribution presents a visual methodology of Participatory Action Research (PAR) called "Photovoice" (Wang & Burris, 1997; Wang, 2006) – the use of this methodology is reported in literature for community engagement and social innovation, especially in developing or left-behind regions (Adams et al., 2017; Bova, 2022; Derr & Simons, 2020; Fantini, 2017; Trout et al., 2019) – discussing about two case studies in which the methodology has been implemented: 1) in the first case using two artificial intelligence-based tools for co-visioning actions in participatory processes, "Midjourney" and "Chat GPT"; 2) in the second case, where the open platform "monithon" was used for civic monitoring of European funds spending, adding a phase in which Midjourney translates the proposals into visions.

The results of these two application of Photovoice will be presented and compared. Both applications of Photovoice are integrated into educational pathways for schools that have facilitated the engagement of young students residing in the areas (of the case studies themselves). The first application of the method involved 21 students from the Metropolitan City of Reggio Calabria using the method to describe the urban heritage and landscape. In this case study, focus groups produced textual "prompts" to contribute in a co-visioning process using AI tools like Midjourney: a chatbot based on artificial intelligence whose task is to produce images that are as faithful as possible to the textual description provided. The second application took place in the Grecanica area of Reggio Calabria – a left behind and low-density area – where the use of the method allowed the students to produce a civic monitoring report on the spending of European funds, using the open-web-platform "Monithon" (Monithon - Civic monitoring marathon of public policies, 2021).

The multidisciplinary approach allowed by PAR methodologies theoretically improves community engagement, facilitates bottom-up governance and decision-making processes. Lastly, the use of PAR methodologies as Photovoice proves to be useful (in particular, but not only) for the achievement of target 10.2 of the 2030 Agenda by involving citizens into participatory processes concerning: 1) policies and social innovation; co-design of urban spaces from a sustainable perspective in line with the third P of sustainability (Prosperity).

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Connecting people and strengthening inter-institutional cooperation: The case of the Portuguese Sustainable Campus Network (RCS)

Dr. Antje Disterheft[1], Dr. Manuel Barros[2], Prof. Dr. Sandra Caeiro[1,3], Ana Carla Madeira[4], Vitor Manteigas[5], António Gomes Martins[6], Margarida Ribau Teixeira[1,7], Aldina Soares[8]
[1]CENSE – Center for Environmental and Sustainability Research & CHANGE - Global Change and Sustainability Institute, NOVA School of Science and Technology, Caparica, Portugal. [2]Ci2 - "Smart Cities Research Center, Escola Superior de Tecnologia de Tomar, Instituto Politécnico de Tomar, Tomar, Tomar, Portugal. [3]Universidade Aberta, Lisbon, Portugal. [4]Comissariado para a Sustentabilidade, Faculty of Engineering Porto, University of Porto, Porto, Portugal. [5]H&TRC - Health & Technology Research Center, ESTeSL – Escola Superior de Tecnologia da Saúde, Instituto Politécnico de Lisboa, Lisbon, Portugal. [6]Universidade de Coimbra, INESC, Coimbra, Portugal. [7]Universidade do Algarve, Faro, Portugal. [8]Escola Superior de Tecnologia de Setúbal, Instituto Politécnico de Setúbal, Setúbal, Portugal

DR. ANTJE DISTERHEFT

Abstract

Networks are an important mechanism for systemic change towards sustainability in higher education institutions (HEIs). In Portugal, there is no formal law or regulation at the governmental level pressuring for this change. Also, due to the lack of collaboration among the Portuguese higher education community, there was a need for action that would allow and strengthen an advanced sustainability implementation in higher education institutions. This work presents the activities that the Portuguese Network Sustainable Campus - Rede Campus Sustentável (RCS) has been undertaking, following a descriptive-reflective approach over the past 4 years of the network's existence. The history and organisation of the network are presented as well as a summary of its main initiatives, namely the results of the first national-wide survey report on the Implementation of Sustainability in Higher Education in Portugal, which was initiated and carried out by RCS and where the current practices in the main sustainability-related fields of actions are listed. This work aims to contribute to the studies about sustainability-oriented networks in higher education, addressing its current and future challenges.

By sharing the experience of the Portuguese Sustainable Campus Network (RCS), this contribution aims to inspire and be useful for possible replications in other regions and contexts. RCS has started to fill in the gap for the lack of a platform that connects Portuguese HEIs in pursuit of advancing sustainability. Started as a network of people and currently with over 280 members, RCS is preparing its future lines of action by fostering and enhancing institutional cooperation. At the same time, the network continues to share and create knowledge in the ten working groups and annual conferences, with increasing visibility and impact. Having carried out manyfold initiatives, being the survey report on the implementation of sustainability in Portuguese HEIs one of the most significant joint efforts of the network so far, RCS is committed to continuing to strengthen HEI's role in sustainability transformation and striving for a liveable future for all.

While RCS addresses all SDGs in its diverse activities, this work relates in particular to SDG 4 - Target 4.7, SDG 13 - Target 13.3, and SDG 16 - Target 16.6, and highlights the importance of the 5P's (People, Planet, Prosperity, Peace and Partnership) for strong inter-institutional collaboration and cooperation in the higher education sector. By fostering the 5P's through the network, they are becoming inherent to the different levels of actions, from teaching to operations and policy-making.

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A Journey of a University's Research Institute towards SDGs: Initiatives, Progress and Challenges

Dr. Choo Ta Goh
Universiti Kebangsaan Malaysia, Selangor, Malaysia

Abstract

Two years after the Rio Conference that was held in 1992, the Universiti Kebangsaan Malaysia (UKM) took the initiatives to establish the Institute for Environment and Development (LESTARI). LESTARI is one of the earliest academia research institutes in Malaysia that place emphasis on research related to sustainable development and sustainability. After 29 years of the establishment of LESTARI, it is timely to analyse progress of LESTARI in promoting sustainable development, especially to address the calls from various international initiatives, such as World Summit on Sustainable Development (WSSD), Johannesburg Plan of Implementation (JPoI), Millennium Development Goals (MDGs); Rio+20 and Sustainable Development Goals (SDGs). This paper discusses the initiatives and progress of LESTARI in the context of research strengths, which include research projects; journal publication, graduated students and activities, that support the SDGs. Also, this paper also discuss the challenges facing by LESTARI in promoting multi-, inter- and trans- disciplines research that are relevant to the SDGs.

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Leveraging South-South Cooperation and Triangulation to Enhance Growth and Resilience in Africa

Dr. Oyebanke Abejirin, Professor Bartholomew Armah, Citra Kumala
United Nations Economic Commission for Africa, Addis Ababa, Ethiopia

Abstract

Continuous sustainable growth and development is key for countries to ensure citizens are well taken care of and living standards are improving. Resilience is also increasingly important in the face of internal and external stresses and shocks that countries encounter. Ensuring growth and resilience has been difficult to guarantee and attain in the past few years in the face of the Covid-19 pandemic, the conflict between Russia and Ukraine and climate change (3Cs). Countries utilize various internal and external means, policies, frameworks, resources, instruments, and partnerships to attain growth and ensure resilience. South-South and Triangulation Co-operation (SSTC) has been noted in the past few years as a route for enabling low- and middle-income countries (LMICs) to attain their socio-economic goals. South-South cooperation is a form of solidarity among peoples and countries in the South that contributes to their national well-being, national and collective self-sufficiency, and achievement of internationally agreed development goals, such as the 2030 Agenda for Sustainable Development. The international community has lauded the need for partnerships and cooperation to achieve sustainable development, incorporating Goal 17, which emphasizes revitalizing global partnerships for the attainment of the Sustainable Development Goals (SDGs). Partnerships and cooperations have become even more pertinent considering the 3Cs which have exposed vulnerabilities in the health, industrial and agricultural sectors of many African countries, while testing their resilience. It has led to a call for the strengthening of food, health and industrial security for these countries and the need to do this through increased cooperation. The combined impacts of the 3Cs have seen negative impacts on various socio-economic indicators across Africa. This paper considers the role of SSTC in ameliorating living standards and promoting growth and resilience among LMICs in Africa, considering the impact of the 3Cs. It reviews in what areas SSTC has been successful in promoting certain kinds of growth and resilience, what challenges has been faced and draws recommendations for how SSTC can be more impactful given the current realities of the 3Cs.

Full Papers

Photovoice, open data and Artificial Intelligence: implementation of a “participatory action research” methodology for social innovation and sustainable co-design processes

Pietro Bova[1]

[1] Department of Architecture and Territory (dArTE), Università Mediterranea di Reggio Calabria, Reggio Calabria, Italy

[1] pietro.bova@unirc.it

Abstract. This contribution presents a visual methodology of Participatory Action Research (PAR) called "Photovoice" (Wang & Burris, 1997; Wang, 2006) – the use of this methodology is reported in literature for community engagement and social innovation, especially in developing or left-behind regions (Adams et al., 2017; Bova, 2022; Derr & Simons, 2020; Fantini, 2017; Trout et al., 2019) – discussing about two case studies in which the methodology has been implemented: 1) in the first case using two artificial intelligence-based tools for co-visioning actions in participatory processes, "Midjourney” and "Chat GPT"; 2) in the second case, where the open platform “monithon” was used for civic monitoring of European funds spending, adding a phase in which Midjourney translates the proposals into visions.

The multidisciplinary approach allowed by PAR methodologies theoretically improves community engagement, facilitates bottom-up governance and decision-making processes. Lastly, the use of PAR methodologies as Photovoice proves to be useful (in particular, but not only) for the achievement of target 10.2 of the 2030 Agenda by involving citizens into participatory processes concerning: 1) policies and social innovation; co-design of urban spaces from a sustainable perspective in line with the third P of sustainability (Prosperity).

1. Introduction

This contribution presents a visual methodology of Participatory Action Research (PAR) called "Photovoice" (Wang and Burris, 1997; Wang, 2006) – the use of this methodology is reported in literature for community engagement and social innovation, especially in developing or left-behind regions (Adams et al., 2017; Bova, 2022; Derr & Simons, 2020; Fantini, 2017; Trout et al., 2019) (Adams, Savahl and Fattore, 2017; Fantini, 2017; Derr and Simons, 2020; Bova, 2022) – in which AI-based imaging tools can be integrated into the process towards sustainable co-design. The contribution also proposes the implementation of such methodology in two case studies: 1) adding a phase in which Midjourney translates the proposals of 23 students into visions, through the use of Midjourney; 2) adding in the process a phase in which young participants learn and use the "Midjourney" and "GPT chat" tools – after a selection between other AI-based tools (Stable Diffusion; DALL-E)[6] – to translate verbal proposal into visions. In particular, the implementation of Photovoice using Midjourney was tested on a small scale within a case study: an educational course involving 21 students (aged between 17 and 18). Those 21 students were involved to discuss issues they face in their own urban landscape heritage, such as the lack of public green spaces or a lack in heritage valorization. At the end of the course, the students produced a series of proposals for some public urban spaces and indicated by them as spaces of the community landscape as well as linked to heritage. Finally, the students' proposals (for the urban landscape spaces they identified) were converted into Midjourney prompts with my facilitation as well as teaching how to use the tool.

[1] Midjourney was the more user friendly and the more adapt to translate the co-enginered prompt in to images

Thus, the students attempted to propose visions for urban spaces/landscapes, including the entrance of a museum in Reggio Calabria (Italy) commonly called MAaRC (Archeological Museum of Reggio Calabria. Furthermore, as a side activity, the students produced descriptions of the heritage to be included in the European platform "Cultural Gems".

Photovoice is evolving with the development of technology that can be used in participatory processes. These attempts to use open data, web-platforms such as Monithon and AI-based tools represent further implementation possibilities (between risks and opportunities) of Photovoice and PAR methodologies in general. Thus, this contribution considers the potential and criticalities of using such tools within participatory action research (PAR) processes and push forward the co-vision and the co-design process. Last but not least, there are few paper or contribution in literature talking about a real integration of AI-based tools in design processes (Ploennigs & Berger, 2022) considering risks and opportunities, and this contribution is one of the first to write about an experimentation in a co-vision process.

2. Literature review & problem statement

There are various participatory action research (PAR) methodologies born from the need of academics to link expert knowledge to the knowledge of communities for the resolution of complex problems (Borda, 2006, 2013; Robles Lomeli and Rappaport, 2018). Among the PAR methodologies, in the field of architecture and landscape, those that use visual tools such as Photovoice (Wang and Burris, 1997) are particularly useful (Bruns and Münderlein, 2016).

However, Photovoice itself presents some critical issues, such as the difficulty of not producing the result expected by the method which is the lasting and proactive dialogue between the community and decision makers (Fantini, 2017; Derr and Simons, 2020).

Having acknowledged the critical issues of the photovoice method, it is useful to consider the evolution of tools based on open data (i.e. Monithon and Open Coesione) which can be linked to the evolution of PAR methodologies. In particular, these new tools help in the implementation of the Photovoice methodology: 1) Monithon or Khoesio (in Europe) to implement the dialogue between communities and decision makers through open knowledge of public expenditure for cohesion policies; 2) AI- based tools like Midjourney for the rapid creation of visual proposals by the community, which can then be further discussed and explored for future technical and economic design.

Starting from the possibility of implementing the Photovoice method, the results of two application (in Italy) of the PAR methodology “photovoice” will be presented and compared in this paper. Both applications of Photovoice are integrated into high school laboratories, the choice to involve high school is (nonetheless) determined by the reason to reach and involve young citizens in the participatory process. Moreover, the decision to involve young people is based, on data from the Italian statistical institute (ISTAT) which see an exodus of young people in the Greek area (Bova, 2022; IstatDashCens, 2022; Strategia Nazionale Aree Interne - Area Grecanica, 2022)

The first application took place in the Grecanica Area of Reggio Calabria – a left behind and low-density area – where the use of the method allowed the students to produce a civic monitoring report on the spending of European funds, using the open-web-platform "Monithon" (Monithon – Maratona di monitoraggio civico delle politiche pubbliche, 2021). The second application of the method involved 21 students from the Metropolitan City of Reggio Calabria using the method to describe urban issues as perceived and experienced by the students themselves. As described before, both this application are an attempt to implement the methodology “photovoice”, declining it according to the two case studies. This contribution, after this comparison to show the “flexibility” of the method, wants to show further the possibility within the integration of “Midjourney” – an AI based tool – in the PAR process. Tools like Midjourney are able to quickly - in about a minute - convert the textual proposals of active citizens into images that can help in the co-visioning process, in a way that implements rather than replaces the work of an actual illustrator: who is usually involved to facilitate the co-visioning stages. To speed up and implement the work of illustrators in the co-visioning stages, it is possible to use those new tools for the representation of ideas expressed by the community in textual form.

Finally, the proposal in this contribution - which is then followed by a proposal for the implementation of participatory action research methodologies through new and accessible AI-based tools, describing also an application on a small sample of participants in a PAR - stems from the assumption that new

AI-based imaging tools can assist the co-visioning phase of focus groups envisaged in various PAR methodologies (world café, photovoice, etc.).

3. Methodology (proposal)

As mentioned in the introduction, there are various PAR methodologies that involve a co-visioning step for design solutions that impact the way a community live. A practical example in which the author of this contribution took part is the co-visioning phase of the "RC metro citizens in transition"[7]: the metropolitan agenda for the achievement of Sustainable Development Goals (UN Agenda 2030) in the city of Reggio Calabria (Italy). On the context of "RC metro citizens in transition", during a workshop day – where there were involved local associations, stakeholders and facilitators – the co-visioning process was facilitated by illustrators from the Mediterranean Faculty of Architecture in Reggio Calabria. At the end of the workshop day, it was possible to return the proposals both verbally and visually, and one of the proposal produced an actual ongoing projects (Bova and Mangano, 2023).

Figure 1. Co-visioning day based on the world café method facilitated by experts and designers at the Metropolitan City of Reggio Calabria – RC metro citizens in transition project *(*Agenda metropolitana | RC Metro Citizens in Transition*, 2022)* – Ph. A. Leuzzo (2022)

Thanks to the illustrators, it was possible to convert the verbal proposals of the workshops into visual presentations as quickly as possible (in about 1 hour). Obviously, the timing in the production of a visual output coming from the workshops or from the PARs (in general) can vary case by case, in relation to the objectives and the different representation tools used.

With the advent of AI-based imaging tools such as midjourney, at least two possible scenarios can be outlined in which the co-visioning process can be implemented.

The first case in which midjourney can implement the participatory process is where the illustrators/facilitators use the tool to speed up the process. In this first case, there is an ad hoc training of the facilitators (who may not even know how to draw) in the use of the tool. In this first case, Midjourney (or similar AI-based tools) is not a substitute tool for the illustrator but it is an additional tool that can speed up and facilitate the process of translating proposals into visions.

The second implementation scenario, instead, involves the community itself as “illustrators” using Midjourney. Facilitators can quickly teach participants how to use the Midjourney tool so that they

[2] Project about Metropolitan developmental sustainable Agenda, according to natonal and regional strategy on 2030 Agenda (UN) in Metro-City of Reggio Calabria. Promoted by “Ministero della Transizione Ecologica (ex MATTM)”, by “Settore 5 - Istruzione e formazione professionale” of Metro-City of Reggio Calabria. Scientific partner of the project: ABITALab dArTe dell’Università degli Studi “Mediterranea” di Reggio Calabria. Scientific Supervisor Professor Arch. C. Nava and technical responsible Arch. Rtda G. Mangano. Website: https: // www.rcmetrocitizensintransition.com/

can take "partial" control of the visioning process and proceed individually in the production of visual and textual proposals to discuss. It should be noted that in this second case, longer periods of time are needed for the relatively quick formation of the involved community. This second case is inspired by the "photovoice" methodology, which in the 1990s (Wang and Burris, 1997; Wang, 2006) saw a training phase among the phases of the participatory process where the community learned the basic notions needed to take photos.

In any case, if both proposals represent opportunities for the implementation of PARs, it is necessary to dwell on the risks that have only recently (given the recent increase in their use) been investigated in the literature.

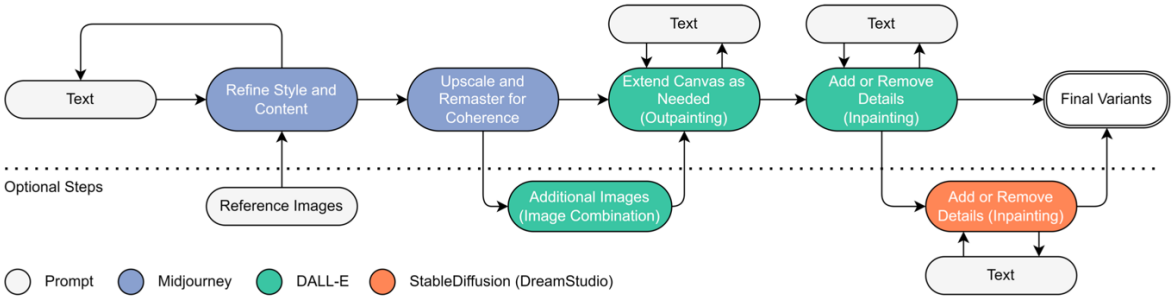
4. Risks

Regarding the use of AI-based imaging tools, specifically referring to "Midjourney" and other similar tools, they must be strongly considered in terms of risks and opportunities. The risks include the use of these tools for creating fake news with hyper realistic images and/or text (Aïmeur, Amri and Brassard, 2023), as well as the cognitive biases that borrow from what already exists online: for instance, asking Midjourney to represent a successful person in the world of finance then the tool will return us a man dressed in a suit and tie rather than a woman. However, this contribution will focus principally on the risks related to the world of design, co-design and co-vision.

In terms of risk related to these fields, the possible total replacement of designers in the field of design or in the artistic field has recently been explored in the literature (Radhakrishnan, 2023). Radhakrishnan in particular compares the results of 40 architecture students against Midjourney's results in the production of images based on textual "prompts" (2023). However, Radhakrishnan's article dwells on the limit of the "prompt" itself as the only way to interact with the tools. At present (June 2023) the speed of evolution of Midjourney and similar tools (competitors) has already made available the possibility to start from an image and modify part of it and/or add piece of image in addition to a writed prompt (Ploennigs and Berger, 2022). Taking this possibility in mind, the 40 students mentioned in Radhakrishnan's article could have converted their sketches into photorealistic images: the visioning process would thus have been implemented without a competition between human beings and AI.

Have to be noticed, those suggested integration of AI-based tools in design processes is being explored recently (Jaruga-Rozdolska, 2022; Ploennigs and Berger, 2022) due to the recent increase in popularity and usability: it's a frontier research topic.

Figure 2. *A Process of using 3 AI-based tools for vision generation. The three tools are Midjourney, Dall-e, Stable Diffusion (Ploennigs and Berger, 2022, p. 15)*



Among the opportunities offered by these rapidly evolving and widespread tools, there is precisely the possibility of using them in an integrated way in the design processes (Jaruga-Rozdolska, 2022; Ploennigs and Berger, 2022). A further opportunity is their inclusion in participatory design processes, given the relative accessibility that these tools have - outside the digital divide - which makes them potentially useful in co-vision and co-design processes.

Furthermore, by including them in the system together with the use of online platforms that use open data for participatory budgets, civic monitoring (Bova, 2022), participatory planning and/or other PARs, the range of possibilities expands.

However, the user should see those tools not as a complete replacement for the work of an illustrator/designer but as tools that can be integrated into the planning and participatory planning processes.

The tools considered in this study generates images that correspond as closely as possible to the textual description provided by the user, using diffusion models (based on GPT-3 or newer machine learning models) to predict the groups of pixels:

> *"These AI art platforms are all using generative machine learning models, specifically text-to-image generative models. Despite their specialization on generating images they are all based on the natural language model GPT-3* (Brown *et al.*, 2020, pp. 1877–1901)*. GPT-3 is trained to generate text that completes a textual input query, more precisely it predicts the next possible combinations of words to an input text. The specific Image GPT-3 models used by AI art platforms are re-trained to instead predict the next cluster of pixels in an image for a given input text."*
> *(Ploennigs and Berger, 2022)*

Finally, a clarification should be made on the reasons for choosing Midjourney as the tool to be used in the testing discussed in this article, rather than Dall-E, Stable Diffusion or others.

Although Midjourney does not offer the possibility of "inpainting" or "outpainting" operations[8], it was selected for its ease of use made possible thanks to the (popular) web platform (VoIP[9]) Discord and its free period during testing. Thus, Midjourney can generate image of solutions, space configurations, visions that can enhance the co-visioning debate and provide more guidance to the human illustrator/designer. Nevertheless, the user have to keep in mind the limit that the represented spaces do not exist and Midjourney can produce only "visions" (so far) in a design process. About this last point, Ploennigs & Berger, 2022 state that is only matter of time until the Building Information Model (BIM) will contribute in the use of AI in an enhanced way:

> *"But, as we already have Building Information Models (BIM) that provide this semantic information it is just a matter of time that new models will arrive that are trained specifically on these datasets and it is likely that they will be able to fulfil all requirements from Table"*
> *(Ploennigs and Berger, 2022, p. 19)*

5. First testing of Midjourney within Photovoice

The experimentation of Midjourney, within the framework of the Participatory Action Research (PAR) method called Photovoice, took place during a Transversal Skills and Orientation Path (PCTO[10]) held at the multimedia laboratory of the University of Reggio Calabria (UNIRC).

This PCTO therefore involved 21 students aged between 17 and 18 from the school named "I.T.E. R. Piria-G.Ferraris-A. Da Empoli Polo Turistico": a school that offers useful training in the technical field and in touristic one.

In particular, the PCTO had three objectives: 1) to train young students on how to set up a narration of the urban heritage useful for sustainable tourism, using the photovoice method to debate in focus groups on the potential and critical issues found in the use of the urban heritage; 2) synthesize verbal proposals for the resolution of the critical issues reported through the Photovoice method; 3) train and inform young people on the use of Midjourney, discussing risks and potential, to then use the tool to convert verbal proposals into visions.

The laboratory of co-visioning and narration of heritage and urban landscape was developed in 4 classroom sessions, for a total of 20 hours in the laboratory, without counting the hours that the

[3] Relatively new functions then also included in the latest version of Adobe Photoshop

[4] Voice over IP

[5] Training courses provided in Italy - as required by Italian law n. 107/2015 "Good school" - which provide laboratory activities for school-age students within universities, companies and start-ups

students spent in their daily lives investigating and photographing the places to be discussed in the laboratory.

The laboratory activities were structured starting from a simplified declination of the photovoice method, given the limited number of hours available, in the following this 7 steps:

1. The 21 students were invited to form sub-groups. The optimal number of participants per group is between 7 and 10 young people according to Wang (2006), but in this case the students preferred to create group of 3 up to 5 people to investigate more urban heritage elements. In this case there were 5 groups;

2. the series of meetings for the PAR, in this case, was determined by the availability of use of the multimedia room of the Department of Architecture of the Mediterranean University of Reggio Calabria between February and March. During the first meeting were introduced and explained: the photovoice method; the objectives of the PCTO; in short, the potential and criticalities of AI-based tools such as Midjourney;

3. Deadlines have been set for sending photographic and videographic material via google form. Together with the photographic and videographic material, they were asked to send a short text - as required by the Photovoice method - which described the potential and critical issues found in the urban place. This step alone can lead to more rounds of photovoice. According to Wang (Wang, 2006), 1 to 3 rounds of photovoice are required, the number of rounds must be decided based on the requests of the participants;

4. During the fourth step, the potential and critical issues in some urban places – community or heritage spaces – selected by the students were discussed. It was possible to start discussions in the classroom which were aimed at the preparation of proposals/visions for the places covered. Finally, the students started drafting textual proposals (for Midjourney) and descriptions of the places to be uploaded on the "Cultural Gems" web platform;

5. In the fifth step, time was spent transferring knowledge and skills in using the Midjourney tool and Chat GPT[11]. The students were thus able to learn how to produce visions starting from their textual proposals. Furthermore, the students were able to verify in a reasoned way if Chat GPT was able to produce different prompts starting from their ones. During the hours in the classroom, the visions were then produced (figures 3 & 4) starting from the proposals in textual form;

6. The sixth step also focused on using the Midjourney tool. In particular, it was possible to discuss the visual results obtained in a critical key, thus making it possible for the students to fully understand trial and error process up to the generation of the vision. For example, from the first 4 images provided by Midjourney based on the prompt, it is possible to request 4 variants of one of the images. Moreover, it is possible to upscale the image in terms of image resolution. In the case the user is not satisfied, it is also possible to “engineer” the prompt again.

7. The seventh step saw the discussion with several Professors - including Prof.ssa in Urban Planning A. Sarlo of the Mediterranean University of RC - on the potential of AI-based tools in the field of co-vision and co-design. Furthermore, the students uploaded descriptions and photos - collected with the photovoice method – about the places they investigated in this PCTO using the online platform "Cultural Gems".

The substantial difference between this declination of Photovoice with AI-based tools and the Photovoice declined for young people (Wang, 2006) is visible in the series of outputs to be brought to discussion with decision makers and policy makers. If the Photovoice method provides for the discussion of

[6] A trained “a model called ChatGPT which interacts in a conversational way. The dialogue format makes it possible for ChatGPT to answer followup questions, admit its mistakes, challenge incorrect premises, and reject inappropriate requests.” (*Introducing ChatGPT*, no date)

photographic material and textual statements and proposals, the (proposed) declination of the method that adds AI-based tools makes it possible to bring even "visions" to discuss in the focus groups and with decision makers.

AI-based tools does not replace the designers who can join focus groups but becomes an additional tool to be used to speed up visioning processes. Furthermore, the AI-based tools for image generation can also be used by the community and young people – after a brief training and awareness about the tool itself - to bring their unique vision drafts within the focus groups discussions (together with photographic and textual material).

Finally, the photovoice method itself has strengths and weaknesses that must be taken into consideration in the design of the participatory process (Fantini, 2017; Derr and Simons, 2020; Bova, 2022) with or without AI-based tools .

In summary, the PCTO aimed at the training and simulation of a community editorial team capable of: 1) indicating and describing the urban heritage elements in a useful manner to tourists, uploading photos and descriptions about some urban places throw using the "Cultural Gems" platform by the Joint Research Center (JRC) of the European Commission; 2) producing textual proposals to simulate a co-vision process about the urban heritage and discuss it.

Figure 3. Vision productions for each subgroup of students, starting from the first prompt up to the upscaling of the images produced by Midjourney

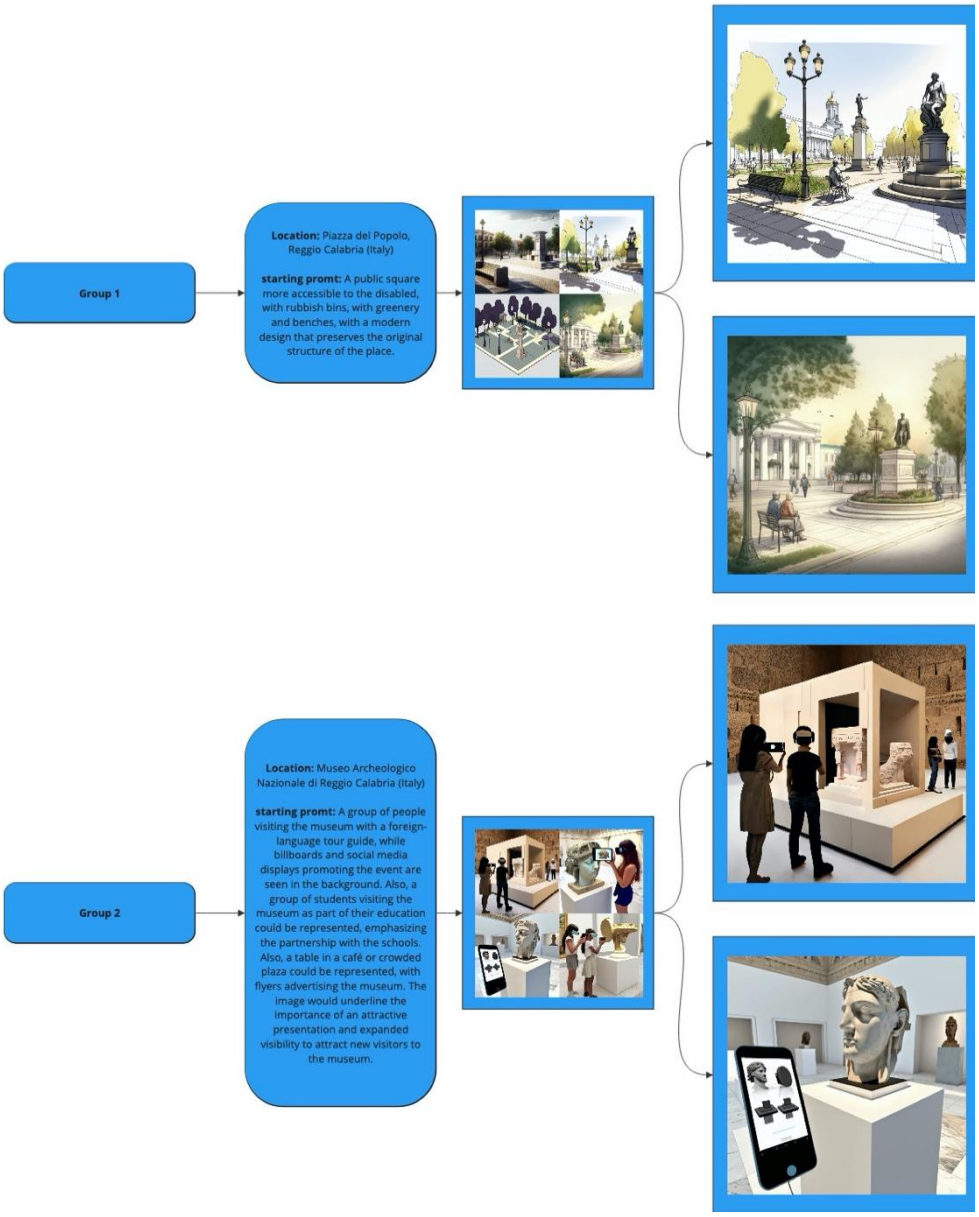
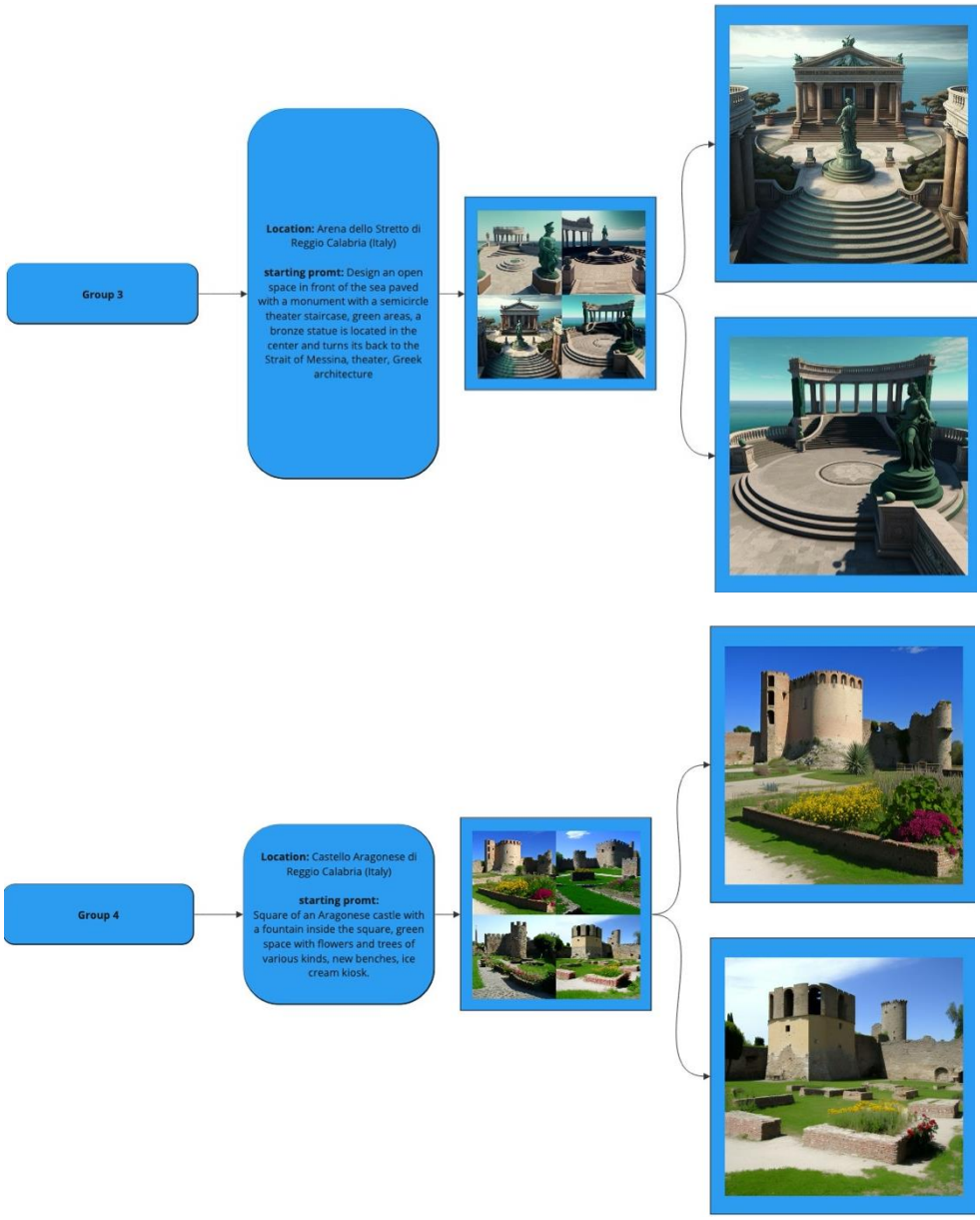
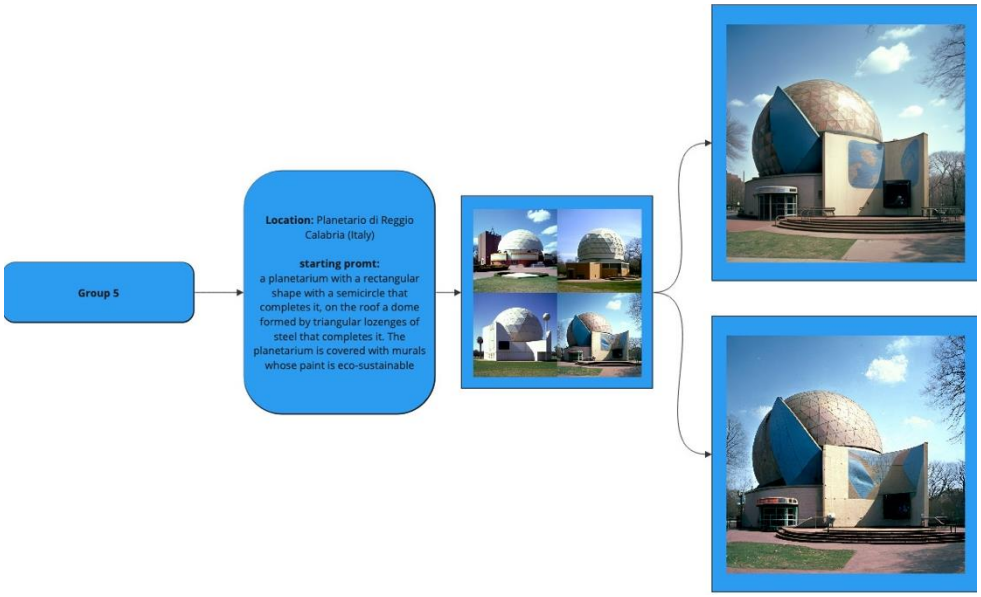

Group 1
Location: Piazza del Popolo, Reggio Calabria (Italy)
starting promt: A public square more accessible to the disabled, with rubbish bins, with greenery and benches, with a modern design that preserves the original structure of the place.
Group 2
Location: Museo Archeologico Nazionale di Reggio Calabria (Italy)
starting promt: A group of people visiting the museum with a foreign-language tour guide, while billboards and social media displays promoting the event are seen in the background. Also, a group of students visiting the museum as part of their education could be represented, emphasizing the partnership with the schools. Also, a table in a café or crowded plaza could be represented, with flyers advertising the museum. The image would underline the importance of an attractive presentation and expanded visibility to attract new visitors to the museum.

Figure 4. Vision productions for each subgroup of students, starting from the first prompt up to the upscaling of the images produced by Midjourney





6. Second testing of Midjourney within Photovoice: "what if" Midjourney was used in a participatory process in Area Grecanica di Calabria

This section of the article takes up some textual proposals brought to a discussion table that saw 23 students from two high schools in the Grecanica area of Calabria (Italy)[12] as protagonists. These proposals are one of the results of an application and declination of the Photovoice method which took place in 2022. In this application of the PAR method it was possible for the students to bring attention to the potential and critical issues present in the landscape they experience every day, and it is also It was possible for them to create a civic monitoring report on the expenditure of European funds for an ongoing project in 2022[13] given its impact on the landscape they discussed (Bova, 2022). During this Photovoice application, the students were able to use the open data on the Open Coesione website (*OpenCoesione - Home*, 2014) and upload the civic monitoring report thanks to the open online platform called "Monithon"[14].

During the discussion table between the students and the decision makers, the students were able to present their proposals – realistic proposals and/or linked to the expenditure of European funds - together with the photographic and videographic material about their report on the landscape of the Grecanica Area of Calabria. However, it was not possible for them to bring proposals in the form of a vision. In this circumstance, the "Midjourney" tool could have facilitated the creation of the supporting visual content. Below are some of the proposals brought by the students to the discussion table that could have had supporting visuals:

- the real estate assets could be restructured, keeping the ruins intact, guaranteeing safety and constant cleaning of the area;
- greater protection of the environment (beaches, parks, urban environment, etc.);
- move towards better resolutions of the waste issue.
- we should constantly encourage monitoring of the various landscapes on which the (funded) projects act, modifying their purpose according to the needs of the landscape (and communities).

[7] Respectively the school for surveyors "Euclide" of Bova Marina (RC) and the linguistic high school "Ten. G. Familiari".

[8] Specifically, the monitored project is the following: ""Conservation and monitoring of the habitat of the oil scrub - juniperetum turbinatae - Fiumara Amendolea SCI area and Capo San Giovanni area - restocking and restoration of species of conservation interest in the oil scrub " (*Report | Monithon*, 2022)

[9] Platform linked to "Open Coesione" which facilitates the drafting of civic monitoring for the expenditure of European funds mainly in Italy

- I would propose the improvement and in some cases the reconstruction of the roads, as there are deep holes that endanger the whole of society, both for those who walk, but also for scooters and cars.
- It would be interesting to organize, in the surroundings, a food and wine tour at km0, through the tasting of bergamots because this one is even used by Guerlain for the creation of perfumes.
- The cultivation of the most representative plant species of the lower Reggio Ionian could be encouraged, starting with those at the highest risk of extinction, also protecting the centuries-old plants of extraordinary beauty.
- increase tourism through excursions that help us discover all the hidden treasures of our Grecanic area
- try to reduce pollution in the sea;
- the surrounding environment of the railways could be improved, in such a way as to have a pleasant view for those who are passengers to observe. It would also be a good way to enhance the beauty of our territory
- Try to give more attention and cares to the territory of the fiumara "Amendolea"[15].

The proposals[16] reported in this article were selected because they referred to specific places shown in photos thanks to the work of the students foreseen by the Photovoice method (Wang, 2006). The prompt engineering process in this case therefore takes into account the presence of the reference images to be used (figure 5).

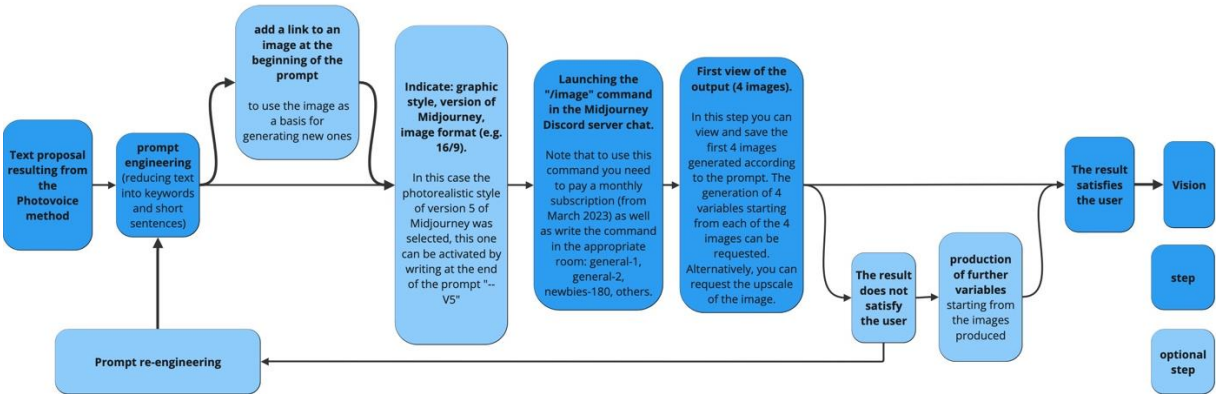
When engineering the prompts, it must be taken into account that Midjourney is based - like its competitors - on a diffusion model that should be similar to the GPT-3 (Ploennigs & Berger, 2022). In order to obtain an optimal result, in this case it is necessary to review the sentences and highlight the keywords, so that the generated images are as faithful as possible to the students' idea. Furthermore, it is possible to request a particular style of representation from Midjourney. In this case, a photorealistic style will be requested by activating version 5 of Midjourney, by adding "-- V5"[17] to the prompt like in the process in this figure n. 5.

[10] The waterways in Calabria are called "fiumara" in dialect. the "fiumara dell'Amendolea" is the most important waterway in the Grecanica area of Calabria

[11] Partial list of the proposals presented at the discussion table between students and decision makers.

[12] Note that there must be a space between the two dashes and “V5”.

Figure 5. Synthesis process of the visions hypothesized using Midjourney (and optionally chat GPT) during the PCTO "Photovoice & Landscape" in the Grecanica area of Calabria (Italy)



Below are the students' Proposals elaborated using the photovoice method, synthesized and engineered in the form of a prompt:

1. landscape where a restructuring and regeneration work has taken place, with intact ruins, people who maintain the landscape, people who visit the landscape --V5;
2. people who protect the environment and the beach, people who collect garbage on the beach -- V5;
3. people who collect and recycle rubbish on the street -- V5;
4. people monitoring landscape health, community action, landscape monitoring technology instrumentation -- V5;
5. reconstructed road, road without potholes, people walking, people riding bicycles, people riding electric bicycles, electric cars -- V5;
6. people on a km0 food and wine tour, people tasting of bergamots -- V5;
7. people who cultivate the most representative plant species of the lower Ionian of Reggio, centuries-old olive trees of extraordinary beauty -- V5;
8. people nowadays on a tourist excursion, sustainable tourism, among the ancient ruins of the Greek area -- V5
9. group of scientists and community people contributing to the reduction of microplastics in the sea, seawater cleaning technology systems -- V5;
10. railroad Surroundings, Train Passengers Admiring the Scenery -- V5
11. group of people who take care of the environment, technological equipment for the production of sustainable energy, energy community, solar panels, wind turbines, Zaha Hadid[18] -- V5.

These prompts have been reused according to the process in figure n. 5. A selection of the synthesized images - through the use of the prompts and the photos produced for the application of Photovoice in the Grecanica Area of Calabria - have been reported in figures 6 and 7. Also, note that Midjourney version 5 was used to synthesize these images.

[1]3 The architectural style of the Arch. Zaha Hadid is included in the prompt, in accordance with the discussion within the focus groups regarding the (not yet built) future "sea museum" of Reggio Calabria designed by the famous architecture studio

Figure 6. Visions starting from the reference photos (of the landscape elements in the Grecanica area of Calabria) and from the prompts n. 1, 4, 5.

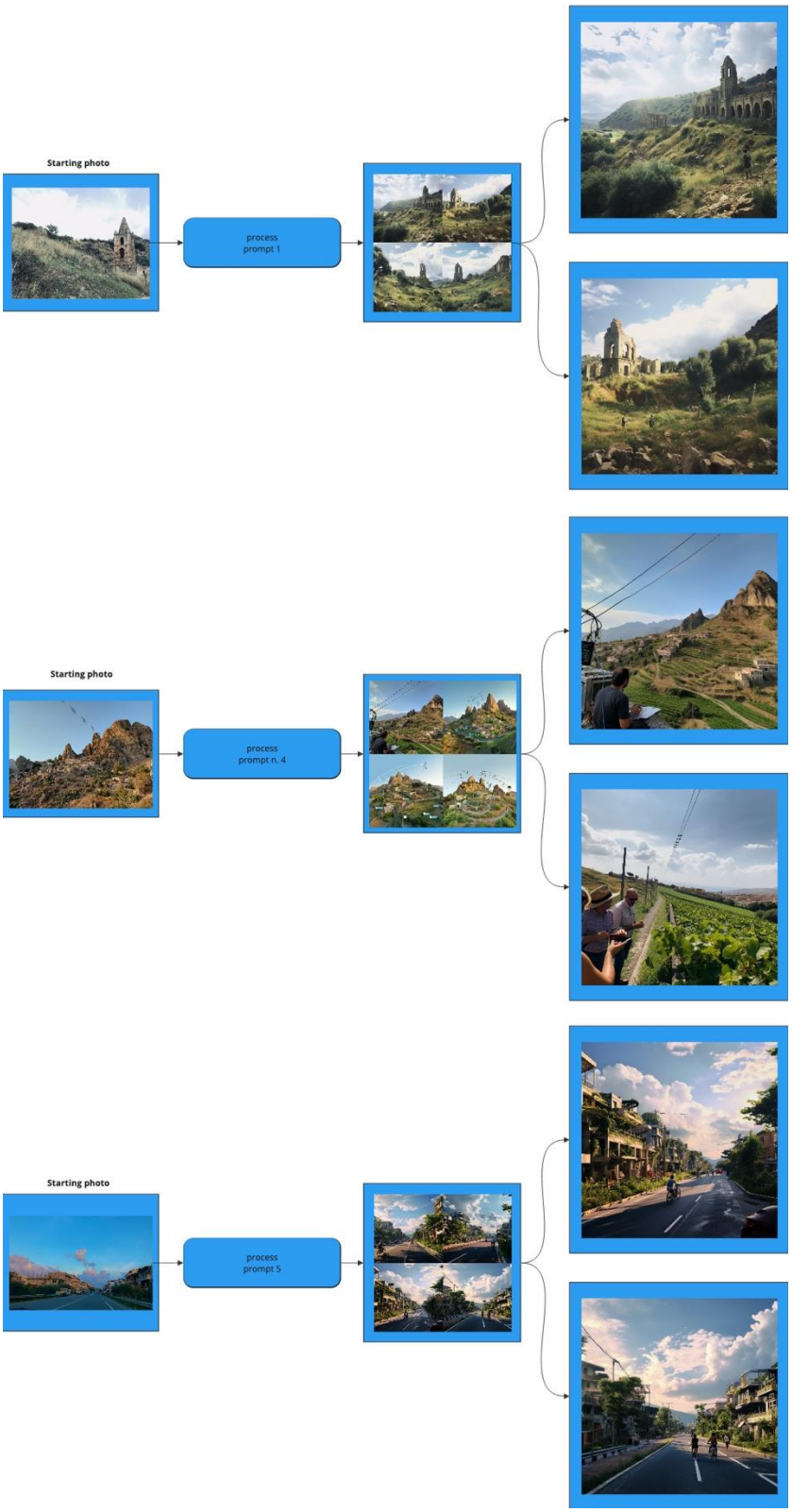
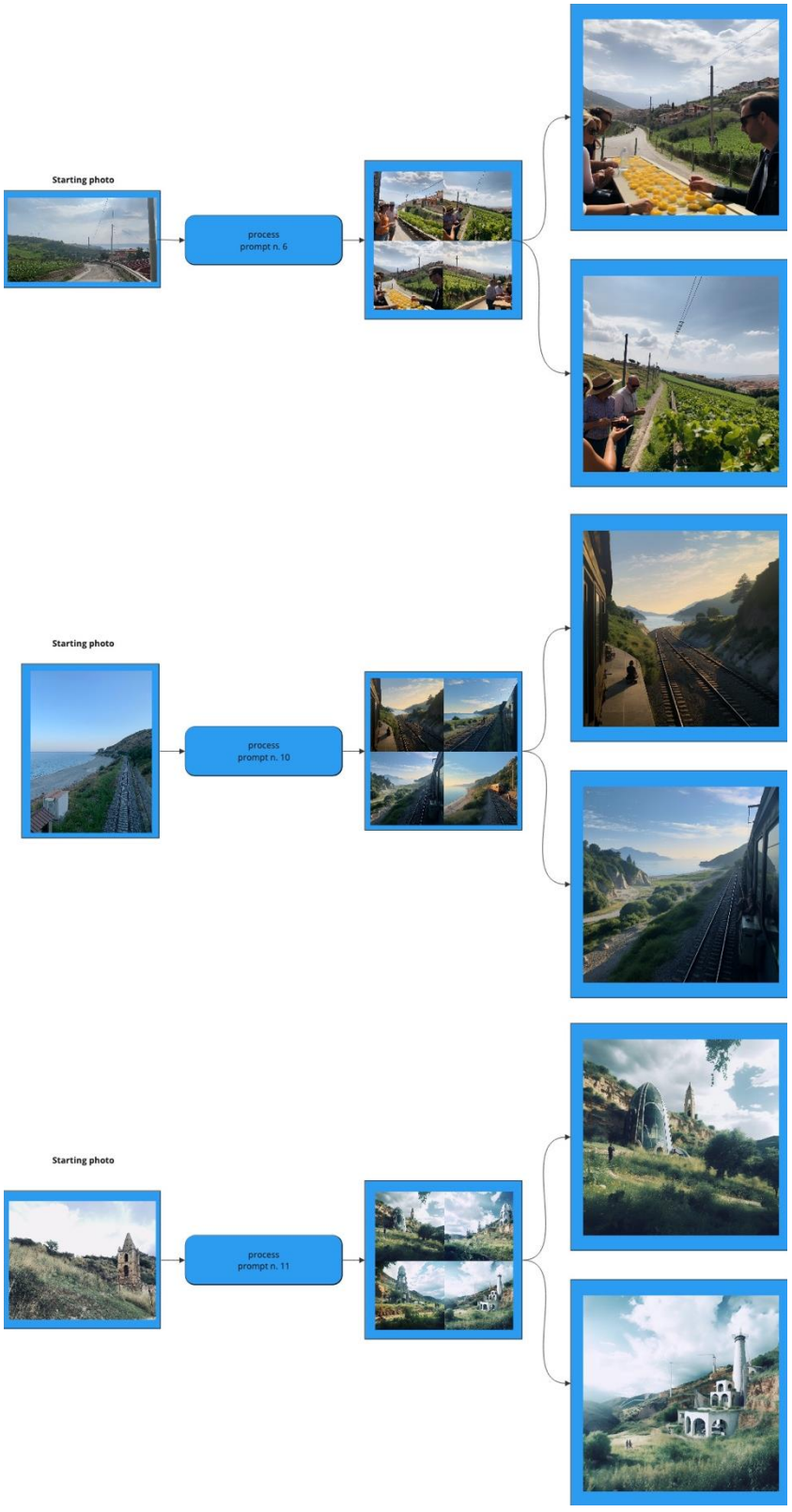


Figure 7. Visions starting from the reference photos (of the landscape elements in the Grecanica area of Calabria) and from the prompts n. 6, 10, 11.



7. Results & considerations

The application of Photovoice in the Grecanica area of Calabria and within the PCTO of UNIRC led to two types of results and outputs produced by the students.

In the first of the two applications with 21 students, it was possible to construct a narrative of the elements of the urban heritage of the metropolitan city of Reggio Calabria which were then reported on the "Cultural Gems" web platform (*Cultural gems*, 2022) and, furthermore, with the integration of Midjourney , it was possible to generate visions starting from textual proposals for these places. In this first application, time was spent transferring knowledge and skills on the use of AI tools (especially on Midjourney and GPT chat), discussing potential and risks.

In the second application, with 23 participants, it was possible to imagine what visions the students would have produced starting from their textual proposals (already) produced - together with the photographic material - as foreseen by the Photovoice method in 2022: to set up the dialogue with the decision makers.

Both experiences - linked by issues related to community, heritage, environment, landscape and social innovation - have produced proposals that look at several of the SDGs of the United Nations 2030 Agenda. In particular, the two Photovoice applications implemented with AI-based tools (per se) represent actions in achieving target 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" (Agenda 2030, UN) – by involving citizens into participatory processes concerning: 1) policies and social innovation; co-design of urban spaces from a sustainable perspective in line with the third P of sustainability (Prosperity).

The implementation of the Photovoice method or other Participatory Action Research methodologies, as proposed in this text, does not replace the work of the designers or the community but rather allows to speed up the co-visioning process. Besides, the testing in the PCTO with 21 students has shown - albeit on a small scale, and further test are needed – that it is indeed possible to transfer the knowledge necessary for the use of the "Midjourney" tool relatively quickly: the entire PCTO was 20 hours. Alternatively, the tool can still be used by the facilitator, who can input the textual proposals for the creation of images – as in the case with 23 students in the Grecanica Area of Calabria - useful in the process of co-visioning and participatory design of places, spaces, and landscapes.

Ultimately, there are still many limitations that do not allow the use of Midjourney-like tools in other phases of the design process, however according to Ploennigs & Berger (2022) – given that these models can be trained and there is already interoperable data that represent buildings (BIM) – it is only a matter of time before such tools can be used in further project phases.

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TRACK 9
Governance. Power and institutions

9c. Public participation and the role of stakeholders

Abstracts

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What constitutes and drives socio-technological and institutional innovations in water governance?

Hiu Ching CHUNG[1], Joanna Tsz Ching WONG[1], Dr Wanxin LI[1,2]
[1]City University of Hong Kong, Hong Kong, Hong Kong. [2]Tsinghua University, Beijing, China

Abstract

Hong Kong's water resources are under increasing stress from supply and demand challenges. Over 70% of drinking water in Hong Kong is imported from Guangdong province, cross the border. Cities relying on the same water source, the Dong river are important economic powerhouses in the Pearl River Delta. Meanwhile, the flow of the Dong river has been reduced by 30%, and the current level of water withdrawals has already exceeded its ecologically safe level (Yang, Chan, and Scheffran 2018). Increases in demand related to economic and population growth and supply decreases due to climate change would increase drought risk and threaten Hong Kong's sustainability. To address these challenges, since 2008, the Water Supplies Department (WSD) has deployed a mix of technological (e.g., smart metering) and non-technical (e.g., water efficiency labeling) measures, and expansion of public education. They have had limited success in reducing water demand (Li, von Eiff, and An 2020).

This article will survey socio-technological and institutional innovations in water governance in cities with water shortages to facilitate international policy learning and develop a holistic approach towards sustainability transitions. We want to understand the drivers, enabling and impeding conditions, working mechanisms, and impacts of those innovations. More specifically, we aim to address the following research questions.

- What socio-technological and institutional innovations have occurred and been documented?
- How much attention have the academics, policymakers, and the public paid to the above-documented socio-technological and institutional innovations, and changes over time?
- Who are the agents of change, and how have they worked with significant water incidents, breakthroughs in science/technology, changes in political leadership, changes in government policies, and/or non-state actors?

Using Melbourne, Singapore, and Israel as case studies, we uncover the system of innovation by systematically analysing the existing documents related to water governance, including academic literature, government regulations and regulations, and reports by civil society groups (NGOs). A combination of bibliometric and textual analysis will enable us to

- substantiate the specifics of documented socio-technological and institutional innovations,
- explicate the narratives on the emergence, adoption, and scaling up of those innovations, and
- constructing the functions played by the major actors in the innovation system, e.g. social guidance, market creation, entrepreneurial activity, knowledge development, resource mobilization, legitimization, and/or positive feedback.

Compared with the existing literature, the contributions of our study are threefold. First, we utilize computational social science methods to develop sustainable water governance theoretical constructs, following a grounded theory approach. Second, we bridge environmental governance and innovation system framework to substantiate the processes of transitions towards improved water sustainability. Lastly, we offer new case studies on environmental policy and governance, particularly on the extremely scarce but life-sustaining resource, water. Practically, our study will inform the Hong Kong SAR Government and other states of innovative measures to improve water sustainability and facilitate knowledge sharing and international lesson learning.

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THE BOTTOM-UP APPROACH TO SUSTAINABLE BUILDING CONSTRUCTION AND THE EMPLOYER'S OBLIGATIONS: A PROPOSED CONTRACTUAL FRAMEWORK

Dr Khariyah Mat Yaman[1,2], Professor Zuhairah Ariff Abd Ghadas[1]
[1]Universiti Sultan Zainal Abidin, Terengganu, Malaysia. [2]Messrs Hisham, Sobri & Kadir, Petaling Jaya, Malaysia

DR KHARIYAH MAT YAMAN

PROFESSOR ZUHAIRAH ARIFF ABD GHADAS

Abstract

Sustainability in construction involves living in harmony with nature. The quest for a secure and healthy society is typically interwoven with economic and environmental endeavours. The construction industry continues to face the challenge of promoting sustainability, both in terms of resource consumption and carbon emissions. If economic and social development is to continue without damaging the environment that sustains us, each member of the building industry must contribute to the identification of new sustainable future pathways. In the construction supply chain, the employer is the main stakeholder that dictates the direction of a project. The employer is the principal contracting party for whom the work is undertaken and usually owns the land where the work is performed. The bottom-up approach to sustainable building construction would necessitate a paradigm change in the employer's requirements. This approach can be mandated through contractual obligations that bind the rest of the supply chain that catalyst the coordination, collaboration, and partnership needed to meet Goal 17 - Partnerships for the Goals (SDG 17). This paper highlights the legal obligations that may affect the employer if sustainability is pursued in a building project. The obligations were derived from analysing the relevant rating tools introduced into the Malaysian construction industry market to assess building sustainability. The requirements were then compared and analysed within the current structure of the building standard forms in Malaysia under the traditional general contracting method. The analysis revealed that whilst the current structure of the standard forms affecting the employer's obligations is to be maintained, there are augmented obligations on the employer's part that must be addressed to successfully embed sustainability requirements in buildings. These augmented obligations are classified into a framework or parameter of employer obligations that can be introduced into the current structure of the building standard forms in Malaysia. The findings form part of the overall strategy to have a standard form catering for sustainable building projects in Malaysia. The findings are significant in providing a platform for understanding the sustainability requirements in so far as the employer's obligations are concerned.

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Envisioning a smart energy transition in Hong Kong: A transdisciplinary community engagement model

Ms Wing Kei Cheung, Dr Daphne Ngar-yin Mah
Hong Kong Baptist University, Hong Kong, China

MS WING KEI CHEUNG

Abstract

Public engagement is crucial for a holistic energy transition. However, conventional community engagement approaches tend to be peripheral to the transitions research agenda, and overly focused on particular groups in the society. This tends to result in dis-empowerment of the remaining community. This research studies the effect of envisioning as a community engagement process to fostering an inclusive smart energy transition. Envisioning is a non-conventional community engagement approach that encourages creative inputs and participation of everyone. The process hopes to cater people of different different ages, interests, cultures. Unlike most generally one-off community engagement approaches, envisioning is a long-term process that builds capacity of local households in order to empower residents to co-learn knowledge on sustainable energy, co-develop visions and co-create energy transition action plans that are tailored to their needs. Four forms of envisioning were designed and applied in the Fairview Park community in Hong Kong. Target groups include general households, children, elderly, intellectually disabled children, as well as university students from Hong Kong, Guangzhou, Seoul and Tokyo. Firstly, to equip households with the abilities to design visions for energy transitions, we invited 24 Fairview Park households to a solar exchange workshop to share about the opportunities and barriers on developing residential and community solar, as well as the possibilities of community solar development. Secondly, to enhance creativity in the envisioning process, three children science workshops were conducted in Fairview Park, with one particularly designed for intellectual disabled children. Thirdly, to visualise the change, a mobile game is designed to allow households to envision and build their energy community. Fourthly, a cross-cultural deliberate workshop for 40 university undergraduates on the Stanford Online Deliberative Platform was conducted, and the method could be applied towards cross-community envisioning workshops.Based on the above trials, I highlight three key preliminary observations. First, it is observed that envisioning is not an inborn skill, instead it could be acquired through knowledge-sharing and trainings. It is challenging to push households to envision their community's future without background knowledge. Second, cross-sectoral collaboration could be an effective method to promote envisioning in the local community, as internal and external organisations bring in and connect various groups of residents in the community. Third, envisioning could be a way to rebuild dialogue across generations. Intergenerational-learning between young children and parents builds up a stronger bond within the community, fostering a more effective communications throughout the envisioning workshop. Envisioning plays an effective role in empowering community members to pave their way towards a more sustainable future. This research project act as a preliminary case, as it will be applied to three other energy communities in Seoul, Sydney and Bristol.

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People's place in state-run forest management: A history of limited capability, its effects and possible avenues for improvements, studied in Himachal Pradesh, India

Mr. Kritishnu Sanyal, Dr. Shyamasree Dasgupta
Indian Institute of Technology Mandi, Mandi, Himachal Pradesh, India

MR. KRITISHNU SANYAL

Abstract

Forest ecosystem services are important for almost all species. Also, many services are commercially valuable. The role of the local communities who often depend on forest for livelihood especially in the developing countries, is crucial for the sustainability of the forests. However, in South-East Asia they are mostly ignored by the policy makers. In India, the roads for community participation in forest management has always been narrowed and curbed by the policy makers. Though without any hierarchically superior outside authority the forest dependent communities can well develop an institution to sustainably manage the local forests, other than some legal user-rights, their perspectives, perceptions, and feelings often remained unaddressed.

We examined how limited capability to the community was always a theme of the state-run forest management regime in India and how it is barred the system from achieving more. We also tried to understand how increased partnership can be achieved through increased capability promoted by the state.

While explored the evolution of modern Indian forest management in the literature we examined the ground reality in Chamba district of Himachal Pradesh in India. Respondents from 600 households selected by random sampling interviewed with a semi-structured questionnaire provided both quantitative and qualitative data required for the same.

We understood that there was a strong sense of alienation from the existing system. Generously recognizing the positive sides of the state-run forest management system, the respondents deeply desired for a change in the existing practice. Though the present options were limited, there was an urge for increased community participation. Changed policies with a larger set of functionings seemed likely to bring the change.

Inclusive institutions create level playing fields and economic opportunities for the people and increase their capabilities. Our study showed that expanding the set of functionings for the community through changed policies was needed. To do that, the present conditions (conversion factors) needed to be changed. Along with the option of trading forest products opening dialogues between the community and the state, involving the community in decision making process at local level, using useful traditional knowledges etc. can act as starting blocks.

Understanding the policies' weaknesses are crucial to find the ways for betterment. A smooth and wider participation of the ground level stakeholders is important for sustainable forest management which helps in achieving SDG 15. Considering its societal impact, the study helps us to understand some of the possible ways in achieving SDG l6. Also, ways advised here are indirectly vital for SDG 1; 2 and 13 as well. This study helps in "…ASSESSING THE 5Ps OF SDGs …" with a greater focus on people and partnership while addressing the issue of prosperity and peace as well. Finally, by offering an understanding of the lacunae of the existing forest management and proposing ways for improvement this study helps is making the planet more sustainable.

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Understanding actor perspectives through narratives regarding challenges for integrated lake basin management

Assoc. Prof. Dr. Sharina Abdul Halim[1], Dr. Zanisah Man[2], Assoc. Prof. Dr. Sarah Aziz[1], Assoc. Prof. Dr. Nor Zalina Harun[3], Ms. Suhaini Md. Noor[3], Ms. Nor Azizah Ishak[1]
[1]Institute for Environment and Development, Universiti Kebangsaan Malaysia, Bangi, Malaysia. [2]Faculty of Social Sciences and Humanities, Universiti Kebangsaan Malaysia, Bangi, Malaysia. [3]Institute of the Malay World and Civilisation (ATMA), Universiti Kebangsaan Malaysia, Bangi, Malaysia

Abstract

Today many lakes suffer from the impact of several pressures, which act simultaneously and interact in a complex manner influencing all levels of the ecosystem. In such cases, the ecological status is varying according to the sensitivity of lake ecosystems and the combination of pressures. With increasing development activities, the threat to water resources is also increasing, thus there is a need to save traditional and historic water resources from being depleted completely. Similarly, for Tasik Chini Basin, while development is inevitable, the impact of over the years unsustainable activities had seriously affected Tasik Chini ecosystem. The dire situation of Tasik Chini Basin (TCB) calls for immediate attention to be addressed particularly in understanding actor perspectives to risks associated with environmental change. Over the last 30 years, Tasik Chini has been experiencing continuing development, including logging and agricultural development that started in the 1970s. Many studies have shown that encroachment on forest reserves and wetlands, and major changes inland cover and use in the TCB have serious concerns on the sustainability of these changes and their effect on the livelihoods of the local communities and the environmental health of TCB is raising concerns. In addition, land use changes in the TCB region have been associated with land degradation,especially soil erosion and depletion of nutrients. Previously, the basin is endowed with rich natural resources of the lake and its environment, now most of these resources are threatened with environmental challenge.Thus, a basin perspective helps in the analysis of the interactions among various types of land uses and other uses, and in the process, it enhances the understanding of the physical, environmental, social and economic influences that impinge on the productivity of land use systems. The objective of this study is two-fold namely, to examine vulnerability to risks associated with environmental change through narratives among local community and stakeholders and to assess adaptation measures and adaptive capacity of local community and stakeholders. It is hoped that participation of a larger number of stakeholders can be sought, and land use planning can be more effectively carried out. The broader view through a river basin is able to capture dimensions that are not normally included in a land use management approach, such as the causes (and not only the effects) of natural resource degradation, related disputes and livelihood options.

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Empowering Migrant Workers: Enhancing Their Inclusion in Public Information Access for Comprehensive Indonesian Human Development

Mr Kadek Wibawa, Mr Muh. Afif Mahfud, Mrs Retno Saraswati, Mr Budi Ispriyarso
Law Faculty-Universitas Diponegoro, Semarang, Indonesia

MR KADEK WIBAWA

MR MUH. AFIF MAHFUD

MRS RETNO SARASWATI

MR BUDI ISPRIYARSO

Abstract

Migrant workers must have access to core human rights, such as the right to information, in order for them to be able to fully engage in society and make decisions that are based on accurate information. It is necessary to provide migrant workers with access to information to protect their rights and guarantee their general well-being and safety.

This study explores migrant worker involvement in public information access for Indonesian human development. The paper focuses on Indonesia's population growth and migrant workers' village development. Migrant employees lack labor skills and data access. The information helps migrant workers participate and make decisions. The information enhances rights and well-being.

This study uses a normative juridical method to determine migrant workers' right to information. It will involve a complete examination and analysis of international human rights agreements, such as the International Covenant on Civil and Political Rights and the International Convention for the Protection of the Rights of All Migrant Workers and Members of Their Families. This approach will make it possible to identify gaps, inconsistencies.

It finds legal flaws and proposes changes to protect migrant workers' information. Indonesian migrant laborers must participate in public knowledge access for total human development. The Indonesian Constitution and transparency law protect public information. Migrant workers need fair enforcement and public knowledge. Solutions are offered. First, education and awareness efforts should teach migrant workers their rights and how to access public information. IT training boosts digital literacy. Second, migrant workers require public information quickly. The government, relevant institutions, and international organizations can gather and exchange labor rights, working conditions, migration rules, and support networks. Migrant worker-specific online portals boost information availability. Third, migrant workers need decision-making opportunities. Committees, policy forums, conferences, and meetings are examples. Media educates migrant workers. These steps empower and preserve migrant workers' public information access. This promotes Indonesian human growth and inclusiveness.

TRACK 9
Governance. Power and institutions

9d. Legal aspects of sustainable development

Abstracts

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From the 1st to the 4th Generation of Human Rights: Where is Malaysia in Fulfilling the Right to live in a Healthy Environment?

Assoc. Prof Rasyikah Khalid[1], Professor Suhaimi Ab Rahman[2]
[1]Universiti Kebangsaan Malaysia, Bangi Selangor, Malaysia. [2]Universiti Putra Malaysia, Serdang, Selangor, Malaysia

Abstract

The right to live in a healthy environment has been promoted in the late 20th century when the international community commits themselves to sustainable development. However, many countries including Malaysia have not incorporated this rights in their constitutions. As a result, there have been difficulties in upholding this right due to the requirement of locus standi. This paper evaluates on the development of rights to live in a clean and healthy environment as part of a human rights, from the first to the present generation of human rights. The paper employs the doctrinal analyses of relevant laws, treaties and cases. The paper concludes that attempts towards achieving the right to live in a clean and healthy environment in Malaysia remain unclear under the first generations of human rights. It is thus submitted that the rights to be incorporated into the Federal Constitution to ensure that Malaysia is not left too far behind from other countries in upholding this fundamental right as a human. Fulfilment of this rights will fulfilment of sustainable development goals 16 on justice.

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China Environmental Resources Contract: Analysis of the determination of validity rules

YUNQI DENG
Faculty of Law, Universiti Kebangsaan Malaysia, Selangor, Malaysia

Abstract

In recent years, China has been paying more attention to environmental protection and proposes to build a resource-saving and environment-friendly society. Environmental resource contracts are an essential part of Chinese civil law in protecting the environment. However, in disputes over environmental resource contracts, there are difficulties in determining the contract's validity. Most contracts were determined to be invalid. In this paper: (1)Reviews violate the mandatory provisions literature and discuss two types of validity determination criteria, (2)Empirically the current status of determining the validity of environmental resources contracts and their extensions, (3)Formulate a unified framework that integrates elements of benefit measurement and proportionality principles, and (4)Theoretically validate the unified framework. Using data from China judgments online over ten years with the supreme people's court and Local courts in 27 provinces, a total of 80 decisions. Next, a unified framework, Using the legislative intent of environmental resource protection law as a starting point, the weighing of interests as a method, and the principle of proportionality as a guide to making value judgments on individual cases. The new framework thus provides a new adjudication idea for the status quo of different judgments in the same case. Breaking down the existing dilemma of determining the validity of contracts in environmental resource contracts, abandoning the current single-determination method, and balancing the preservation of environmental law's social and public interest with the equal preservation of the interest of freedom of contract. The paper also makes several recommendations for future research, including the accumulation of cases in judicial practice for a typological summary and a more refined rule for determining the validity of environmental resource contracts.

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Revisiting the Legal and Institutional Framework towards Water Sustainability: A Critical Analysis on Malaysian Water Sector.

Muhammad Nazrul Abd Rani[1], Associate Professor Dr Rasyikah Md Khalid[2]
[1]University of Dundee, Dundee, United Kingdom. [2]Universiti Kebangsaan Malaysia, Bangi, Malaysia

Abstract

Revisiting the Legal and Institutional Framework towards Water Sustainability: A Critical Analysis on Malaysian Water Sector.

The government of Malaysia amended the Federal Constitution in 2005 to regulate the water supply and services sector. As a result, the National Water Services Commission was established as the economic regulator for the water services sector. This will solve the state's financial inability to provide better water supply services and ensure water operators achieve full cost recovery. However, water supply disruptions continue after nearly two decades, especially in industrialized states like Selangor, Johore and Penang. The study finds that the current legal frameworks empower several authorities in the water supply sector. to carry out their responsibilities. The Ministry of Natural Resources, Environment and Climate Change (NRECC) offers policy directives for water services, while SPAN is responsible for the economic regulation of the water operators. Meanwhile, the Ministry of Health oversees the quality of drinking water, while the Ministry of Rural Affairs is in charge of water supply in rural areas. As the owner of watercourses, the state government is responsible for safeguarding the water catchment areas, including rivers. The rivers, if badly polluted, will cause water operator to stop work and causes water supply disruption. This study suggests a new legal and institutional framework for water services law in Malaysia, particularly emphasizing economic, health, and environmental regulation. This will ensure the government to achieve SDG No. 6 on clean water, which is pertinent in ensuring other goals towards sustainable development in the country.

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Research on Environmental Information Disclosure Rules of Listed Companies——From the Perspective of the Legalization of Chinese Corporate Social Responsibility

HuiHui Wu, Professor Ali Hasani Mohd
Faculty of Law, Universiti Kebangsaan Malaysia,, Banji, Malaysia

Abstract

Abstract：With the increasing public attention to environmental issues, the legal system of environmental information disclosure of listed companies has also become an emerging development field in China's environmental legal system and financial legal system in recent years. The academic and practical circles have begun to call for the adoption of existing securities and corporate legal systems to promote the disclosure of environmental information of listed companies and strengthen the legal basis for listed companies to undertake social responsibilities. Therefore, in recent years, environmental information disclosure has gradually become a key area for Chinese listed companies to undertake corporate social responsibility. However, the construction basis of the legal system for environmental information disclosure of listed companies is essentially incompatible with the legislative goal of investor protection in the Securities Law, which has led to the incompatibility between the Securities Law and the Environmental Law in the process of supervising the environmental information disclosure of listed companies. It is not a small difficulty to coordinate and apply the two systems; at the same time, under the existing system of company law on fiduciary duties of directors, the rules for the disclosure of environmental information of listed companies will lead to institutional goals between shareholder protection and stakeholder protection conflict. After analysis and demonstration, this paper finds that there is still a considerable institutional bottleneck in the introduction of a mandatory environmental information disclosure mechanism for listed companies within the existing securities law and company law mechanisms. It is impossible to coordinate the application of securities law and environmental law. There is also no way to well resolve the conflicts and contradictions between the company's shareholder protection and stakeholder protection. Finally, a suggestion is put forward to explore the possibility that listed companies disclose environmental information on a voluntary basis, which may be relatively low in cost and relatively strong in feasibility.Effective voluntary disclosure of environmental information can promote the establishment of corporate reputation.

Keywords: Environmental information disclosure; Supervision of listed corporations; Corporate social responsibility;Stakeholder; Securities law

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Transitioning just transitions in the energy sector

Dr Alexandra Harrington

Lancaster University Law School, Lancaster, United Kingdom

DR ALEXANDRA HARRINGTON

Abstract

Much of the attention paid by the international community, and national communities, to energy transitions has been to the need for a shift from carbon intensive forms of energy to green or renewable energy sources. This is a critical area of focus and had moved law, regulation and policy across the global and national spheres toward encouraging advancements in green and renewable energy. In itself, this can be seen as advancing an emphasis on the links between energy law and just transitions, with inherent connections to human rights concerns.

However, left out of these discussions and legal systems to date has been the understanding that green and renewable energy sources will not remain static and, indeed, the ways in which international laws are focused on promoting continuous innovation in these sources of energy. As a result, law and regulation often seeks to control certain forms of green and renewable energy – such as solar or wind energy – without taking into account the reality of technology and capacity transitions in these sectors in the short and long-term. At the same time, the ways in which just transitions in the energy sector are reflected in law and regulation tends to focus on transitioning away from one source and toward another without an understanding that this type of transition will most likely be cyclical as technologies advance and adapt.

This presentation will highlight the need to shift the international and nation understanding of just transitions in the content of green and renewable energy so that it includes the reality of multiple transitions as a matter of legal and regulatory policy. It will then offer suggestions for how to structure these shifts so as to include human rights concerns. It will link to SDG 7, SDG 8, SDG 9, SDG 13, and SDG 16. It will also correspond to assessing people, planet and prosperity within the conference framework.

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Regional energy integration in the SADC region

Dr Abraham Klaasen
North West University, Potchefstroom, South Africa

Abstract

The Southern African Development Community, or SADC, is an intern-governmental organization of 16 Southern African states with its goal being regional socio-economic integration as well as political and security cooperation among member states. SADC has twenty-seven protocols legally binding on member states dealing with issues such as defense, development, the illicit drug trade, free trade, and the movement of people. SADC Member states experience water and electricity pressure due to population growth and agricultural and industrial development. Most of SADC's population lives in poverty and energy generation and supply remains a problem for most of the member countries. The Protocol for Energy was signed by SADC member states in 1996 and have at its core, the purpose of promoting harmonious energy development for the region. Unfortunately, the Protocol in its current form does not make provision for the effects of climate change and the effect of power generation thereon. Currently the power utilities of mainland SADC members, apart from Malawi, Angola and Tanzania are interconnected allowing countries to supply electricity to one another through a competitive market. However, only about 50% of the region's residents have access to electricity with an energy shortfall being experienced by most countries in the region. The challenges faced by SADC members to generate electricity has affected socio-economic growth, sustainable development, and industrialization throughout the region. Currently the region places a heavily reliance on coal for most of its energy generation, which runs contrary to global efforts to curb greenhouse gas emissions, and on hydropower, which is highly susceptible to climate change, as demonstrated by the current drought. This paper looks at the design and implementation of an appropriate institutional framework for the regional production and distribution of energy. The study reviews SADC's energy resources and recommends policies based on an integrated, reliable, and sustainable system. A coordinated approach stimulates economic growth and can make energy generation and supply sustainable while fighting the effects of climate change. The study comprises a critical review of relevant legislation, both local and regional, on energy generation and supply. The study uses electronic sources, textbooks, and academic articles. It is critical for SADC countries to do some introspection. The drive towards energy sufficiency and efficiency should strive to utilize the vast array of renewable energy resources available that includes solar, hydro and wind energy generation. It is critical to review regional and national energy frameworks to align them with energy realities in the regional and global community. The study makes recommendations regarding "hard" infrastructure, in the form of development and exploitation of renewable energy sources and "soft" infrastructure, harmonized policies and cooperation in electricity planning and energy development.

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Deforestation in the eyes of Earth Jurisprudence

Ms Nadiah Athirah Mat Daud[1], Ms Hanna Syafiah Shah Headan[1], Dr Nabeel Althabhawi[2]
[1]UKM, Bangi, Malaysia. [2]UKM, Bangi, Iraq

Abstract

The forest in Malaysia and even around the world faces the problem of deforestation. The causes of deforestation are from humans and the implication also affected the people around the world. In order to prevent future harms to nature, Earth Jurisprudence theory has been put out. The theory recognizes the rights of nature and adopts that nature has the rights in law which is that they should have their own legal entity to protect themselves. Earth Jurisprudence also believes the laws must have connection between human and nature as human and nature must co-exist together in this humanity. This article aims to explain and analyse how Earth Jurisprudence helps to prevent deforestation and how far the law around the world has applied Earth Jurisprudence in their law of nature. Earth Jurisprudence is reflected in the Wild Law with the concept that nature has the right to be protected and humans need to protect as we depend on nature to stay alive just like indigenous people. The example will be taken from India, Malaysia and also Ecuador which is the first country to adopt the rights of nature in their constitution. Wild Law is important as the laws adopted the theory of Earth Jurisprudence and shows how humans need nature and how nature can cause the suffering of humans around the world if it is not protected. This article shows that Wild Law seeks to make laws that give a positive connection between people and nature. Wild Law has the potential to become a powerful force in defending the rights of nature against the erasure of today's society

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Understanding Advance Medical Directive and Death Wishes to Treatment

Dr. Mohd Zamre Mohd Zahir[1], Assoc. Prof. Dr. Tengku Noor Azira Tengku Zainudin[1], Dr. Haniwarda Yaakob[1], Assoc. Prof. Dr. Ramalinggam Rajamanickam[1], Dr. Nur Khalidah Dahlan[1], Dr. Hazlina Shaik Md Noor Alam[1], Dr. Muhammad Hatta[2], Dr. Yati Nurhayati[3], Dr. Sudiyana sh[4], R. Murjiyanto[4], Dr. Dyah Permata Budi Asri[4], Dr. Nurul Hidayat Ab Rahman[1], Rozlinda Mohamed Fadzil[1], Rachel Decruz[1], Aminurasyed Mahpop[1], Ahnaf Ahmad[1]
[1]Universiti Kebangsaan Malaysia, Bangi, Malaysia. [2]Universitas Malikussaleh, Aceh, Indonesia. [3]Universitas Islam Kalimantan MAB, Kalimantan Selatan, Indonesia. [4]Janabadra University, Yogyakarta, Indonesia

DR. MOHD ZAMRE MOHD ZAHIR

Abstract

If someone becomes terminally ill and unconscious, an Advance Medical Directive (AMD) can be used to communicate that they do not wish to undergo extraordinary life-sustaining treatment. Meanwhile, death wishes are the conscious or unconscious desire for the death of another or of oneself. Here, the problem is whether there is a law governing the individual's rights relating to AMD and/or death wishes. Ultimately, everyone cares about doing what is best for the patient. Who, then, makes the ultimate decision? Is an advance medical directive (AMD), created before the patient lost the ability to express his or her preferences, the best option? The first goal of this paper is to analyse the legal perspective of protecting someone when communicating his or her wishes before dying. Secondly, to recommend improvements relating to AMD and death wishes for treatment in Malaysia. This paper employs a qualitative method. It has been found that there are dilemmas faced by doctors, patients and family members to determine the patient's wishes before he or she dies. Therefore, the recommendation ought to have elements that can save lives while still respecting the patient's autonomy over that life's course and his or her desires.

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FROM COPYRIGHT PROTECTION TO SUSTAINABLE DEVELOPMENT: HOW THE COPYRIGHT ACT (AMENDMENT) 2022 ADDRESSES DIGITAL PIRACY AND SUPPORTS THE SUSTAINABLE DEVELOPMENT GOALS

MR MOHD SYAUFIQ BIN ABDUL LATIF, PROF. DR. NAZURA BINTI ABDUL MANAP, DR. NABEEL MAHDI ALTHABHAWI
FACULTY OF LAW, UNIVERSITI KEBANGSAAN MALAYSIA, BANGI, Malaysia

MR MOHD SYAUFIQ BIN ABDUL LATIF

PROF. DR. NAZURA BINTI ABDUL MANAP

DR. NABEEL MAHDI ALTHABHAWI

Abstract

The introduction of the new Copyright (Amendment) Act 2022 in Malaysia aims to combat digital piracy and strengthen copyright law in the digital sphere. This aligns with Sustainable Development Goal (SDG) 16 which promotes peaceful and inclusive societies for sustainable development and calls for effective, accountable, and inclusive institutions at all levels. By improving copyright law, Malaysia is taking steps to build effective institutions that can protect the intellectual property rights of individuals and businesses. The new Copyright Act (Amendment) 2022 introduced in Malaysia Act aims to provide access to justice for all and promote accountability in the enforcement of copyright law. The result indicated that while copyright law in Malaysia plays its role in combating digital piracy, improvements of the provisions through the Copyright (Amendment) Act 2022 such as the introduction of current new offences aimed at tackling the latest trends of digital piracy on the internet and conferment new investigative powers to assistant copyright controllers are needed to review in order to further support copyright enforcement mechanism in Malaysia. These improvements to the law are needed in order further support copyright enforcement mechanisms in Malaysia and promote legal sustainability, which is a key aspect of SDG Goal 16. Hence, it is the aim of this article to explore how the Copyright Act (Amendment) Act 2022 Malaysia can be used to fight digital piracy and provide access to justice for right holders at all levels through a new copyright enforcement measure introduced in the Act. This article employs library-based research which collects data from statutes, journals, books and case law.

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Towards A Healthy Generation: 'Modifying' or 'Selecting' Embryos Using Gene Therapy or Preimplantation Genetic Diagnosis

Dr Haniwarda Yaakob, Dr Tengku Noor Azira Tengku Zainudin, Dr Mohd Zamre Mohd Zahir
Universiti Kebangsaan Malaysia, Selangor, Malaysia

Abstract

Having children who are free from genetic diseases is a dream for most parents. Thanks to the advancement in medical technologies, this dream can now be a reality. Healthy children will not only be a benefit to their parents, but is also an asset to the society and nation. Healthy citizens may contribute towards the development of a nation in many ways. This is in line with Sustainable Development Goals (SDGs), particularly SDG3 that aims to promote the well-being and health of citizens of all ages. The advancement in medicine and technology is, arguably, a useful tool that can be utilised in the pursuit of creating a healthy society. This can be achieved by avoiding the birth of children with genetic diseases by using technologies such as gene therapy and preimplantation genetic diagnosis. Although the ways in which both technologies work differs, the end result remains the same, that is, to ensure the birth of children who are free from genetic diseases. In a nutshell. gene therapy 'modifies' embryos while preimplantation genetic diagnosis 'selects' the desired embryos. Both techniques, however, involve numerous legal and ethical concerns that should be scrutinised before they can be legally permitted in Malaysia. This is the main crux of this paper where the issues surrounding both technologies are carefully analysed. The aim of this analysis is to determine the appropriate legal framework that can be adopted in Malaysia on the use of these innovations as part of the effort to fulfil SDG3.

Keywords: Law; Bioethics; Gene Therapy; Preimplantation Genetic Diagnosis; Sustainable Development Goals; SDG3.

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IMPROVEMENT OF INVESTMENT LAW DEVELOPMENT IN INDONESIA BASED ON ARTICLE 22 LAW NUMBER 25 OF 2007 CONCERNING CAPITAL INVESTMENT AND OMNIBUS LAW

Marlina Widiyanti, Annalisa Yahanan, Febrian Febrian, Mada Apriandi
Sriwijaya University, Palembang, Indonesia

M A R L I N A W I D I Y A N T I

Abstract

Legal development in capital investment is a national legal program to create a good legal culture and economic ensure profits for business owners as well as continuity of state development with an impact on society. Article 22 of Law Number 25 of 2007 on Investment stipulates investors are given right to use land rights in territory of Indonesia. Normative legal this research is conducted to identify legal concepts and principles used to regulate economy, especially those used as basic framework investment regulation and research is used to build a legal construction in terms of refinement of investment law development in increasing investment in Indonesia, accordance with global order is guided Presidential Decree Number 29 of 2004 concerning Implementation of Investment in Framework of Foreign Investment (PMA) and Domestic Investment (PMDN) through the One-Stop Service System and Law Number 25 of 2007 concerning Investment, and the agency authorized to coordinate the implementation of investment in Indonesia is the Investment Coordinating Board (BKPM). Approval, licensing and investment facility services in the context of PMA and PMDN are carried out by BKPM, based on the delegation of authority from the Minister that fosters the relevant investment business fields through a one-stop service system.

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Towards A Net-Zero Society -What Taiwan can Lean from the Laws and Policies to Develop Hydrogen Energy in Leading Countries

Dr. Yachi Chiang
National Taiwan Ocean University, Keelung, Taiwan

Abstract

Hydrogen energy, with its zero carbon emissions, low pollution, and high electrical energy conversion efficiency, has become a focus of green energy in leading global technology countries in recent years. For example, in 2020, the European Commission established the European Clean Hydrogen Alliance, planning to create hydrogen production sites across Europe by 2030 to form a European hydrogen energy infrastructure. In 2021, the Biden administration in the United States proposed the "Energy Earth shots Initiative" and further announced in 2022 an investment of over 9 billion dollars in the "Green Hydrogen Energy Plan" to establish regional hydrogen energy centers and supply chains. In 2017, Japan revealed its "Japan Hydrogen Basic Strategy," aiming to construct a commercial-scale hydrogen supply chain by 2030, leading the world in achieving the goal of a "hydrogen energy society." In 2021, New South Wales, Australia, declared its support for Australia to become a "global hydrogen superpower" and allocated over 3 billion Australian dollars in subsidies to the Australian hydrogen industry.

In response to the global trend of pursuing net-zero emissions, supply chain decarbonization pressure, and the negative impacts of extreme weather, Taiwan's cross-ministerial agencies, including the National Development Council, Environmental Protection Administration, Ministry of Economic Affairs, Ministry of Science and Technology, Ministry of Transportation, Ministry of the Interior, Council of Agriculture, and the Financial Supervisory Commission, officially announced the country's "2050 Net-Zero Emission Pathway" on March 30, 2022, serving as a cross-generational, cross-disciplinary, and international energy and industrial transformation project and key strategy.

According to Taiwan's "2050 Net-Zero Emission Pathway," the country will strengthen hydrogen energy technology development and application, enabling hydrogen to become the primary source of innovative clean energy by 2050 and gradually replace traditional fossil fuels. In addition, Taiwan will construct a "hydrogen supply and demand system," including researching short, medium, and long-term hydrogen supply promotion strategies, planning hydrogen sources and infrastructure, and collaborating with countries like Australia, Japan, and Germany in hydrogen energy. By 2050, hydrogen energy is expected to account for 9% to 12% of Taiwan's total power sources.

As leading global technology countries consider hydrogen energy as an essential green energy source for the future, hydrogen has become a crucial alternative for the transformation of traditional high-pollution industries. Taiwan, surrounded by the sea, has great potential for hydrogen energy. However, the country's hydrogen industry is still in its infancy, and the issues may not necessarily lie in technology but rather in the policies and legal aspects required for hydrogen development. It remains uncertain whether Taiwan is adequately prepared. Based on this background, this article attempts to organize hydrogen energy development policies and legislations in the European Union and the United States, exploring policies or legislations that leading countries in hydrogen energy have already implemented or planned, and examining what Taiwan can learn from them.

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Climate change, water management, and urban planning governance: a case study on extreme events of droughts and floods in Águia Branca, ES, Brazil

Dr Stella Emery Santana[1,2,3], Marcos de Jesus Oliveria Filho[4], Gabriel Miller[4]
[1]Centro Universitário FAESA, Vitória, Brazil. [2]UFES/PROFAGUA, Vitória, Brazil. [3]Robert H. McKinney School of Law, Indianapolis, USA. [4]UFES/PROFAGUA, Vitoria, Brazil

DR STELLA EMERY SANTANA

MARCOS DE JESUS OLIVERIA FILHO

GABRIEL MILLER

Abstract

This study analyzes extreme events, such as droughts and floods, as climate change indicators and how they influence how a local government regulates urban planning and a local government is bound by water management regulation. The paper analyzes the international, Brazil's, and Espirito Santo's state regulations on climate change, water management, and urban planning national and local legislation.

The connection of these extreme events as climate change indicators are also demonstrated. Through a systematic legal interpretation, this paper combines all the legal instruments that a local government in Brazil would have to be a bind for climate change, water management, and urban planning. In this context, it's explained how governance plays a significant role.

As Brazil occupies the 53rd position in the Sustainable Development Goals (SDG) among 163 countries measuring the indicators, SDGs 6, 11, and 13 will be investigated and narrowed by the topics discussed in this paper, i.e., extreme events of droughts and floods, water management and urban planning. The goal of this part of the analysis is to verify if the measures in place in the city of Águia Branca in the countryside of Brazil are connected to achieving the SDGs.

Águia Branca is a municipality with around 10.000 people, and its territory is 454,448 Km². Most of the area is in a rural zone, representing most of its economic activity. This is a region where everyone knows everyone, and the separation between technical knowledge and decisions made by government officials is not always as technical as we would like to see. This happens because people are acquaintances or family members, and making technical decisions becomes difficult due to their common bonds. Brazil's old-style politics in small cities play a huge role in decision-making. And in this case, we will analyze how the regulations described previously will be applied in the municipality of Águia Branca, as well as how the cited SDGs are shaping or not the picture.

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Microplastic Pollution in Marine Ecosystem and Plastic Recycling Strategies in Malaysia and Indonesia: A Legal Approach

Dr Hanim Kamaruddin[1], Ms Nur Aliya Zamimi[1], Dr Normawati Hashim[2]
[1]Faculty of Law, Universiti Kebangsaan Malaysia, Bangi, Malaysia. [2]Faculty of Law, Universiti Teknologi MARA, Shah Alam, Malaysia

Abstract

The presence of microplastics in the marine ecology is worrying. According to the United Nations, the ocean contains approximately 51 trillion microplastic particles, which is 500 times more than the stars in our galaxy. Indonesia and Malaysia, in particular, struggle to handle and tackle the problem of microplastics, as it has been discovered that uncontrolled plastic waste from these countries ends up in the oceans. According to the Indonesian Institute of Sciences (LIPI), between 0.27 and 0.60 million tonnes of plastic waste enter Indonesia's waterways each year. According to a 2015 analysis by Jambeck, Malaysia generated 0.94 million tonnes of unmanaged plastic waste, of which between 0.14 and 0.37 million tonnes may have been washed into the ocean. Furthermore, Indonesia is identified as the biggest contributor of plastic trash to the ocean, with an annual production of about 9 million tonnes, while Malaysia is ranked ninth in the world due to poor waste management implementation. As a result, marine ecosystems in both nations are continually threatened by the accumulation of microplastics, leading to a rise in marine mammal extinctions. Indonesia and Malaysia face additional challenges in managing their local plastic litter due to unregulated stranded material from other locations, such as plastic imports exacerbated by the absence of proper legal and policy mechanisms. This study explores the legal governance of microplastic waste management and recycling programs in Malaysia and Indonesia using a doctrinal qualitative approach in which various legal instruments and other secondary legal documents are descriptively evaluated to reveal the legal concerns. This article explores and analyses existing legislative governance on plastic waste management and sustainable approaches, such as robust recycling plans in different nations. The article indicates that in Malaysia and Indonesia, regulatory processes on plastic waste management are in place, however, they are not effectively applied and enforced to prevent the degradation of marine habitats caused by microplastics. In addition, plastic recycling initiatives are not regularly presented as an activity that promotes economic benefits through trash segregation and recycling practices in communities. In order to safeguard marine ecology from microplastic contamination, proper waste management through segregation and the installation of waste treatment facilities are required.

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The Role Of Cooperative Federalism between Federal and State Government Towards Sustainable Housing Development

MR HILMY SAZLIN AZNY ABDUL AZIZ[1], Jady Hashim[2], Rasyikah Khalid[2]
[1]UKM, BANGI, Malaysia. [2]Universiti Kebangsaan Malaysia, BANGI, Malaysia

MR HILMY SAZLIN AZNY ABDUL AZIZ

Abstract

The concept of sustainable development is the effort to maintain the well-being of the physical environment inhabited by a group of people who will strive to ensure that the physical environment is in good condition and able to meet the needs of life. Sustainable housing development should combine environmental protection, reasonable use of natural resources, protection of economic growth, and social progress. In Malaysia, the government has implemented the concept of sustainable housing development, but it is insufficient and poorly implemented. With the rising levels of urbanization, governments implemented numerous housing programs, laws, and policies. However, attaining sustainable housing development and closing the housing demand-supply gap appears to be increasingly difficult. For example, 183 of 450 certified green buildings are residential (GBI, 2018). Nevertheless, the country has a housing stock of 5.2 million, and 100,000 housing units are added every year to this figure. The problem is that the implementation of sustainable housing development in Malaysia is very low and requires attention and action to address this issue. This article will look into the concept of cooperative federalism to achieve sustainable housing development. This study aims to use and evaluate qualitative legal research methods. An in-depth interview method based on established guidelines will be implemented. Analyze the role and cooperation played by Federal and State Government Departments and make references and comparisons of laws and practices in selected countries such as the United Kingdom, Australia, and Canada regarding the concept of sustainable housing development. The focus of linking this study with the SDG is Sustainable Development Goal 11 which is Sustainable Cities and Communities. The target is to make housing safe and affordable by 2030. This study will meet development needs along with the concept of sustainable development based on more universal aspects such as social, economic, technological, and Sustainable Development Goals (SDGs) to support development in Malaysia. This study will propose a harmonious cooperative federalism mechanism to ensure sustainable housing development can be achieved in Malaysia. Reviewing laws and policies regarding sustainable housing development that is being implemented and then suggesting improvements

Keywords: **Sustainable Housing Development, Cooperative Federalism, Sustainable Development Goals (SDG's)**

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Sports industry and sports scandals challenge: Sustainably under threat?

Mr Zairul Izzain Ibrahim, Jady Hashim
Universiti Kebangsaan Malaysia, Bangi, Malaysia

MR ZAIRUL IZZAIN IBRAHIM

Abstract

The National Sports Vision (VSN 2030) has outlined a new direction for national sports development. VSN 2030 is a complementary to the National Sports Policy 2009 which aims to instil a sports culture among Malaysia which divided into two folds namely sports for all and high performance sports. This vision is a catalyst in driving the Malaysian sports industry to remain sustainable by six strategic cores , among others to develop efficient sports organisation , safe, integrity and justice. Through this concept, VSN is developed to strengthen sports industry by reinforcing sports organisation with good governance and professionalism. On the other hand, SDGs particularly SDG 16 on peace, justice and strong institution which clearly reflects this with its emphasis on governance and integrity as a key enabler of prosperity and sustainable growth. However, the government effort is hampered by the sports scandals. News like doping, match-fixing and corruption are challenges to the integrity of sport. According to the media reports, sports scandals such corruption still becoming cancer to the developments in this country. As such, these papers aim to discuss the issues and challenges that are facing in Malaysian sports industry. The analysis is sosio-legal research by evaluating applicable laws and regulations and also data from the interview.

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Local Administration and Its Power to Manage the Natural Resourses

Dr. Nuthamon Kongcharoen
Chiang Mai University, Chiang Mai, Thailand

DR. NUTHAMON KONGCHAROEN

Abstract

People and community are the key persons to successful natural resources management. However, Thailand legal implementation is undermined people's participation when it is incompatible with the national legislature with the unity of law principle. Hence, the local administrations have struggled to trajectory legal pluralism especially in the people's participation in natural resources management. For SDG goal 15, national and local planning that requires the integration process of development and poverty reduction strategies. One major tool would be decentralization. Local administrations can enact by-law or municipal allow people's participation for their natural resources, but the situation in Thailand seems frozen the decentralized power to the local. Examples from the observation in Chiang Mai Province where the communities demanded their rights to participate in community forest management show that the national plan does not provide the real practical decentralization. To comprise the national plan and the local capacities local regulation would be the potential resolution to sustainable development for environmental justice which ecosystem and biodiversity can survive while people can live healthy. People can be forest stewardships. This scenario starts with local regulation with people true participation. From the national part, the strategic plan of decentralization is long delay and still no light at the end of the turner. Lack of political will and skeptical to the local administration are the main factors. The legislation to grant local authority still find the ignited almost three decades since the Constitution of 1997. There are, at least, three types of communities. First, the beginner cannot find the way to start and remain un-regulate; un-participate. Second, the middle model enacted the local regulation already, but there is no enforcement. The veteran communities with long experiences and now, plan to revise and move forward. These case studies would compare with the strategic plan of target 15.9 in which shads some lights from the international environmental agreements to domestic law.

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Towards achieving sustainable development goals for abandoned children in Malaysia through foster care

NADHILAH A.KADIR
UKM, Bandar Baru Bangi, Malaysia

Abstract

In many parts of the world, children without families including those who have been abandoned, abused, and neglected are the most vulnerable children. These children need the best care and protection possible because they have been deprived of a family environment. A newborn infant may be abandoned anywhere, such as in a public restroom, in front of houses, or even in a dumpster. Some of these abandoned infants are also discovered dead. Those that survive are sent to welfare institutions. Notwithstanding the Child Act (Amendment) 2016's acknowledgement of family-based care, many children without families in Malaysia including abandoned children continue to languish in institutions. Research have demonstrated that institutional care has a detrimental effect on a child's physical, intellectual, or mental development. Hence, family-based care should be chosen over institutional care in order to protect a child's wellbeing and right to a family. One of the best alternatives to traditional family care is foster care. However, except from a few provisions in the Child Act of 2001, there is currently no specific statute governing foster care in Malaysia. There are also no formal foster care agencies that evaluate a foster parent's eligibility. Thus, this paper will examine foster care as a preferable alternative care option for abandoned children in order to better understand it from legal perspective. This study uses a qualitative approach that is based on library research. The discussion is related to Goal 3 of the United Nations Sustainable Development Goals (SDGs) regarding health and wellbeing under target 3.2, to end all preventable deaths under 5 years of age since abandoned children cases in Malaysia contribute to death of new-borns. In this regard, foster care is perceived as a legal protection measure for abandoned children. This paper will also contribute to the advancement of children's welfare and strengthen the child protection system by building inclusive society including children in accordance with the 5P of SDGs: people, planet, prosperity, peace and partnership.

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The Urgency of Climate Justice on Legal Reasoning To Enhance Climate Policies Enforcement

Anggita Doramia Lumbanraja, Aga Natalis, Dr Tri Laksmi Indreswari
Faculty of Law, Universitas Diponegoro, Semarang, Indonesia

Abstract

The enforcement of environmental law in Indonesia, specifically environmental criminal law, has been deemed feeble and ineffective. Numerous instances of environmental destruction have resulted in mild sentences or even acquittals, diminishing the deterrent effect. This results from the inadequacies in the justices' arguments and their limited comprehension of the fundamental principles of climate justice. This study seeks to investigate the pressing need for incorporating climate justice into the legal reasoning of judicial decisions to enhance the efficacy of climate policy enforcement. This research sheds light on the challenges encountered by Indonesian judges by employing qualitative methods and relying on literature studies within the field of law. The findings demonstrate that Indonesian judges frequently adhere to the prevalent civil law system tradition, which results in rigorous decision-making processes and oversimplification of complex cases. In the context of climate justice, judges must comprehend the interconnectedness of the climate policy system beyond statutory regulations. Therefore, legal reasoning emerges as an indispensable mechanism for incorporating climate justice into judicial decisions. By employing sound legal reasoning, judges can integrate climate justice principles into their arguments, thereby ensuring that their decisions contribute to environmental protection, climate change's effects, and the promotion of social and intergenerational equity.

Keywords: Climate Justice; Climate Policy; Legal Reasoning; Indonesian Judges.

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The Legal Aspects of Thrifting Business and its Impact on MSME Enterprises and the Environment Sustainable

S.H., M.H. Putri Ayu Sutrisno, S.H., M.Kn Umaira Hayuning Anggayasti, S.H., M.H. Feri Effendy
Faculty of Law, Universitas Diponegoro, Semarang, Indonesia

S.H., M.H. PUTRI AYU SUTRISNO

S.H., M.KN UMAIRA HAYUNING ANGGAYASTI

S.H., M.H. FERI EFFENDY

Abstract

The thrifting business trend in Indonesia currently has many enthusiasts. Since the profits from this business reach more than ten million dollars. The concept of obtaining branded products at reasonable prices is very appealing to a variety of groups. In addition, certain people consider thrifting as an effort to preserve the environment and prolong the useful life of an item.

From another perspective, using second-hand goods have the risk of transmitting disease. Evidently, this can exacerbate the post-pandemic situation, which has not fully recovered.

Some second-hand items have been prohibited for decades. The government has issued Regulation of the Minister of Trade (Permendag) Number 40 of 2022, Concerning Amendments to Regulation of the Minister of Trade Number 18 of 2021, Concerning Export Prohibited Goods and Import Prohibited Goods. However, the rampant smuggling of used products, which causes losses to the Indonesian government and violates applicable laws and regulations, has become a major concern. Furthermore, this thrifting business has reduced the demand for domestically produced items, among other negative effects.

As a result, the authors are interested in researching the influence of thrifting regulations on sustainable business and the environment. This research was undertaken using a normative juridical approach.

The research shows that the laws and regulations relating to the thrifting industry need to be managed to ensure the effectiveness of implementing these regulations and foster a healthy and sustainable economic climate for MSMEs and the environment.

This research concludes that the thrifting business, which is currently snowballing, has been regulated by the Minister of Trade Regulation (Permendag) Number 40 of 2022 concerning Amendments to the Minister of Trade Regulation Number 18 of 2021 concerning Export Prohibited Goods and Import Prohibited Goods. Nonetheless, second-hand goods, mainly clothing and footwear, are imported in rat routes and small ports. These actions are unquestionably unlawful yet challenging to halt. Therefore, it is necessary to adhere to stringent rules and conduct in this thrift store.

The selection of the theme Legal Aspect of Sustainable Development, which in the end, the authors present this research, The Legal Aspects of Thrifting Business and its Impact on MSME Enterprises and the Environment research, is expected to contribute on implementing the Sustainable Development Goals or SDGs, especially goal number 12, which encompasses educating the public about responsible

consumption and production, that ensuring consumption and production patterns are managed using sustainable methods. Furthermore, this complies with two of the five principles of the 5Ps, which are the global agenda of the SDGs; Planet and Prosperity, which pertain to protecting the earth from damage and attained by economic development that upholds justice for everyone can sustain themselves in prosperity, physically and economically, socially, and technologically, which are also in unity with nature.

Keywords: Thrifting Business, Legal Aspects, MSME Enterprises, Environment Sustainable

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Recent Reform of Corporate Environmental Information Reporting Regulation in China – A Preliminary Assessment

PhD in laws candidate Lai Yee CHOY
The Chinese University of Hong Kong, Hong Kong, Hong Kong

Abstract

Environmental law and corporate social responsibility ('CSR') have been becoming increasingly intertwined attributable to the long-lasting issue of corporate pollution. Nowadays, the regulation of environmental information disclosure plays a vital role in fostering CSR as well as constituting the foundation for effective environmental risk management. To strengthen its environmental governance regime, China aims to form a mechanism for mandatory corporate environmental information disclosure by 2025. In order to achieve this goal, the Ministry of Ecology and Environment ('MEE') has put forth two sets of rules (collectively '2022 MEE Regulations') with effect from 8 February 2022. The implementation of the 2022 MEE Regulations represents an overhaul of the pre-existing corporate environmental information reporting system. Because this reform is in its nascent stage, the significance of the 2022 MEE Regulations remains under-researched. The current research takes an initiative to perform a preliminary examination of the 2022 MEE Regulations, inspecting in what ways China's environmental information reporting structure has been improved.This paper conducts a doctrinal study of the doctrines and rules concerning the 2022 MEE Regulations and a comparative analysis of the environmental information disclosure requirements under the 2022 MEE Regulations and pre-existing rules. In particular, this study looks into the 2022 MEE Regulations in nine main aspects, including: (i) types of companies required to disclose environmental information; (ii) determination and announcement of the covered companies; (iii) timeliness of disclosure; (iv) way of disclosure; (v) information required to be disclosed; (vi) disclosure exemptions; (vii) disclosure format; (viii) penalties imposed on violators; and (ix) information transparency. The analysis finds that the 2022 MEE Regulations cover a larger scope of companies and involve a higher level of public engagement. Remarkedly, the 2022 MEE Regulations adopt a centralized approach to standardize the way of disclosure submitted by all covered companies. The covered companies are required to upload their corporate reports to a national mandatory environmental information disclosure system established by the MEE. Annual disclosure employs a differentiated disclosure approach under which the extent of information disclosed is linked to the nature of the covered companies. A nation-wide environmental governance mechanism is scheduled to be fully implemented by 2025, providing the general public with free access to the corporate environmental information disclosures uploaded to the centralized disclosure system. These reforms are expected to upgrade the quality of corporate environmental information disclosure substantially, alleviating the greenwashing problem.

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Rethinking Pesticides Management Law and Policy in the Face of Climate Change Risks

Professor Hsing Hao Wu
National University of Kaohsiung, Kaohsiung, Taiwan

PROFESSOR HSING HAO WU

Abstract

In response to climate change and increasing food supply demands due to the growing global population, the increasing consumption of pesticides globally imposes great health and environmental concerns. International and national legal regimes on pesticide management both require appropriate legal and policy approaches to protect food consumers' and farmers' health from increasing consumption of pesticides. This article first explores the international governance of pesticide usage and then discusses the limits of existing international legal regimes tackling environmental and health concerns of pesticides in use. The international governance on agrochemicals mainly focuses on ensuring the trade of pesticides and other agrochemicals does not present significant health risks to farmers and food customers of importing states. The treaties and international institutions have difficulties in testing and listing hazardous pesticide products in a timely manner.

This article then analyzes the recent Roundup litigation that incurs panic for farmers to use pesticide products. Roundup is a widely used herbicide to eliminate weeds produced by Monsanto and has been legally challenged in the U.S. on the grounds of severe human health concerns since 2016. The claims of thousands of product liability and tort lawsuits are based on a 2015 report released by the World Health Organization (WHO) that animal tests found glyphosate as "probably carcinogenic" and potentially harmful to DNA in human cells. Finally, this article provides policy suggestions that tackle the health concerns of increasing pesticide usage and ensuring sustainable food security at both the international and national government levels. There is an urgent need for global leaders to explore sensible and sustainable approaches to tackle global food security issues without compromising environmental and health protection. The deregulation of GM crops technology and promotion of sustainable agriculture may serve as sensible and in-time solutions to reduce pesticide consumption and water usage.

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How to regulate and design new software technology, including AI, so that human rights violations can be avoided and adverse environmental can be minimalised?.

professor Tineke Lambooy[1], LL.M. Penny Simmers[2]
[1]Nyenrode Business University, breukelen, Netherlands. [2]lab future generations, amsterdam, Netherlands

PROFESSOR TINEKE LAMBOOY

Abstract

The development of technology moves forward every day. This paper's topic dives into the question of how to regulate and set up a governance structure concerning the development of new software technology, including AI. Currently, in many jurisdictions, the design and governance of new software technology is not regulated. Often, unwanted and unforeseen problems occur with new software: the design is not inclusive and discriminates when put into practice. Or, the software technology causes a tunnel vision for the receivers of information and hence contributes to polarization in society. Software technology is also employed in warfare, even when not designed for that purpose. Moreover, the use of software technology and the storage of data requires enormous quantities of energy and raw materials from mines for the production of the hardware on which the software runs. Studies reveal that both resources negatively affect the environment and, often, human rights. The European Commission and also some national governments are in the process of developing strategies and policies to influence software developers and software users to ensure inclusiveness. In April 2023, US president Biden called for regulation concerning and proposed to establish an 'AI Authority' tasked with regulating and overseeing this sector.

In this paper, first an analysis is presented of the legislative and policy developments in this field in the European Union and the United States and of the academic literature on this subject. Next, a model is presented to address the issues raised above. The model can be used by private sector parties that decide to produce and govern their software in a responsible way and the model can inspire governments that consider regulating the sector. The model is a roadmap that shows how ethics and inclusivity can become part of the software technology design and governance and how the environmental adverse impact can be made transparent. The involvement of stakeholders at an early stage is key as is the formulation of the goals. The model is the result of qualitative and theoretical studies conducted by the Dutch NGO Lab for Future Generations and elaborated by the authors.

The paper contributes to creating more insights concerning fulfilling the SDGs 12 (responsible consumption and production), 13 (climate action) and 16 (peace, justice and strong institutions).

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Can the granting of Rights of Nature to natural entities such as a mountain, river or an animal species, contribute to a better protection of nature, considering the existing nature protection laws?

professor Tineke Lambooy[1], LLM and Master in Arts penny simmers[2]
[1]nyenrode business university, breukelen, Netherlands. [2]lab future generations, amsterdam, Netherlands

PROFESSOR TINEKE LAMBOOY

Abstract

Worldwide, in more than 40 jurisdictions, over 400 initiatives have been launched to grant or acknowledge legal rights and/or legal personality to elements of nature such as rivers, mountains, forests, types of animals and individual animals. Approximately two-thirds thereof were established Rights of Nature have been granted or acknowledged in the Americas, South-East Asia, New Zealand and Australia, Africa and Europe. In many of those countries, nature protection laws have been in place for a long time. For example, in the European Union, the Bird Directive and Habitat Directive were adopted in the 70s and 80s of the last Century. Nonetheless, many reports reveal an enormous reduction of species and deterioration of ecosystems everywhere in the world due to the impact of human activity. Apparently, even though nature protection legislation is in place, this does not stop or diminish the ongoing destruction of nature. As humans are just one species of the community of life, humans decide over the fate of all other species. The concept of Rights of Nature embraces a more holistic perspective of nature and the relationship of people with the rest of the community of life. It values the intrinsic value of elements of nature and promotes that those elements also gain a legal position and voice in the legal systems which we have constructed. Examining the open access data base linked to the above referenced Journal of Maps study, shows that Rights of Nature have been established in various ways, regards a variety of natural entities and have developed various models of representation and governance regarding the natural entity that holds rights. In this study three Rights of Nature representation and governance models are compared: the Yarra River in Australia, the Mar Menor in Spain and the legislative proposal for the Dutch part of the Wadden Sea. Additionally, the experiences in Colombia with the legal personality of the Colombian Amazone forest and the Atrato River, in Bangladesh with the legal personality of the Turag River, in New Zealand with the legal personality of the Whanganui River, in Ecuador with the Constitutional Rights of Nature in Ecuador, and in the United States with the rights granted to Mountain Lake Park will also be considered. The method is doctrinal and comparative case studies. The analysis of the case studies will lead to a discussion on the ways in which the granting or acknowledging of Rights of Nature can add/adds to existing environmental legislation. The paper contributes to creating more insights concerning fulfilling the SDGs 14 (Life below water) and 15 (Life on land). In addition, granting Rights of Nature also contributes to SDG 16 (peace, justice and strong institutions).

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CULTURAL RIGHTS OF ORANG ASLI FROM LEGAL PERSPECTIVES

Dr Muhamad Sayuti Hassan, Associate Prof Dr Rohaida Nordin
UKM Bangi, UKM Bangi, Malaysia

Abstract

The Aboriginal Peoples Act of 1954, which protects the rights of the Orang Asli, is inadequate and out of date. In spite of the fact that the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) provides worldwide recognition of the rights of indigenous peoples, Malaysia does not currently have a comprehensive legal framework that recognises the Orang Asli's right to culture. These legal constraints need a holistic approach to the Orang Asli's right to culture, which incorporates concerns of language, education, identity, customary practice, traditional knowledge, and customary land. As a result, the primary purpose of this study is to analyse the existing legal framework of the cultural right of the Orang Asli people. In addition to that, the current study elaborates the on the rights to the culture of indigenous peoples in accordance with international legal standards. This study employs doctrinal legal research to accomplish the said objectives. This study revealed that the existing legal framework on the cultural rights of Orang Asli is not compatible with international law standards. In conclusion, this paper can substantially contribute to the attainment of sustainable development by advocating for Orang Asli's right to culture, in particular, goal 10 of the Sustainable Development Goals, which aims to reduce inequality, especially target 10.2 to 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 2030.

Full Papers

Regional energy integration in the Southern African Development Community

Abraham Klaasen [1]

ABSTRACT

The Southern African Development Community, or SADC, is an intern governmental organisation of 16 Southern African states with its goal being regional socio-economic integration as well as political and security cooperation among member states. SADC has twenty-seven protocols legally binding to member states dealing with issues such as defence, development, illicit drug trade, free trade, and the movement of people. SADC Member states experience water and electricity pressure due to population growth and agricultural and industrial development. Most of SADC's population lives in poverty and energy generation and supply remains a problem for most of the member countries. The Protocol for Energy was signed by SADC member states in 1996 and has at its core, the purpose of promoting harmonious energy development for the region. Unfortunately, the Protocol in its current form does not make provision for the effects of climate change and the effect of power generation thereon. Currently the power utilities of mainland SADC members, apart from Malawi, Angola and Tanzania are interconnected allowing countries to supply electricity to one another through a competitive market. However, only about 50% of the region's residents have access to electricity with an energy shortfall being experienced by most countries in the region. The challenges faced by SADC members to generate electricity has affected socio-economic growth, sustainable development, and industrialisation throughout the region. Currently the region places a heavily reliance on coal for most of its energy generation, which runs contrary to global efforts to curb greenhouse gas emissions, and on hydropower, which is highly susceptible to climate change, as demonstrated by the current drought.

Keywords: Energy integration; Regional integration; Renewable energy; Southern African Development Community; Southern African Power Pool.

[1] Abraham Klaasen (LLD), North West University, South Africa.

INTRODUCTION

The Southern African Development Community (SADC) is a regional body compromising 16 African states.[2]

Figure 45 - Map of SADC countries.

The main objectives of SADC are to achieve economic development, peace and security, and growth, alleviate poverty, enhance the standard and quality of life of the peoples of Southern Africa, and support the socially disadvantaged through Regional Integration. These objectives are to be achieved through increased Regional Integration, built on democratic principles, and equitable and sustainable development.[3] SADC's Regional Energy Access Strategy and Action Plan[4] sets the aim to utilise energy resources strategically to ensure affordable, sustainable, secure energy supply with climate finance initiatives on the forefront.

SADC has also adopted a Protocol on Energy, signed in 1996, which invites Member States to co-operate on research and development of low-cost energy sources applicable to Southern Africa.[5] Numerous other co-operation agreements has been signed between Member States, including SADC Energy Cooperation Policy and Strategy in 1996, the SADC Energy Action Plan in 1997, the SADC Energy Activity Plan in 2000, and the Regional Infrastructure Development Master Plan and its Energy Sector Plan in 2012. Other strategies include the Regional Energy Access Strategy and Action Plan 2020 to 2030, the Renewable Energy and Energy Efficiency Strategy and Action Plan 2016 to 2030, the SADC Industrial Energy Efficiency Programme, and the development of the Regional Gas Master Plan.[6] However, progress have been slow in harnessing the available energy generation capacity for SADC. Several SADC members are currently experiencing energy generation shortcomings and must resort to loadshedding.[7] Challenges include an increasing demand for energy driven by an increasing population resulting in an energy deficit.[8]

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2 Figure 1 – Map of SADC region. Source: South African History Online, June 2023 https://www.sahistory.org.za/article/southern-african-development-community-sadc

3 The objectives of SADC as stated in Article 5 of the SADC Treaty, 1992.

4 Available at https://www.sadc.int/pillars/energy

5 Available at https://www.sadc.int/document/protocol-energy

6 See SADC Strategic Plans https://www.sadc.int/pillars/energy

7 Loadshedding refers to the practice interruption of an electricity supply to avoid excessive load on the generating plant. This occurs when the demand strains the capacity of the system.

8 Mabhaudhi Southern Africa's Water–Energy Nexus: Towards Regional Integration and Development MDPI 3 available at https://www.mdpi.com/2073-4441/8/6/235

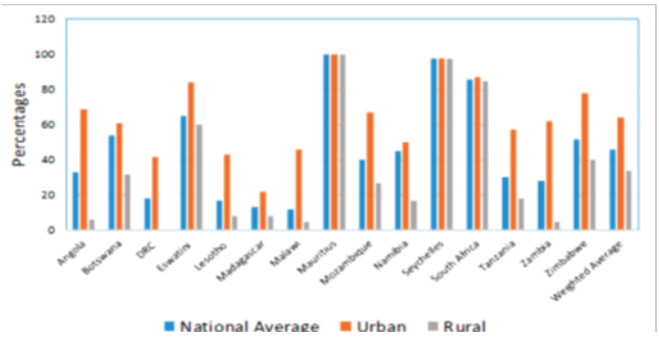

Figure 46 – SADC access rate to energy (2018)

While progress is being made to scale up access to energy, the SADC region is experiencing power shortages, which has negatively affected trade, industry, delivery of social services and the general economic development. However, access to electricity in SADC is still very low with a regional average electrification rate of 48% in 2020 although there is some improvement.[9]

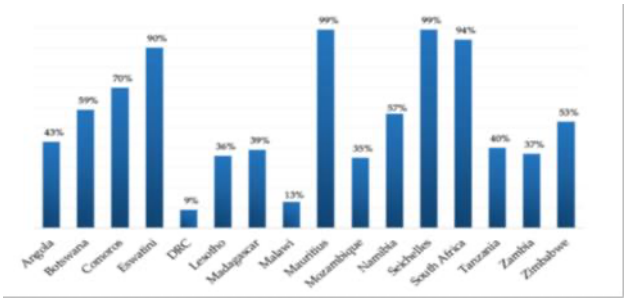

Figure 47 – SADC energy access (2020)

Regional energy generation in SADC aims to address energy deficits, promote sustainable development, and foster economic growth across the region. By pooling resources, expertise, and infrastructure, the SADC member states can optimize energy generation, improve access to electricity, and enhance energy security for the benefit of their populations.

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METHODOLOGY

The study comprises a critical review of relevant legislation, Treaties and Procedures agreed upon by SADC for the integration and harmonisation of energy in the region. The study critically analyses existing data regarding energy generation and distribution within the SADC region. Forecast models are used where possible to set the tone for renewable energy generation within the current SADC region.

RESULTS AND DISCUSSION

Overview of the legal structure for energy generation and integration for SADC

Regional energy integration within SADC has been an ongoing effort. To keep pace with the increasing demand for electricity as well as the need to support and promote sustainable development and regional integration, SADC has put in place various legal, regulatory and institutional frameworks to facilitate the growth of the energy sector. These initiatives and mechanisms promoting regional energy integration within SADC include:[10]

1. SADC Protocol on Energy: The Protocol recognises the need for a co-ordinated approach to energy strategy formulation and planning for the SADC region. It promotes the harmonious development of national energy policies and recognises the principle of energy diversity. The goal of the Protocol is to promote integration in the region with the aim of achieving regional self-sufficiency.[11]

2. SADC Power Pool: The vision of the Power Pool is to create a fully integrated and competitive energy market and a provider of sustainable energy solutions for the SADC region. The Power Pool further aims to integrate interconnected power systems and energy grids to promote cross-border electricity trade between SADC members. Interconnection of energy systems and grids have been achieved to some extent.[12]
Therefore, the Power Pool allows for the exchange of surplus electricity among Member States.[13]

Figure 48 – SADC Energy Grid

3. Regional Energy Infrastructure Development: SADC adopted the Energy Sector Plan (ESP) in 2012.[14] The ESP reveals the Energy Sector Plan (ESP) which is designed to address key strategic objectives for the energy sector, namely, ensuring energy security, improving access to modern energy services,

[10] For a detailed discussion see Justo, Tafula and Moura (2022) https://doi.org/10.3390/en15217860
[11] Available https://www.sadc.int/document/protocol-energy
[12] Figure 4 - SADC Energy Grid. Source: SADC Power Pool https://www.sapp.co.zw/
[13] Available at https://www.sapp.co.zw/about-sapp
[14] Executive summary (2012) available at https://www.sadc.int/sites/default/files/2021-08/Regional_Infrastructure_Development_Master_Plan_Executive_Summary.pdf

tapping energy resources and achieving financial and environmental sustainability. The ESP focuses on "hard" infrastructure projects such as projects for energy generation and transmission projects, storage facilities and pipelines and transport facilities.

The ESP also investigate shortfalls in "soft" infrastructure such as lack of co-ordinated or harmonised policy and regulatory frameworks, institutional support and financing and investment.

4. Renewable Energy Strategy and Action Plan:[15] The Plan states that Southern Africa has the potential to achieve universal access to modern energy services if a strategy is pursued to harness its renewable energy sources. The Plan puts in place strategies to explore the increasing use of renewable energy in Southern Africa and to ensure that the regional energy sector is aligned with global trends towards clean and alternative energy sources such as solar, hydro and wind. The Plan sets the basis for "hard" infrastructure development, such as exploiting and developing hydropower resources in the region; and developing regional interconnectors and hence energy pooling to improve reliability and security of supply.
5. Regional Harmonization of Regulatory Frameworks and Tools for Improved Electricity Regulation.[16] The Framework aims to enhance the sustainability of the regional energy sector by setting out principles, rules, processes and standards for SADC. The main objective is to harmonise regulatory frameworks to facilitate energy trading within SADC. The Framework

sets the stage for a combination of studies, capacity building and development tools to realise the main objective of enhancing the sustainability of the energy sectors of identified regions to create an enabling environment for regional energy cooperation, attract investment, and ensure a level playing field for energy market participants.

6. Integrated Institutional Capacity Building:[17] This SADC programme facilitates capacity building initiatives and knowledge sharing among member states to enhance technical expertise, policy formulation, and regulatory capabilities in the energy sector. The aim is to promote effective implementation of regional energy integration initiatives and enhances overall energy governance within the SADC region.

There are numerous policies and frameworks in place to promote co-operation and harmonisation of the energy sector of the various SADC countries. However, although the "soft" infrastructure is in place to facilitate co-operation among member countries, in practice there is still a lack of sufficient urgency among SADC member countries to effectively integrate their energy sectors to realise the goals set. Regional integration and cooperation are essential for SADC members to meet and address both energy challenges and renewable energy targets. There are indications that regional integration can be used to resolve regional energy problems or shortages.[18] However, as the authors point out, despite the efforts to achieve energy
integrations in the regions, lack of infrastructure development continues to be a barrier to closer integration. Furthermore, the challenges to develop harmonious energy integration plans that suits the individual interests and needs of member countries continue to hamper progress. Although SADC members agreed to renewable energy targets, energy generation projects, including renewable energy generation projects are left to individual member countries, with no integration in the planning or development of such projects. Chingono and Nakana also points out that the process for regional integration for SADC members have been characterized by the limited progress of signing protocols and agreements that are not implemented.[19] SADC currently has 27 legally binding protocols from which

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15 Available at https://sadc-energy.sardc.net/index.php?option=com_content&view=article&id=136:sadc-renewable-energy-strategy-and-action-plan-key-to-ensuring-sustainable-energy-for-all&catid=37&Itemid=143

16 Available at https://projectsportal.afdb.org/dataportal/VProject/show/P-Z1-FA0-181

17 Available at https://www.sadc.int/project-portfolio/integrated-institutional-capacity-building-iicb

18 Akinyemi, Efobi, Osabuohien & Alege (2019) 518.

19 Chingono & Nakana s (2009) 399.

flows further committees, programmes and plans. Chingono and Nakana list further issues that hamper regional integration as follows:[20]

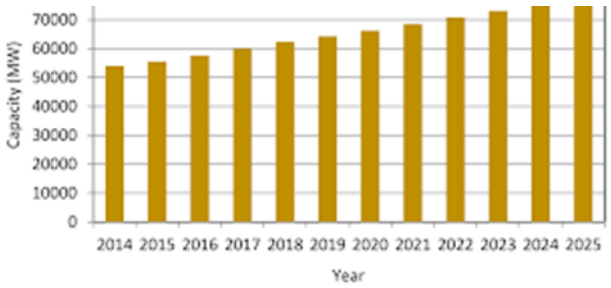
> …[n]ationalist rivalry; incompatible political and economic systems; mono-cultural agro-based economies; unjust international economic structures; debt and dependency on the West; lack of infrastructure, financial and technical resources; the uneven distribution of the benefits of integration; multiple membership to regional organizations; poor economic and political governance; institutional incapacity; lack of grassroots support; rapid population growth; and slow economic growth.

Chingono and Nakana also lists the uneven benefits of economic integration as a reason why regional integration is taking so slow. A highly developed economy such as South Africa is more likely to benefit from increased regional trade while less advanced economies such as Mozambique and Lesotho will not reap any immediate benefits.[21] Currently the renewable energy finance flow also shows that South Africa have received the largest amount of investment in renewable energy generation from foreign sources,[22] with financing not available or negligible for other SADC members.

Energy generation capacity for the SADC region: Projects

Electricity access across Southern Africa is still very low,[23] and forecasts show that population increase and economic development drives energy demand.[24]

Table 2- SADC Power Pool – Demand Forecast



However, institutional restructuring has allowed nine power utilities on the Southern African mainland to interconnect their power utilities to allow for energy trading.[25]

Several priority projects were identified by SADC to improve energy generation and supply for the region. These projects mainly consist of energy transmission projects which can assist in the transfer of energy throughout the region and is based on infrastructure development. This includes the Zimbabwe-Zambia–Botswana–Namibia Interconnector transmission project which links the four countries and has the capacity to increase energy trading among the participants and provides for an alternative route for energy sharing to help decongest the principal transmission corridor that passes through Zimbabwe.[26] The Zambia–Tanzania–Kenya Interconnector high voltage transmission line project aims to create a link between Southern African Power Pool (SAPP) and the east African Power Pool (EAPP). If completed, this project will allow energy to be transmitted from the Cape to Cairo.[27] The project status is ongoing with contracts awarded and works in progress. The Mozambique-Zimbabwe-South Africa project is aimed at complementing other regional transmission lines and facilitating power transfer within the SAPP network. This will improve

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20 Chingono & Nakana (2009) 402.

21 Chingono & Nakana (2009) 404.

22 Expanding Renewable Energy for Access and Development The Global Development Policy Centre (2020) 24 https://www.bu.edu/gdp/files/2020/11/GDP_SADC_Report_EN_Nov_16.pdf

23 Figures 2 and 3 - SADC Electricity Access as discussed above.

24 Table 2 – SADC Power Pool Demand. Source Madhlopa (2015).

25 Angola, Malawi and Tanzania are currently not interconnected. Figure 4 - SADC Energy Grid as discussed above.

26 SADC Energy Monitor. page 26

27 SADC Energy Monitor page 27

the interconnection between the strong network in the south and the weak network in the North of the region. The project therefore aims to achieve grid stability.[28] The Central Transmission Corridor in Zimbabwe aims to increase the North-South Corridor reliability and transfer capacity through Zimbabwe to a capacity of 650 MW. This will allow energy transmission from the hydro sources of the northern part of the region to be traded in a sustainable manner to the southern part of the region.[29]

The mentioned projects all have the intent to provide member states with increased accessibility to the energy grid to facilitate the trade of energy between members in the region. However, the problems with generating capacity experienced by individual members have led to a situation where demand for energy is exceeding the availability of energy available for trade. The SAPP monthly performance report for April 2023 shows a steady decline of energy trade through SAPP due to the unavailability of energy. The report shows the lowest trade in the volume of energy since 2017.[30]

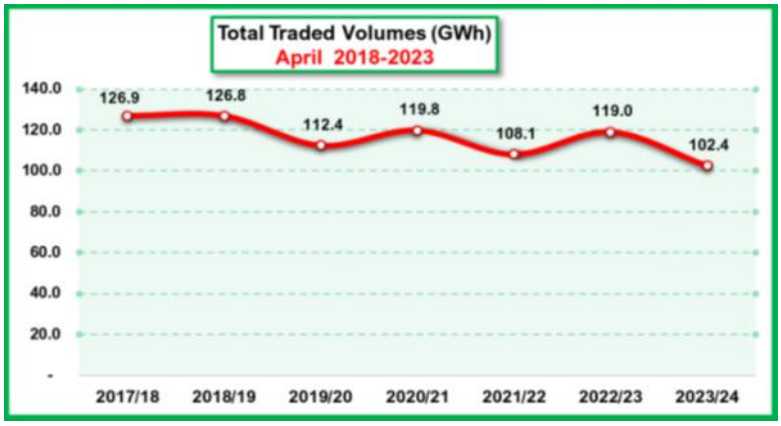

Figure 49 - Traded energy volumes from April 2018 to April 2023

The SADC Renewable Energy and Energy Efficiency Strategy and Action Plan (REEESAP) provides a framework for member states to develop renewable energy and its key objectives are achieve energy security and to mobilize financial resources for renewable energy to achieve low carbon development.[31]

The SADC Centre for Renewable Energy and Energy Efficiency (SACREEE) is also currently implementing different programs for renewable energy through its Adoption of Distributed Renewable Energy for Productive Use' project.[32] Examples include the Regional Project on Cooling Products in the EAC and SADC region[33] which aims to provide technical expertise on climate technology. The Global Capacity Development Program in Renewable Energy[34] aims at creating increased knowledge and capacity of selected organizations and participants about how different energy systems solutions based on renewable energy can be developed at different levels in society, from local communities without network connections to larger plants at the national macro level. The SAPP Program for Accelerating Regional Energy/Transformational Projects is implementing a programme for the acceleration of regional energy transformation.[35] The Southern African Solar Thermal Training and Demonstration Initiative is a regional initiative on capacity building and demonstration of solar systems.[36] SADC Renewable Energy Entrepreneurship Support Facility provides support for renewable energy market development in the region.[37] Although SADC is committed to achieving 53% renewable capacity by 2040, none of these projects are directly focused on the generation of renewable energy. Renewable energy should play a vital role in the SADC region as member states seeks to address energy challenges

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28 SADC Energy Monitor page 28.

29 SADC Energy Monitor page 28.

30 Figure 5 - Traded volumes from April 2018 to April 2023. Source SAPP Market Report April 2023 https://www.sapp.co.zw/market-reports

31 Available at https://www.sacreee.org/document/reeesap-southern-africa-renewable-energy-and-energy-efficiency-strategy-and-action-plan

32 SACREEE Programs and Projects https://www.sacreee.org/programs-and-projects

33 https://www.sacreee.org/content/regional-project-cooling-products-eac-and-sadc-region

34 https://www.sacreee.org/content/global-capacity-development-program-renewable-energy

35 https://www.sacreee.org/content/sapp-program-accelerating-regional-energytransformational-projects-sapp-arep

36 https://www.sacreee.org/content/southern-african-solar-thermal-training-demonstration-initiative-soltrain

37 https://www.sacreee.org/content/sadc-renewable-energy-entrepreneurship-support-facility-0

and transition to a more sustainable and carbon-neutral energy future. The renewable energy potential for SADC is near limitless.[38]

RE Source	Potential	Installed Capacity
Hydro	40 874MW	12 000MW
Solar	20 000 TWh/year	1% of generated electricity
Wind	800 TWh/year	Less than 1% wind generated
Biomass	9500 MW based on agricultural waste	2500 MW generated electricity
Geothermal	4000 MWQ	None

Table 16 Table 1- Renewable Energy Potential for SADC

The SADC Energy Monitor shows an increase in the generation of renewable energy for SADC up to 2017.[39] The ample sustainable energy resources available to SADC range from solar and wind energy to hydro and gas energy. However, most SADC countries have harnessed only a small fraction of the renewable energy available to the region. Although coal is contributing to high carbon emissions, the heavy reliance on thus type if fuel for energy generation is not likely to change soon. South Africa rely on coal for about 77% of its energy generation. South Africa has abundant coal reserves, and these can be exploited at extremely favourable costs.[40]

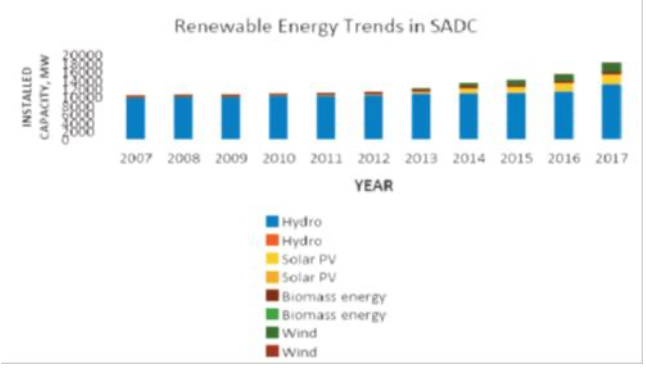


Figure 6 – Renewable energy trends in SADC

The regional generation energy mix is dominated by non-renewable energy, with coal still used to generate 62% of the energy in the region. Hydroelectricity accounts for the highest renewable energy generation accounting to 21% of the energy mix. Wind and solar energy generation accounts for 7% of the total energy generated for the region.[41]

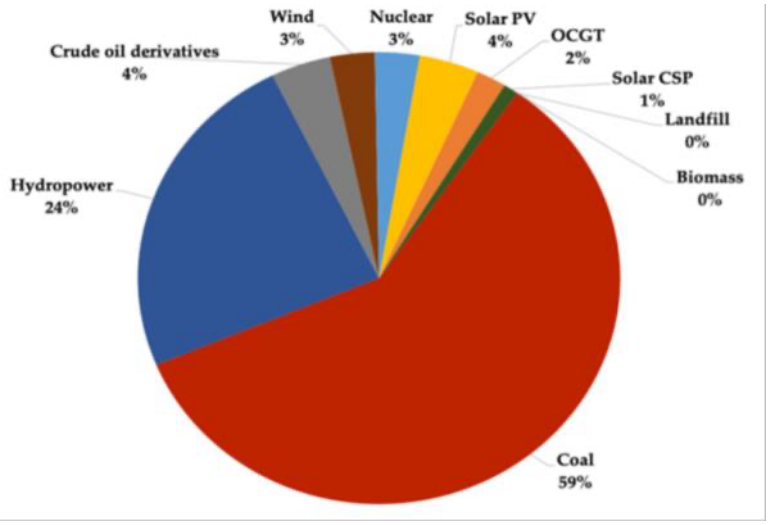
[38] Table 1 - Potential Renewable Energy generation in SADC. Source Based on the data SADC REEESAP 2016 available https://www.sacreee.org/sites/default/files/documents/files/REEESAP_Report_2016-2030.pdf

[39] Figure 6 - Growth in Installed Capacity from renewable Sources, SADC 2007 – 2017. Source SADC Energy Monitor available https://www.sadc.int/sites/default/files/2021-07/SADC_ENERGY_MONITOR_2018.pdf

[40] Department of Mineral and Energy Resources, republic of South Africa https://www.energy.gov.za/files/coal_frame.html

[41] Figure 7 - SADC - Energy Installed Generation Mix (2021). Source SAPP. Annual Report: Energising the SADC Region for Economic Development; SAPP: Harare, Zimbabwe, 2021.

Figure 7 - SADC - Energy Installed Generation Mix (2021)



Renewable energy sources in the SADC region

1. Solar power: Most areas of Southern Africa average more than 2500 hours of sunshine per year and average solar-radiation average is 220 W/m2 compared to about 100 W/m2 for Europe. Solar power is therefore the most readily accessible resource for energy generation in Southern Africa.[42] According to the SAPP, South Africa and Namibia are the only two members in the region that produces on-grid solar power.[43] Off-grid energy solutions are however growing in more countries in the region with solar off-grid home systems becoming prevalent in the region. Namibia currently houses the largest solar PV plant in Africa and the countries Renewable Energy Feed-In Tariff added a total of 70 MW to the grid. In Zimbabwe the Rural Electrification Agency in Zimbabwe has installed 372 solar powered systems (off-grid) to provide limited essential systems at schools and clinics, representing an equivalent power-generating capacity of 334.5 Kw.[44]

Mozambique also started construction on a solar power plant at Mocuba in the Zambesia province, this project is expected to deliver 80 000 MWh per year of energy to Mozambique's northern regions.[45]

2. Hydropower: Traditionally, hydropower has been the cheapest renewable energy source for the SADC region. Currently hydropower is the main renewable energy source for the following states: Angola 63%, DRC 99%, Lesotho 100%, Malawi 90%, Mozambique 82%, Namibia 97%, and Zambia 85%. However, the current drought being experienced in parts of SADC has led to the generating capacity of hydroelectric dams being lowered due to falling water levels. Stanzel wrote in 2014 that two of the largest reservoirs in the world, the Kariba and Cahora Bassa reservoirs, located along the Zambesi River, provided over 70% of the generated energy of the SAPP (excluding energy generated by South Africa).[46] In their work, the authors evaluated the impact of climate change on the energy production levels of the reservoirs. The research used a simulation model of future drying climate to predict the effect of climate change on the energy production of the reservoirs. The model shows a higher decrease in load factors for both short term and long-term scenarios.[47]

Spalding-Fecher and Joyce's study in 2017 shows an output decline from major Zambezi hydropower plants of 10-20%.[48] The authors find that climate related risks have the potential to further undermine the contribution of hydropower resources to the SAPP, especially with the planned expansion capacity of hydropower in the SADC region.[49] According to Justo, some SADC member states are still investing in large and small hydropower projects to harness the potential of hydropower. However, Justo questioned

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42 Department of Energy, South Africa, renewable energy https://www.energy.gov.za/files/esources/renewables/r_solar.html

43 SADC Energy Monitor 37.

44 SADC Energy Monitor 38.

45 SADC Energy Monitor 38.

46 Stanzel & Kling (2014) 640.

47 Stanzel & Kling (2014) 644.

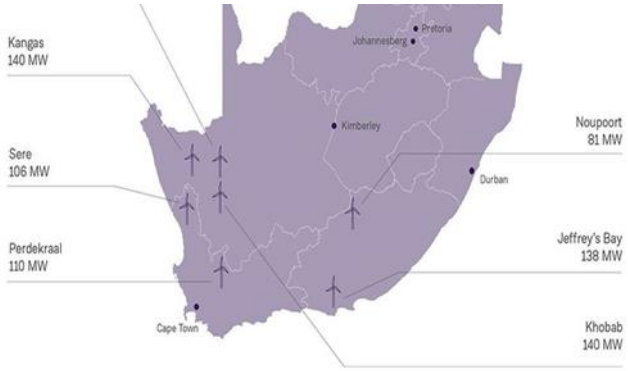
48 Fletcher & Joyce (2017) Pages 84-97.

49 Spalding Fletcher and Joyce (2017). See also Uamusse ,Tussupova & Persson (2020) 4842. https://doi.org/10.3390/app10144842

the continued reliance on hydropower due to rainfall becoming increasingly unpredictable due to climate change.[50] New hydropower projects also carries relevant environmental and social impacts such as the destruction of habitat for wildlife and the relocation of communities in affected areas. These problems have led to a reduction in the development of large-scale hydropower projects.[51]

3. Wind energy: According to the African Development Bank, wind-energy generation in SADC has the potential to provide more than 170 GW of additional power.[52] In South Africa, the high wind speeds, 12 m/s at 100 m height at the best sites, and on average 7.5-8m/s, offer very favourable conditions for wind installations, particularly along the coastlines. There are 36 wind projects in South Africa, currently generating 3.024 MW of capacity, though private operators are expected to install over 500 MW through current operations.[53]

Figure 8 - Wind Energy Production South Africa



To the best knowledge of the writer, Namibia, Mauritius, and Mozambique have installed wind energy capacity so far. Zimbabwe intends to generate 100 MW from wind by 2025 and have launched a pilot project in Mamina (Mashonaland West) meant to study the viability of generating energy through wind-power. However, according to a report by the African Development Bank, overall climate change considerations are generally not as high a priority as access, cost and energy considerations in determining the adoption of wind energy.[54]

4. Geothermal energy: Geological surveys have shown that Malawi, Mozambique, and Tanzania have huge potential for geothermal energy with estimates of 4 000 MW available. South Africa have eighty-seven recorded thermal springs, however, since geothermal flow measurements is very low (the current hottest temperature measurement at surface is 67.5°C, the potential of electricity generation on large scale is very low.[55]

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50 Justo, Tafula & Moura (2022) 7860.

51 Luz, Moura & de Almeida (2018) 2637–2643.

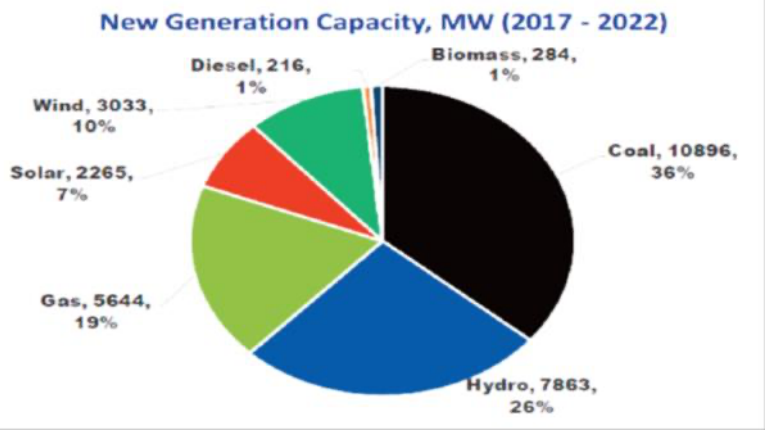
52 African Development Bank - The Bank Group's Strategy for The New Deal on Energy for Africa 2016 – 2025 https://www.afdb.org/fileadmin/uploads/afdb/Documents/GenericDocuments/Bank_s_strategy_for_New_Energy_on_Energy_for_Africa_EN.pdf See also the African Development Bank Working Paper on Development of Wind Energy in Africa, available at http:/www.afdb.org/

53 African Development Bank Working Paper on Development of Wind Energy in Africa, available at http:/www.afdb.org/ at 10. Figure 8 - Wind Energy Production in South Africa. Source Siemens Gamesa Renewable Energy https://www.siemensgamesa.com/en-int/explore/journal/2022/10/south-africa-wind-power-energy-transition

54 African Development Bank Working Paper on Development of Wind Energy in Africa, available at http:/www.afdb.org/ at 23.

55 Tshibalo, Olivier & Venter (2010) 10.

Figure - 9 New Electricity Generation Capacity SADC (2017 – 2022)



The SADC Energy Monitor shows planned new energy generation capacity for SADC, timeframe 2017 – 2022, which includes 10% wind energy, 7% solar energy and 26% hydro energy. However, the new energy generation plans still includes 36% for coal and 19% for gas generation.[56]

Challenges in the realisation of energy harmonisation for the SADC region

According to Justo there are several policy considerations applicable to developing countries such as SADC members which are not addressed in energy extension and generation planning studies. This relates to insufficient initial infrastructure, especially for rural areas.[57] Secondly, the problems created by the unequal access to energy on a sub-national level. The power grids for individual SADC members are not of equal development and capacity. Thirdly, the importance of integrating on-grid and off-grid energy solutions. Off-grid energy solutions have been found to be a cost effective and reliable option to expand energy access in developing countries.[58]

Import duties on renewable energy technologies and the costs associated therewith, also makes renewable energies uncompetitive in fossil-fuel rich countries such as South Africa, where coal is abundant and can be mined relatively cheaply.[59] The fact that some renewable energy generation requires base capacity supplied by a more stable energy resource also complicates energy generation plans. The African Development Bank suggests that base load capacity should be provided by nuclear or hydropower plants which are overall less polluting.[60] However, the reliance of hydropower and the constraints of the unpredictability of extreme climate events such as droughts has decreased the reliability of hydropower as a source for base capacity. This in turn can again shift the generation focus for SADC members to fossil fuels, making renewable energy targets harder to meet. Nuclear powerplants are also costly to develop and are not always accepted by members of the public over safety and waste generation concerns. Nuclear power stations also need major uninterrupted water supplies for cooling, something that cannot always be guaranteed in a drought stricken Southern Africa.

The Global Policy Centre's Report on Expanding Renewable Energy for Access and Development (the Report) also shows that a coal legacy, in especially South Africa with its abundance of coal, a coal focussed policy trajectory, entrenched coal interests and the impacts of potential mining job losses, are proving a barrier to the commitment to renewable energy.[61] Further barriers to renewable energy finance in SADC includes risk and financing challenges, with some countries experiencing currency and credit rating failings. Corruption perception and policy and tariff uncertainty also undermines renewable energy

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56 Figure 9 - New electricity generation capacity planned SADC (2017 – 2022). Source SADC Energy Monitor.

57 Figures 2 and 3 - SADC Access to Electricity as discussed above.

58 Justo, Tafula and Moura (2022) 15.

59 African Development Bank Working Paper on Development of Wind Energy in Africa, available at http:/www.afdb.org/ at 21.

60 African Development Bank Working Paper on Development of Wind Energy in Africa, available at http:/www.afdb.org/ at 22.

61 Expanding Renewable Energy for Access and Development Global Development Policy Centre (2020) 29 https://www.bu.edu/gdp/files/2020/11/GDP_SADC_Report_EN_Nov_16.pdf

finance. Corruption is listed in the Report as the third most important risk factor identified hindering the funding of renewable energy projects. The lack of local capacity and technical expertise, poverty and labour uncertainty are also listed as factors hampering renewable energy financing. The Report also mentions public private partnerships as a way of funding renewable energy projects. However, ideological ideals, mistrust and a lack of cooperation between the public and private sector actors are barriers to renewable energy projects in SADC.[62] This is despite a regional framework for public private partnerships approved by SADC members in 2013.

CONCLUSION

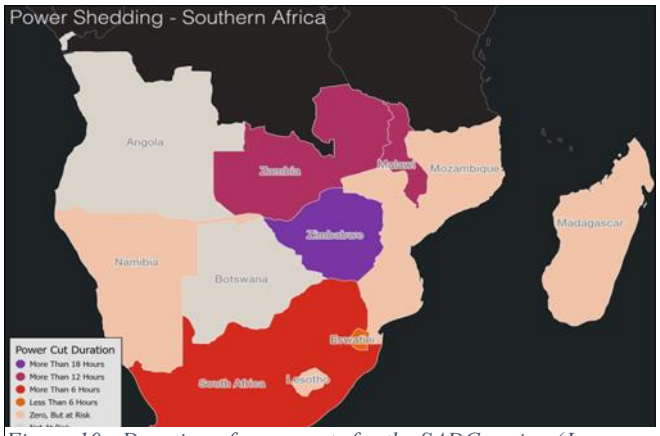

Figure 10 - Duration of power cuts for the SADC region (January – March 2023)

Energy sustainability is a core component of sustainable development and through regional integration, energy self-sufficiency and renewable energy targets can be met by SADC. Although progress has been made with regional energy integration for SADC, economic and political barriers still hamper true energy integration and renewable energy generation. The SAPP and the linking of the energy grids of member countries already allows for energy trading between countries.

However, most SADC member countries still experience energy generation shortages that leads to load shedding.[63] Although many SADC countries address renewable energy targets directly in their national energy generation strategies, it is also necessary for SADC members to nationally commit to renewable energy targets and aligned their energy development plans accordingly. To achieve energy sustainability in the region, energy planning must be done holistically, member countries must develop renewable energy generating capacity in their own territories which can and will supplement the energy developments and needs in other SADC countries. This requires greater integration and support among countries at the planning stage, something that is currently not occurring. Mutual assistance and the aggregation and pooling of resources can assist member countries to lessen the high cost involved in developing renewable energy sources.

Encouraging and investment in policies to encourage local manufacturing of renewable energy components must be implemented by member countries. Public private partnership should be encouraged, including private renewable energy generation projects, to lessen the financial burden on the economies of member countries. Governments should ensure that such private projects are supported by regulations to make them competitive and able to undertake large scale projects.

Rural electrification is of concern in SADC. The percentages listed in figures 2 and 3 shows the dismissal access to sustainable energy in rural areas of some member countries. Off-grid energy options should be included as part of an integrated planning approach to sustainable energy development. Energy equality

62 Expanding Renewable Energy for Access and Development Global Development Policy Centre (2020) 37 https://www.bu.edu/gdp/files/2020/11/GDP_SADC_Report_EN_Nov_16.pdf

63 Figure 10 - Duration of power cuts for the SADC region (January – March 2023). Source Crisis 24 https://crisis24.garda.com/insights-intelligence/insights/articles/alternating-current-southern-africas-issue-with-load-shedding

can to a certain extent be addressed through the option of household and other off-grid solar systems. This will provide communities with viable energy sources without placing any further burden on already strained grids. Such community level benefit-sharing will not only uplift rural communities but can also lead to greater community support for renewable energy projects. For successful development of rural areas, however, grid extension and development will still be necessary.

Through effective collaboration between SADC countries, mutual trust, sufficient investment in human capital and technical expertise and the creation of a working regional framework to enhance capacity sharing and planning of renewable energy generation, regional integration for ensuring regional energy sustainability for SADC can be met.

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Understanding Advance Medical Directive and Death Wishes to Treatment

Mohd Zamre Mohd Zahir[1*], Tengku Noor Azira Tengku Zainudin[1], Haniwarda Yaakob[1], Ramalinggam Rajamanickam[1], Nur Khalidah Dahlan[1], Nurul Hidayat Ab Rahman[1], Muhammad Hatta[2], Yati Nurhayati[3], Sudiyana[4], R. Murjiyanto[4], Dyah Permata Budi Asri[4], Rozlinda Mohamed Fadzil[1], Rachel Decruz[1], Hazlina Shaik Md Noor Alam[1], Aminurasyed Mahpop[1], and Ahnaf Ahmad[5]

[1] Faculty of Law, Universiti Kebangsaan Malaysia (UKM), 43600 UKM Bangi, Selangor, Malaysia
[2] Faculty of Law, Universitas Malikussaleh, Aceh, Indonesia
[3] Faculty of Law, Universitas Islam Kalimantan, Indonesia
[4] Faculty of Law, Janabadra University, 55231, Yogyakarta, Indonesia.
[5] Jabatan Kehakiman Syariah Negeri Terengggganu, Aras 5, Bangunan Mahkamah Syariah, Jln. Sultan Mohamad, 21100 Kuala Terengganu, Terengganu, Malaysia

[*] Corresponding author's e-mail address: zamre@ukm.edu.my

Abstract

If someone becomes terminally ill and unconscious, an Advance Medical Directive (AMD) can be used to communicate that they do not wish to undergo extraordinary life-sustaining treatment. Meanwhile, death wishes are the conscious or unconscious desire for the death of another or of oneself. Here, the problem is whether there is a law governing the individual's rights relating to AMD and/or death wishes. Ultimately, everyone cares about doing what is best for the patient. Who, then, makes the ultimate decision? Is an advance medical directive (AMD), created before the patient lost the ability to express his or her preferences, the best option? The first goal of this paper is to analyse the legal perspective of protecting someone when communicating his or her wishes before dying. Secondly, to recommend improvements relating to AMD and death wishes for treatment in Malaysia. This paper employs a qualitative method. It has been found that there are dilemmas faced by doctors, patients and family members to determine the patient's wishes before he or she dies. Therefore, the recommendation ought to have elements that can save lives while still respecting the patient's autonomy over that life's course and his or her desires.

Keywords: Advance Medical Directive; death wishes; ethics; law; treatment.

1. Introduction

Sustainable Development Goal 3, on "Good Health and Well-being", is one of the 17 Sustainable Development Goals established by the United Nations in 2015. Both a person's health and quality of life are significantly influenced by how they live. It is increasingly acknowledged that human efforts and prudent lifestyle choices made by members of society have an equal role in preserving and developing health as the advancement and application of health science. COVID-19 is an infectious disease that is currently not known to have a recognised vaccine. On March 11, 2020, the World Health Organisation (WHO) announced that the COVID-19 outbreak has developed into a global pandemic. The WHO has urged states to take swift, immediate, and aggressive action to halt the virus's spread, citing "the alarming levels of spread and severity" [1].

Apart from COVID-19 issues, the matter regarding patient consent is crucial. Here, it is significant to discuss AMD. AMD can be used as a document describing the types of care that the patient will be allowed to receive and those that are not allowed when the patient has been impaired [2]. In situations where individuals no longer have control over what is being done to them, AMD (also known as "Arahan Perubatan Awal" (APA) in the Malay language) gives a patient a voice [3] [4]. As a result, AMD is a directive that gives a patient the freedom to exercise his right to choose how to best care for himself before he becomes unable of doing so [5]. In short, someone can exercise his free right as a person until he ultimately becomes disabled [3]. Therefore, this paper will discuss about AMD and the link with death wishes.

2. Literature Review

Several studies have found the significance of AMD and the viewpoint relating to death wishes. AMD is a directive, and someone is free to use his or her right to decide how to provide the best treatment for themselves before becoming incapable of doing so [5]. Before someone dies, he can make his decision about his medical treatment. But the important thing is he must be competent to do so. Under English common law, consent or refusal given by a patient to medical treatment is only said to be valid when he does so after being given sufficient information, done voluntarily and whether he can decide at the time. In *Re T (Adult)* [1992] 4 All ER 649, the "Competency Test" prescribed by the House of Lords must meet "three conditions." The first condition, at the time the decision regarding the medical treatment is made, the patient must have the legal capacity and can express consent or rejection of treatment. This means the patient must be an adult and not suffer from any disability that may affect his or her ability to make their own decisions. Doctors need to consider whether the patient can match the consequences of the decision to be made.

The second condition is that the patient at the time the decision is made must be aware and intend that the scope and basis of his or her consent apply in the circumstances. In *Airedale NHS Trust v Bland* [1993] 1 All ER 821, the court emphasized the need for specific treatment in ensuring that past refusals can still be considered relevant in the current situation. The third condition, at the time the decision is made, the patient must know the nature, purpose, and effect of the treatment he has agreed to. This third condition can be seen through the case of *Re C (Adult, refusal of treatment)* [1994] 1 All ER 819, to determine whether the patient has adequate understanding, there are "three aspects" that need to be met. The first aspect needs to be proven that the patient understands and can store the information provided in relation to medical treatment. The second aspect, the patient believes in the information provided. The third aspect, the patient can understand in-depth and use the information to make judgments and balance his judgment between the need to undergo the treatment with the risks that may occur.

The conditions of giving such valid consent or permission are applicable in determining the validity of an AMD such as whether the patient making the AMD has all the necessary information and is truly competent when expressing his or her consent to continue or refuse medical treatment. If the patient does not meet the conditions of ability previously stated through the case of *Re T (Adult)* [1992] 4 All ER 649, the AMD of the patient becomes invalid. Therefore, any action or decision related to the medical treatment of the patient during the period of his incapacity shall be made in the best interest of the patient.

In some studies, found that there is connection between AMD and ACP. According to Hospis Malaysia (2017), advance care planning (ACP) is a process to help individual plan his medical care in

advance so if he becomes too unwell to make decisions for himself, his wishes can still be respected by his health care team, his family and carers [6]. According to Hospis Malaysia (2017), anyone over 18 years of age can make an advance care plan [6]. Everyone can, and should, have one, but especially people who have chronic or life limiting health conditions; are entering residential care facilities; believe their family may have different views or beliefs to their own; and have a condition that may lead to a loss of capacity to make decisions (such as dementia).

According to Erik K. Fromme, Carole Montgomery and Susan Hickman (2023), there are many different approaches to training health professionals in planning and serious illness communication [7]. Three of the most established formational national programs are Respecting Choices, VitalTalk, and Ariadne Labs' Serious Illness Care Program (Erik K. Fromme, Carole Montgomery and Susan Hickman, 2023) [7]. Respecting Choices (RC) programs focus on both building the systemic framework necessary to integrate the broader concept of person-centred decision making into standard practice, as well as building skills to facilitate robust planning conversations (Erik K. Fromme, Carole Montgomery and Susan Hickman, 2023) [7].

Zee Nee Lim, Wan Jun Ng, and Chee Chan Lee (2023) claim that advance care planning (ACP) implementation at the institutional level, initiatives to create educational programmes, and research activities to comprehend patient attitudes and perceptions on advance care planning are all examples of positive developments in Malaysia [8]. However, there are still issues, such as a lack of understanding and awareness, a lack of a legal framework to direct the execution of advance care planning, and a lack of effective national initiatives. There is still a lot to learn about ACP on a national and international level before Malaysia decides to implement it. ACP is a public health issue and requires concerted effort of all stakeholders, including Government agencies, academic institutions, and non-government organizations to raise public awareness. More research is needed to shape the future direction of ACP development in Malaysia. ACP is a public health concern that calls for a collaborative effort from all interested parties, including governmental organisations, academic institutions, and non-governmental organisations. To determine the future course of ACP growth in Malaysia, more research is required.

According to Erik K. Fromme, Carole Montgomery and Susan Hickman (2023), it is also becoming more widely acknowledged that when engaging the public, the earlier emphasis on making extremely specific decisions about the future needs to give way to an emphasis on preparing people for communication and decision-making [7]. There are numerous programmes for health care workers to promote in-depth investigations of objectives, values, and preferences, and the resources available to support this work in the community and in the healthcare, setting are expanding. To fully comprehend the complexity of planning implementation and to pinpoint person-centered outcomes that will enable high-quality planning, more study is required.

The study pertaining to autonomy states that as patient autonomy increased in the middle of the 20th century [9]. Cressida Auckland (2023) noted that Millian concepts of freedom had become so ingrained in bioethical theory that attempts to defend paternalism often included making one of two assertions [9]. Either way, they have entailed contesting the importance of autonomy as an ethical rule and raising the issue of whether it should always be prioritised over other ethical standards. Or, they have attempted to question the autonomy of decisions by arguing that they are not independent in a significant way. Both strategies are readily apparent in discussions about the moral validity of advance directives, where people have questioned whether precedent autonomy should always take precedence over the person's current best interests and whether it is actually possible to foresee in advance the entire nature and implications of the decision that is currently under consideration [9].

According to Sajid Muzaffar (2011), the patient's uncertainty regarding the course of treatment frequently makes things more difficult [10]. One such patient who showed up at an A&E department after harming themselves by taking a fatal dose of antifreeze was Kerrie Wooltorton. She continued to reject the treatment despite having an Advance Decision prohibiting any sort of overdose recovery. She passed away three days after her wishes were granted. The medico-legal position in a circumstance like the one raised by the case, poses numerous ethical and practical difficulties. It bases its argument that there are numerous lessons to be learned from this case on the mental capacity and case law, both of which plainly favour life preservation (Sajid Muzaffar, 2011) [10].

According to Sajid Muzaffar (2011), there are enough safeguards for treating clinicians if they are not satisfied of the validity and applicability of the advance decision and decide to override it (Sajid Muzaffar, 2011) [10]. As an alternative, any choice to abide by the advance decision must have solid

evidence to back it up. When specific requirements under the Mental Health Act are satisfied, the Mental Capacity Act itself permits defiance of the patient's desires. The primary lesson to be learned is that this path was not taken in the Wooltorton case [10].

According to Roop Gursahani et al. (2023), India is undergoing economic, demographic and epidemiologic transitions [11]. The healthcare industry is expanding rapidly as the burden of non-communicable diseases increases. The Indian Supreme Court has enabled Advance Medical Directives (AMD). AMD is the document containing preferences for future decision. Implementation of Advance Care Planning (ACP) will depend on civil society and the palliative care sector until government support is available. ACP is the process of discussion with an adult subject (and significant others), at any stage of health or illness but often towards the end of life, whereby preferences for future treatment are stated and documented, in preparation for a stage where they can no longer participate in medical decision making. This should preferably include the designation of a proxy or surrogate decision maker and preferred place of care or death [11]. Advance medical directives were legally and constitutionally validated in India in 2018 but on a practical basis were enabled only in January 2023. This narrative review is an overview of the socio-legal landscape and suggests a road map for the immediate future (Roop Gursahani et al., 2023) [11].

It was viewed as a crucial recognition of both patient autonomy over end-of-life decisions and the right to a dignified death when the Supreme Court gave legal status to the idea of "advance medical directives" in 2018 and permitted passive euthanasia, subject to strict safeguards (The Hindu, 2023) [12]. Doctors eventually discovered, however, that some of the detailed instructions proved to be "insurmountable obstacles". The instructions were recently simplified and made more practical by a Constitution Bench order. A court magistrate is no longer required to countersign the advance direction. It could instead be attested in front of a notary or a gazetted officer [12].

If the notary or officer is satisfied that the document was executed voluntarily, without coercion or inducement, and with full understanding, that suffices in place of the magistrate. The initial recommendation that the executor identify a guardian or a close relative who would have the authority to consent to deny or withdraw medical care, in the event that the executor became incapable of making a decision, has been updated to name more than one guardian or relative [12]. It is now the responsibility of the person making the advance directive to give copies of it to the guardians or close family members named in it, as well as to the family doctor. Previously, the magistrate was responsible for notifying family members about the advance directive in case they were not present when it was executed. Digital health data might possibly contain it (The Hindu, 2023) [12].

The above review indicates that AMD created before the patient lost the ability to express his or her preferences. Some studies show the connection between AMD and ACP. Plus, the study also indicates the significance of principle of autonomy when an individual has a freedom to decide for his own life including before dying. This study of end of life individual is not a taboo topic, it is a crucial topic to be discussed because everyone has right against his own preference including for his own medical treatment and care. This paper will further explain the uniqueness of method used when researching this topic.

3. Methodology

This paper adopted a legal research method by utilising a qualitative analysis. This paper focused on the area of study that discussing about the concept of AMD and death wishes for treatment using content analysis. The author will analyse the literatures, see the content of the literatures and discuss them here. Krippendorff asserts that content analysis can take on a variety of shapes, ranging from straightforward word counts to conceptual analysis (Krippendorff, K., 2004) [13]. When conducting research and producing this work, secondary sources and qualitative approaches were prioritised with a focus on both primary and secondary sources [14] [15]. Based on the study, the authors will discuss about the finding and suggestion at the final stage.

4. Results and Discussion

The passage discusses the COVID-19 vaccine rollout in Malaysia and the importance of preserving autonomy in healthcare decision-making. Malaysia has been successful in its vaccine rollout, prioritizing

groups such as the elderly and healthcare professionals. Preserving autonomy is crucial in protecting the principle of autonomy, as patient autonomy is considered fragile and is a core concern in biomedical ethics [16].

Based on the study, Robert Audi indicates autonomy as an autonomous means of control to provide justification for controlling and manipulating one's attitudes (Audi Robert, 2001) [20]. This inspiration can be contained in a corresponding practical judgment, an internal role known as motivational, or can come to a practical judgment externally as a wish, regardless of the judgment (Audi Robert, 1991) [21]. Besides that, when we are focusing on autonomy, there is an aspect of medical paternalism that we will highlight. Medical paternalism is a collection of medical beliefs and procedures in which a doctor decides that the wishes or choices of a patient should not be honoured. Throughout the early to mid-20th century, these practices were present and were marked by a paternalistic approach and a lack of respect for patient autonomy (Brennan Troyen, 1991) [22]. Paternalism has been restricted in recent years, and blind trust in doctors' decisions has become frowned upon (Medical Protection Society Limited, 2017) [23]. Therefore, the autonomy principle is used to determine the patient's decision over the doctor who wanted to decide for his or her patient.

Jennings (2007) [24] and Griffin (2008) [25] differentiate between autonomy in terms of free will and autonomy in the context of political freedom within a community, free from interference by third parties or the State (Berlin, 1969) [26]. For this paper, the terminological distinction is adopted, where autonomy refers to the ability to choose one's actions, while liberty refers to the ability to act without interference. Interference with liberty can occur through actions or omissions, and appropriate safeguards to promote liberty extend beyond negative obligations to simply leave individuals alone (Griffin, 2008) [25].

Previously, Malaysia's Temporary Measures for Reducing the Impact of Coronavirus Disease 2019 (COVID-19) Act 2020 (COVID Act) was gazetted and came into force on 23 October 2020. The COVID-19 Act took effect on 23 October 2020, for a period of two years, or in compliance with the date or term of the applicable sections of the Act (Saritha Devi Kirupalani, 2021) [27]. One of the measures taken by the Malaysian government to assist individuals and businesses affected by the COVID-19 pandemic is the COVID Act. Its goal is to reduce the pandemic's impact. Parties' failure to perform contractual responsibilities as a result of steps taken under the Prevention and Control of Infectious Disease Act 1988 and in such a situation are described in Part II of the COVID Act, the innocent party will not be entitled to exercise their rights, post 23 October 2020 as per the COVID Act.

The COVID Act has worked to fix as many facets of the pandemic as possible. However, the measures have been criticised as being too little and too late to relieve the pressure created by the pandemic (Saritha Devi Kirupalani, 2021) [27]. Even though various changes to Malaysian legislation, the savings provisions mentioned above have the effect of watering down their intended purpose. Nonetheless, in these unprecedented times, the introduction of the COVID Act is a step in the right direction. Following the implementation of the Act, additional amendments may be required to improve or add to the prescribed steps for resolving the various issues that arise because of the pandemic.

The Prevention and Control of Infectious Diseases Act 1988 (Act 342) in Malaysia could potentially be relevant in addressing the current situation. This act governs the prevention and control of infectious diseases, with specific diseases listed in its First Schedule. Although COVID-19 is not explicitly listed, it could potentially fall under the category of "any other life-threatening microbial infection." The act allows the Minister of Health to declare an area as an infectious local area in the event of an outbreak or threat of an epidemic, granting certain powers for control and prevention. However, both the COVID-19 Act and Act 342 seem to lack specific provisions addressing patients' autonomy in relation to medical treatment.

Furthermore, according to Dhvani Mehta and Akshat Agarwal (2021), due to the COVID-19 pandemic, people have had to face their mortality [17]. Anxieties about making decisions at the end of life were made worse by the thought of being in hospitals, away from friends and relatives. However, COVID-19 is not the only instance of this problem; doctors and patients in critical care settings deal with it daily as well. According to Beauchamp and Childress (2009), the perception that patients should be permitted to make their own decisions about their care is most strongly associated with respect for autonomy [16] This belief is related to concerns about confidentiality, privacy, fidelity, and truth-telling. In this situation, he or she may also stipulate in an AMD that he or she does not wish to continue treatment or get any further medical attention. The AMD was created with the idea of autonomy in mind. Patient

can meet his doctor to discuss about his AMD and the decision to have it. Issues surrounding end-of-life care decision-making are, however, not unique to COVID-19 alone and are faced by doctors and patients in critical care settings daily. On the other hand, lack of legal certainty and fear of prosecution often prevents doctors from taking ethically sound decisions (Dhvani Mehta and Akshat Agarwal, 2021) [17]. In March 2018, the Supreme Court of India, in *Common Cause v Union of India,* delivered a judgment that:

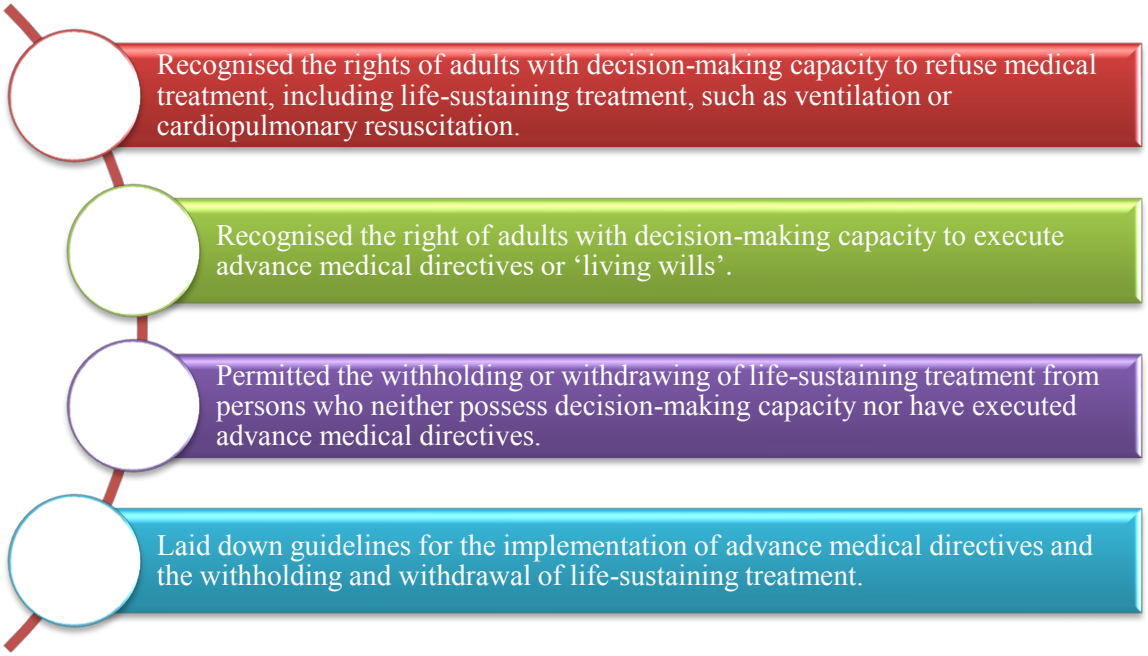

Table 1: Explanation of the judgment in *Common Cause v Union of India* [17].

However, in the absence of a workable procedure for the withholding or withdrawal of life-sustaining treatment, healthcare professionals find themselves unsure of the appropriate course of action at the end of life [17]. They are hesitant to act in accordance with professional medical guidelines on the withholding or withdrawal of such treatment for fear of legal action. As a result, patients are subjected to potentially non-beneficial treatment that may be against their wishes. The flowchart below in Figure 1 outlines the streamlined procedure for making end-of-life decisions.

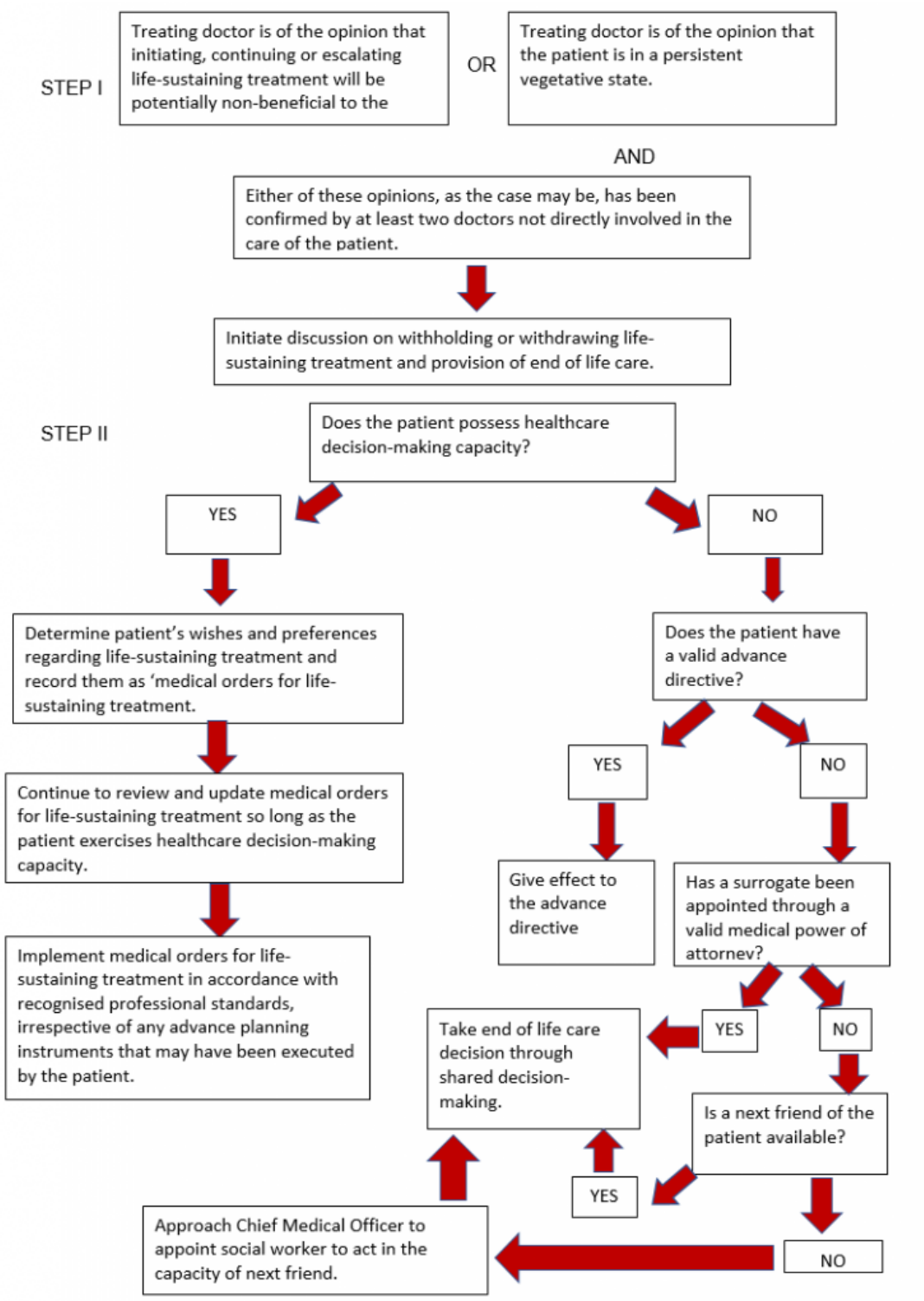

Figure 1. Flowchart outlines the streamlined procedure for making end-of-life decisions (Dhvani Mehta and Akshat Agarwal, 2021) [17].

Based on Figure 1, the model shows the person to make a declaration regarding their wishes to continue or decline receiving life-sustaining treatment such as artificial respiration and cardiopulmonary resuscitation. It also shows that the person to appoint a healthcare power of attorney or surrogate decision maker to implement their wishes.

Environmental health is the branch of public health that focuses on how the built and natural environments affect people's health. To successfully control factors that might have an impact on health, the requirements that must be followed to produce a healthy environment must be established (Dovjak et al., 2019) [18]. For the sake of human health, environmental health places a special emphasis on the built and natural environments.

Article 17, Consent for Treatment of Patients by Registered Medical Practitioners (Consent Guidelines) clarifies that in general, every individual has the right to refuse medical treatment, and competent individuals have the right to choose medical treatment. Article 18, the Consent Guidelines, among others, explains that:

> *"A medical practitioner should refrain from providing treatment or performing any procedure where there is an unequivocal written directive by the patient that such treatment or procedure is not to be provided in the circumstances which now apply to the patient"* [19].

The growth of AMD legislation in Malaysia is still slow-moving [2]. No local case relating to AMD has yet been identified [15]. A specific statute or other legal improvement pertaining to AMD is crucial. Although the registered medical practitioners of the Malaysian Medical Council (MMC) by means of Articles 17 and 18 of the Consent Guidelines have a general guideline that mentions AMD, this is still unclear and is just a soft regulation. In general, any person can decide to refuse medical treatment pursuant to Article 17 (Malaysian Medical Council (MMC), 2016) [19]. Article 18, the Consent Guidelines clarify that a registered medical practitioner (doctor) must refrain from providing treatment or performing any procedure if there is a clear written instruction by the patient that the treatment or procedure should not be given in circumstances that indicate the patient will be given treatment. In Article 18 of the Consent Guidelines, the detailed information that can be summarized is as follows:

- Doctor must comply, without division with the treatment noted on the patient's instructions as per the conditions stated therein;
- Doctor is not required to comply with any patient's AMD that contains instructions that are against the law such as euthanasia and abortion;
- Doctors should assess the validity of AMD by referring to several factors. The first factor is whether the AMD is clear and specific enough to be applied to the clinical situation that arises. The second factor is whether it can be said that the AMD is prepared after thinking deeply in relation to the current situation for example whether the instruction is provided before or after the detection of the disease. The third factor is whether there was any reason to doubt the patient's level of ability at the time the instruction was provided or whether there was any undue pressure on the patient to make the instruction;
- If the validity of the AMD is questioned by the doctor, he or she should refer to the patient's spouse or immediate family member, and the physician should consider the need to seek legal services as well as discuss with his or her colleagues involved in the patient's treatment process;
- In emergency cases, a doctor may provide treatment on the grounds of the patient's best interests based on his or her professional assessment until legal advice is obtained regarding the validity and scope of the patient's AMD.

A legally qualified person has the right to make a choice in respect of his own body [15]. AMD being a legal document that one signs in advance to inform the doctor treating oneself (in the event of terminal illness and unconsciousness) that one does not want any extraordinary life-sustaining treatment to be used to prolong one's life [28]. For such a person, the right to refuse care always remains, irrespective of his or her reason for making such a decision, either his or her choice appears rational, uncertain, unreasonable, or even non-existent. The existing body of literature indicates that good health is an integral component of autonomy and is commonly associated with the right to life and death. In the context of medical treatment, autonomy assumes great importance as patients need to ensure active

involvement in their healthcare decisions, rather than blindly following their doctors without understanding their own circumstances.

5. Conclusion

The ability to continue doing the things that are important to them, to maintain their decision- making capacity, to maintain their independence, and to uphold their personal autonomy are all made possible by excellent health and well-being. The right to health and the autonomy principle, which are in line with Sustainable Development Goal 3 and will bring healthcare as close as is practicable to where people live and work, are essential parts of continuous healthcare. The government must rigorously monitor the chain of positive instances as COVID- 19 spreads quickly while respecting the idea of patient autonomy. Regardless of what occurs or how much it costs, all nations must work together to ensure that their citizens' health is maintained. To further maintain a healthy atmosphere in our society, everyone must work together to fulfill their individual tasks.

The lack of a regulatory framework for AMD is the legal barrier in this instance. As previously said, the answer to this issue is the creation of a solid, standard legislation that governs AMD. It is important to have a legal improvement pertaining to AMD such as a specific law. It has been discovered that determining the patient's wishes before to death presents problems for doctors, patients, and family members. The advice should therefore include components that can save lives while yet respecting the patient's autonomy over the path of their life and their wishes.

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FROM COPYRIGHT PROTECTION TO SUSTAINABLE DEVELOPMENT: HOW THE COPYRIGHT ACT (AMENDMENT) 2022 ADDRESSES DIGITAL PIRACY AND SUPPORTS THE SUSTAINABLE DEVELOPMENT GOALS

Mohd Syaufiq Abdul Latif[1], Nazura Abdul Manap[2] and Nabeel Mahdi Althabhawi[3]

[1] Faculty of Law, Universiti Kebangsaan Malaysia, Malaysia.
[2] Faculty of Law, Universiti Kebangsaan Malaysia, Malaysia.
[3] Faculty of Law, Universiti Kebangsaan Malaysia, Malaysia.

[4] syaufiqlatif@gmail.com

Abstract.

The introduction of the new Copyright (Amendment) Act 2022 in Malaysia aims to combat digital piracy and strengthen copyright law in the digital sphere. This aligns with Sustainable Development Goal (SDG) 16 which promotes peaceful and inclusive societies for sustainable development and calls for effective, accountable, and inclusive institutions at all levels. By improving copyright law, Malaysia is taking steps to build effective institutions that can protect the intellectual property rights of individuals and businesses. The new Copyright Act (Amendment) 2022 introduced in Malaysia Act aims to provide access to justice for all and promote accountability in the enforcement of copyright law. The result indicated that while copyright law in Malaysia plays its role in combating digital piracy, improvements of the provisions through the Copyright (Amendment) Act 2022 such as the introduction of current new offenses aimed at tackling the latest trends of digital piracy on the internet and conferment new investigative powers to assistant copyright Controllers are needed to review to further support copyright enforcement mechanism in Malaysia. These improvements to the law are needed to further support copyright enforcement mechanisms in Malaysia and promote legal sustainability, which is a key aspect of SDG Goal 16. Hence, this article aims to explore how the Copyright Act (Amendment) Act 2022 Malaysia can be used to fight digital piracy and provide access to justice for rights holders at all levels through a new copyright enforcement measure introduced in the Act. This article employs library-based research which collects data from statutes, journals, books and case law.

1. Introduction

The rapid advancement of technology and the proliferation of digital platforms have revolutionized the way creative works are accessed, shared, and consumed (Craig, et al., 2016). While these technological developments have provided numerous benefits, they have also given rise to new challenges in protecting intellectual property rights, particularly in the environment of copyright (Aversa, et.al, 2019). Recognizing the need to adapt copyright laws to the digital space, Malaysia has recently enacted the Copyright (Amendment) Act 2022. This comprehensive legislation is designed to reinforce the exclusive rights of right holders and combat the increasing prevalence of digital piracy. The implementation of the new Copyright (Amendment) Act 2022 in Malaysia not only addresses the challenges posed by digital piracy but also contributes to the broader goal of sustainable development. This aligns with Sustainable Development Goal 16: Peace, Justice, and Strong Institutions. SDG 16 seeks to promote peaceful and inclusive societies, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels. By strengthening copyright enforcement provisions to combat digital piracy, Malaysia aims to achieve these objectives and contribute to sustainable development in the following ways.

Firstly, the Copyright Act (Amendment) 2022 ensures that right holders have the necessary legal tools to protect their rights in the digital sphere. By enabling enforcement authorities to combat digital piracy using a new legal tool provided under the act and hold infringers accountable for their actions, the act

promotes access to justice for right holders, ensuring their works are protected and their rights are upheld. Secondly, the new legislation empowers enforcement authorities, such as the Intellectual Property Corporation of Malaysia (MyIPO) and the Ministry of Domestic Trade and Cost of Living (MDT), with new investigative powers to deter infringers and enforce copyright law effectively. This strengthens the institutions responsible for copyright enforcement, enhancing their ability to address digital piracy and protect the rights of authors and rights holders. Thirdly, copyright protection is crucial for fostering a vibrant creative sector and encouraging innovation. By deterring digital piracy and ensuring that right holders are adequately protected, the Copyright (Amendment) Act 2022 promotes an inclusive society where creators have the confidence to create and share their works, leading to cultural enrichment and economic growth. The enactment of the Copyright (Amendment) Act 2022 in Malaysia reflects the country's commitment to achieving Sustainable Development Goal 16 by strengthening copyright enforcement provisions. Additionally, by protecting the rights of creators and fostering innovation in the copyright-based industry, Malaysia contributes to building peaceful, just, and inclusive societies while creating a conducive environment for sustainable development. Thus, the following sections will explore the specific conducts of digital piracy towards right holders exclusive rights, the key provisions of the Copyright (Amendment) Act 2022 followed by a discussion on the challenges and recommendations for its effective implementation in addressing digital piracy particularly in Malaysia

2. Methodology

The methodology employed in this article is library-based research, which involves gathering information from a variety of sources such as statutes, scholarly articles, books, and reports. This approach allows for a comprehensive exploration of the implementation of the Copyright (Amendment) Act 2022 and its effectiveness in addressing the challenges posed by digital piracy in Malaysia. By employing this methodology, the research aims to contribute and improve the general understanding of the digital piracy, the role of Copyright (Amendment) Act 2022 in combating digital piracy as well as how the Copyright (Amendment) Act 2022 may contribute to achieving SDG goal 16. This article also seeks to inform policymakers, stakeholders, and enforcers about the potential impact of the Copyright (Amendment) Act 2022 in combatting digital piracy and to identify gaps to resolve digital piracy issues happening in Malaysia.

3. Result and Discussion

3.1 Introduction of Digital Piracy and the Role of Sustainable Development Goal

Infringement of copyright occurs when someone uses a whole or a substantial part of an author's copyrighted work without authorization. Authors, also known as right holders, have the exclusive right to prevent any unauthorized use of their work without consent, as enumerated in the Copyright Act of 1987. In the digital environment, there are various types and forms of copyright infringement that involve the unauthorized use of someone else's work, particularly in the digital sphere (Al-Rafee, 2002). One example of copyright infringement in the digital environment is digital piracy (OECD, 2009).

Digital piracy has been defined as the illegal copying or downloading of digital material, such as software, music, videos, audiobooks, and other copyrighted material (Al-Rafee, 2002). It also refers to the illegal copying, downloading, or sharing of digital products, such as music, software, computer games, movies, electronic books, and other copyrighted material (Lowry et al., 2017). Examples of digital piracy include downloading commercial software from illegal sites, using peer-to-peer technology to download the latest movies, downloading a bestseller book in electronic format, or downloading copyrighted songs using torrent software (Al-Rafee et al., 2010).

Digital piracy encompasses the unauthorized utilization and distribution of copyrighted works through digital and social media platforms or service providers (Thomas, 2018). This form of infringement occurs when individuals share, download, or make copyrighted content available without obtaining proper

authorization from the right holders. The rapid growth of digital piracy has been driven by the desire for convenient and readily accessible content, particularly among the consumers and copyright end users (Lapan, 2009). Until today, it presents significant challenges for businesses as digital piracy diminishes revenue streams and alters consumer consumption patterns (Aversa, 2019) opting from legal to illegal use of copyrighted content without right holders being remunerated.

To address the issue of digital piracy and protect right holders exclusivity, it is crucial to consider the Sustainable Development Goal 16 (SDG 16) set by the United Nations. SDG 16 aims to promote peaceful and inclusive societies, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels. One of the targets under SDG 16 is (i) to significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets, and combat all forms of organized crime and (ii) to promote the rule of law at the national and international levels and ensure equal access to justice for all.

By aligning efforts to combat digital piracy with SDG 16, stakeholders can leverage the international commitment towards promoting inclusive societies and strengthening institutions to protect right holders' exclusive rights. This alignment can facilitate the development of legal frameworks and enforcement mechanisms through the Copyright Act (Amendment) 2022 to combat digital piracy effectively.

3.2 Addressing Digital Piracy in Malaysia: Strengthening Legal Frameworks and Promoting SDG 16

It is worth noting that digital piracy remains an ongoing concern, affecting governments and the copyright industry worldwide, including Malaysia (Tay, 2008). Research has shown that digital piracy and infringement of rights raise concerns surrounding the enforcement of legal measures for the protection of copyrights (Nasir et al., 2007). Scholars and experts, such as Lowry et al. (2017), Aversa (2019), Lapan (2009), and Tay (2008), unanimously express concerns about the threat of digital piracy to right holders globally.

The consequences of digital piracy are far-reaching (Charles, 2007). It seriously limits right holders' ability to profit and control the distribution of digital products, leading to severe losses for digital content producers, consumers, and society as a whole (Sadiku, 2021). Taking into account the significant losses incurred by the entertainment industry in Malaysia due to piracy, estimated at RM3 billion in 2021 (The Sun Daily, 2021), the implementation of SDG 16 can play a crucial role in mitigating losses brought by digital piracy. By addressing digital piracy through the lens of SDG 16, Malaysia can strengthen its legal and institutional frameworks, enhance enforcement efforts, and promote a culture of respect for intellectual property.

In Malaysia, section 13(1) of the Copyright Act 1987 provides authors and right holders an exclusive right over their copyrighted works. The exclusive right also can be referred to as the right to control where the author and owner of the copyrighted work are given the right on how their work may be reproduced in any material form, communicated, performed, showed, played, distributed, and rented to the public. With the exclusive rights to control given, authors and right holders are given the rights on how to deal with or commercialize their copyright works including assigning, licensing, and disposing of their copyright to anyone in the world. The author and right holders of the work may enforce exclusive rights and moral rights given under the law by requiring that any person who wants to use the work is subject to obtaining prior authorization or payment for such use. Failing to obtain authorization of use from the author of the work may result in an infringement of copyright.

However, despite the legal provisions in place to protect and enforce the rights of authors and right holders in Malaysia, there are various conducts that may infringe upon these exclusive rights and contribute to digital piracy. To critically addressing digital piracy in Malaysia and promoting SDG 16, it is important to examine the prevalent conducts related to digital piracy as follows:

3.2.1 Copying of the work

Section 3 of the Copyright Act 1987 defines the word 'copy' as a reproduction of a work in various form namely (i) written form (ii) the form of a recording or film, or (iii) any other material form. The act also defines the word 'reproduction' as the making of one or more copies of a work in any material form or version. The word 'material form' was also being defined to mean any storage form whether such form is visible or non-visible which capable of being reproduced. Broadly, the act of copying provided under the act may synonymously mean reproducing where such conducts require a person to reproduce a copy of the work into any other forms subject to right holders permission.

In the context of digital piracy, the act of unauthorized copying or reproducing copyrighted works is commonly referred to as 'downloading'. While the act itself does not explicitly define 'downloading', it can be inferred from the definition of reproduction that downloading is considered as one of the activities involved in obtaining a copy of a work in a different material form, particularly in digital formats. The act of downloading may be considered a form of reproduction apart from copying, as it involves reproducing a copy of the content and making it available in a digital format to be downloaded. While the broader term of reproduction encompasses a wide range of activities including copying and downloading, the term 'download' may specifically refer to a certain method of obtaining digital content via copying which has been made available in internet or digital space. To illustrate further, the court in the case of *Readsoft Aktiebolag & Anor v Petraware Solutions Sdn Bhd & Anor [2013] MLJU 1606* recognize the concept of copying as one of the conducts that infringe right holders exclusive rights (reproduction rights) under section 13(1) of Copyright Act 1987. In this case, it was ruled that the defendant was liable for copyright infringement, i.e., digital piracy by way of copying, downloading, and reproducing a substantial part of the plaintiff's user interface, system flows, and terms from the plaintiff's original software protected by Section 13(1) of the Copyright Act 1987.

3.2.2 Making available of the work

Article 6 of WIPO Copyright Treaty of (WCT) of 1996 specifically grants an author the exclusive right to authorize the making available of their original and copies of their works to the public through sale or other transfer of ownership. Records of the Diplomatic Conference ("RDC 1996") leading to the WCT 1996 further explain the notion of 'making available' to include:

> "The relevant act is the making available of the work by providing access to it. What counts is the initial act of making the work available, not the mere provision of server space, communication connections, or facilities for the carriage and routing of signals. It is irrelevant whether copies are made available for the user or whether the work is simply made perceptible to, and thus usable by, the user"

The records attempted to clarify 'making available' as 'providing access to a copyrighted work. By providing access to the work, the reading of RDC 1996 suggests that an individual who provides access via a hyperlink for example undertakes to share and make available the work to the public with or without right holders consent. In Malaysia, the closest definition of making available has been clarified under the notion of 'communication to the public' envisage under section 3 of the Copyright Act 1987 and section 13(1) of Copyright Act 1987 to mean as:

> a transmission of a work or performance through wire or wireless means including the making available of a work or performance to the public in such a way that members of the public may access the work or performance from a place and at a time individually chosen by them.

Here, (Khaw, L.T, 2017) argued that the communication to the public rights is referring to the transmission of the work and not to the copies of the work. In other words, communication to the public rights, instead of focusing on the doings or conducts of disseminating the physical work, it emphasizes on the transmission and accessibility of the work itself. In the context of digital piracy, any person who transmits copyrighted works via the internet without obtaining prior authorization is considered to perform two different conducts in infringing rights holders exclusive rights namely (i) the conduct of illegally making available of the copyrighted work and (ii) the conduct of illegally transmitting the

copyrighted work. Anyone who shares, makes available or transmits the copyrighted work without consent would thus be caught infringing 'communication to the public under section 13(2) of Copyright Act 1987 and such conducts may constitute digital piracy acts.

The distribution right and reproduction rights however under section 13(1)(a) and section 13(1)(e) of Copyright Act 1987 also correspond to the Article 6 of WCT. Although the act does not mention specifically whether distribution rights and reproduction rights include the making available rights, it may be implied that it covers aspects of it. For example, if individuals provide access to a work using hyperlinks, and share those links to the public, such doings or conduct may be caught infringing right holders exclusive rights of reproduction, communication to the public and distribution rights. An example of above discussion was best illustrated in the case involving *Microsoft Corporation v Act Integrated System Sdn Bhd [2013] 2 MLJ 735, CA* pertaining to infringement of section 13(1) of Copyright Act 1987 of right holders where the court emphasize on the importance of 'conducts' that caused harm to right holders exclusive rights in digital environment. In that case, the plantiff claim that the defendant infringing its copyright by 'reproducing and marketing' pirated copies of its computer programmes (illegal software preload in computers) without its permission or license. The court ruled that in order for plaintiff to establish a copyright infringement claim, there plaintiff shall proof that there is a 'reproduction' of pirated copies of the software and such conduct harming plaintiff exclusive rights. In this case, the court of appeal finds that the selling of computers preloaded with illegal software harming right holders exclusive rights. What is more important in this case is that the court requires no knowledge to prove there is infringement towards right holders exclusive rights. As long as there is a conduct which harms the right holders exclusive rights, any person would thus may be liable for copyright infringement and digital piracy.

3.2.3 Making a derivative out of original work

Right holders have the exclusive rights under the Copyright Act 1987 to prevent unauthorized reproduction of its copyrighted work enshrined under section 13(1)(a) of Copyright Act 1987. Such right include the right to control, authorize and prohibit any translation, adaptations, arrangements and other transformation out of right holders original work without consent. In Malaysia, section 3 of the Copyright Act 1987 further clarify the general meaning of adaptation involving the acts of converting an original work to a different 'version' of the work such as the conversion of original literary work or artistic work into a film. Although the term derivative and adaptation are related concepts, both right however carry different roles and functions. The word 'derivative' under Section 7 of Copyright Act 1987 encompasses a broader concept that includes not only adaptations but also translations, arrangements and other transformation of copyrighted works build upon existing copyright material. While adaptation is the specific type of derivative work that involves converting or transforming a work from one medium to another medium primarily while preserving the essential components or nature of the original work. In digital context, making an adaptation of the work involves converting, modifying or transforming the original work into a different form including digital formats may constitute digital piracy. In digital context, the concept of adaptation of rights comes into play when individuals create a derivative work that transforms or adapts existing copyrighted material to a new work. In Malaysia, adaptation of right holders exclusive rights is subject to permission and licensed under section 13(1) of the Copyright Act 1987. For example, if an individual makes a short clip based on various clippings of the movies, prior permission shall be obtained from right holders incorporating the story or elements of the original work of film into the clips. Failure to obtain permission for adaptation of work into a new work thus may constitute digital piracy.

In the case of Mohd Syamsul bin Md Yusof & Ors v Elias bin Idris [2019] 4 MLJ 788, the court provided an explanation regarding the proof of reproduction (adaptation) of the plaintiff's novel, Aku Bohsia, into a film titled Bohsia Jangan pilih Jalan Hitam, created by the defendant. The court stated that establishing reproduction (adaptation) depends on the specific facts and circumstances of the case. In this particular case, the court concluded that the ideas and elements associated with the plaintiff's novel, such as Mat Rempit (motorcycle gangs) and Bohsia (young girls involved in risky behaviors), are common and general concepts within Malaysian society. Therefore, the court determined that there was no substantial

similarity between the plaintiff's novel and the defendant's film. When it comes to adaptations or derivative works, if the elements or concepts being copied are considered common or generic, they may not be considered substantial or original enough to warrant copyright protection. In such instances, the court may rule that there is no infringement because the similarities between the works are based on commonly used concepts or elements that are not exclusive to the original work. Therefore, it is suggested that any unauthorized adaptation of a work by an individual may be considered a form of digital piracy. However, in cases where the elements or concepts being copied are deemed common or generic, the court may not find substantial similarity, and thus, infringement may not be established.

3.2.4 Transmitting the content of the work

In the digital environment, the act of transmitting the content of a work without obtaining prior permission from the right holders can potentially infringe right holders exclusive rights as specified in section 13(1)(aa) of the Copyright Act 1987. The previously discussed notion of "communication to the public" are concerned to the transmission of right holders copyrighted works. To put it simply, it involves the dissemination of the work through wired or wireless means without acquiring the necessary permission from the right holders. This encompasses activities such as (i) facilitating the means of transmission and (ii) making the work or performance accessible to the general public at large at the time and place individual chosen by them that may infringe right holders exclusive is such action is done without due authorization.

In the recent Malaysian case of *The Football Association Premier League Ltd & Anor v Bar Theory Sdn Bhd & Ors [2023] 9 MLJ 16*, the defendant has been sued for showing, playing, screening, streaming (making available) of copyright content in its restaurant premises. In this case, the court pursuaded to apply the definition of communication to the public as enshrined Article 3(1) of EU InfoSoc Copyright Directive 2001 and section 20(1) of United Kingdom Copyright, Designs and Patents Act 1988 where by making available of copyrighted content in defendant set-top box (illicit streaming device) to other patrons (new audience) has infringed both communication to public right and performing, playing rights under section 13(1) of Copyright Act 1987 owned by plaintiff. Thus, the transmission of right holders work digitally without permission to a wider audience may contribute to digital piracy.

3.3 Mitigating Digital Piracy: Leveraging Copyright (Amendment) Act 2022 in Protecting Right Holders' Exclusive Rights and Supporting the SDG 16

The Copyright (Amendment) Act 2022 in Malaysia aims to enhance copyright protection and enforcement measures in order to mitigate digital piracy and support Sustainable Development Goal 16, which focuses on promoting peaceful and inclusive societies, providing access to justice, and building effective institutions. In enforcing the exclusive rights of the author and owner of copyright in combating digital piracy, the Copyright Act 1987 has provided various enforcement mechanisms throughout the act since 2012 by introducing an anti-digital-piracy mechanism that includes an anti-camcording provision (“ACP”), technological protection measures (“TPM”), rights management information (“RMI”), and introduction of limitation of liabilities of service providers (also known as Safe Harbor Provision) (“SHP”). The Copyright Act 1987 was later amended through Copyright (Amendment) 2022 and enforced on 18th March 2022. One of the primary objectives of the newly enacted Copyright (Amendment) Act 2022 may be seen in the Dewan Rakyat Hansard dated 15 December 2021 where the honourable former Minister of Domestic Trade and Consumer Affairs (known as Ministry of Domestic Trade and Cost of Living), Dato’ Sri Alexander Nanta Linggi clearly stated that:

> “…the act (copyright act) has been amended to strengthen provisions relates to copyright in evolving digital environment which introduce various copyright offences to include illegal streaming and illegal access sharing in digital sphere”.

The Director General whilst commenting on the new Copyright (Amendment) Act 2022 (The EdgeMarkets, 2022) further reiterates on digital piracy concerns where:

> "…digital piracy has become increasingly rampant over the years. With the strengthening of the enforcement of copyright laws, particularly in the digital sphere, we hope this will curb digital piracy and raise awareness amongst users to choose the appropriate medium so as to avoid any infringement."

It is noted that the new Copyright (Amendment) Act 2022 was enacted to protect primarily the right holders exclusive rights against digital piracy. Hence, this article will highlight and discuss important and amendments in the new Copyright (Amendment) Act 2022 with regards to combating digital piracy in Malaysia to support SDG Goal 16 as a whole.

3.4 SDG 16.4 Reducing illicit financial and arms flows, strengthen the recovery and return stolen asses and combat all forms or organized crime

3.4.1 Introduction of personal liability for an offence relating to streaming technology

The introduction of personal liability for offenses relating to streaming technology is a measure aimed at reducing illicit financial flows and combatting organized crime, as well as strengthening the recovery and return of stolen assets. This provision recognizes the significant impact of digital piracy and illegal streaming on right holders and their ability to monetize and control the distribution of their copyrighted content.

The new act, through section 43AA of Copyright Act 1987 explicitly acknowledges streaming technology as a platform that facilitates copyright infringement. It criminalizes various activities related to streaming technology, including manufacturing, importing, hiring, offering, advertising, possessing, or distributing any service that enables copyright infringement. This provision applies to not only the manufacturers of illicit streaming devices but also individuals and entities involved in advertising or offering streaming technology through e-commerce, social and content sharing platforms, broadcasters, and online advertisers.

By defining streaming technology broadly, the legislation covers a range of software and hardware components that facilitate unauthorized access to copyright content. This includes computer programs, software applications, android packages (APKs), and hardware devices such as illicit streaming device or known as ("ISD") or Android Boxes that allows unauthorized access to copyright content via its devices. The provision holds directors or authorized persons of corporate bodies personally liable if the body corporate is involved in the commission of the copyright offense. These individuals may be held accountable for assisting in the offense unless they can prove that the offense was committed without their consent and that they took all necessary precautions to prevent it.

By introducing personal liability for offenses related to streaming technology, the legislation aims to deter individuals and entities from engaging in copyright infringement and facilitating illicit streaming. This can help reduce the flow of illicit financial transactions associated with copyright infringement and organized crime. Furthermore, strengthening the recovery and return of stolen assets becomes more feasible when the individuals responsible for facilitating the offenses can be held personally liable and brought to justice.

3.4.2 Sharing infringing copies online

Illicit financial flows and organized crime often participate in digital piracy activities and thrive through the illegal distribution of copyrighted content by way of digitization of the work (Irina, A., 2019) and sharing infringing copies online. The ease of digitization and distribution allows infringers to reproduce copyright content leading to widespread piracy and the loss of potential revenue for right holders (Sadiku, 2021). The infringers might make available the digitized content via hyperlinks on digital and social media platforms for free streaming, downloading, and unlimited sharing online. To overcome this problem, the Copyright (Amendment) Act 2022 makes the act of sharing infringing copies online an offence for any person who provides or shares the online location of any works or copies of works to any

other person without authorization of right holders via Section 41(1)(k) of Copyright Act 1987. By making it an offense, the legislation aims to disrupt the illicit distribution of copyrighted works and deter individuals from engaging in this form of copyright infringement. This contributes to the broader objective of reducing illicit financial flows, as the unauthorized distribution of copyrighted works often generates revenue for organized crime networks and individuals involved in digital piracy. Under the provision, individuals found guilty of providing or sharing infringing access to online location may face significant greater criminal penalties. These penalties can include a fine not exceeding RM250,000 and imprisonment for a term not exceeding 5 years, or both. By imposing such penalties, the legislation aims to deter individuals from engaging in the unauthorized distribution of copyrighted works and facilitate the recovery of the revenue and return of stolen copyrighted assets.

3.4.3 Expansion of criminal liability for obstruction of search

The new Copyright (Amendment) Act 2022 has expanded the scope of criminal liability for obstruction to search under section 48(f) of Copyright Act 1987 in order to cater for any person who:

> "…knowing or having reason to believe that an offence has been committed, causes any evidence of the commission of that offence to disappear with the intention of screening the offender from legal punishment, or with the knowledge that he is likely thereby to screen the offender from legal punishment, or with that intention or knowledge gives any information in respect of the offence which he knows or believes to be false".

Section 48(f) was enacted based on section 201 of Malaysia Penal Code ("PC") (Act 574) where the provision comprises two aspects which is to criminalize (i) any person who causes the disappearance or concealing of evidence and (ii) any person who gives false information with the intention of screening the offender from legal consequences. In the context of digital piracy, the provision seeks to punish an accomplice "B" who knowingly "A" has manufactured ISD devices preloaded with an illegal software application that makes it easy to conceal, erase, or give false information about the illegal software application upon search by enforcement authorities in order to protect A from prosecution. With the new provision introduced, the provision thus would make B also liable as an accomplice to A.

The expansion of criminal liability for obstruction of search under the Copyright (Amendment) Act 2022 aims to hinders the operations of organized crime in the digital sphere. It sends a strong message that obstructing the search for evidence and engaging in digital piracy activities will not be tolerated. By deterring individuals from participating in such illegal activities, the Act contributes to the overall efforts to combat organized crime, disrupt digital piracy illicit financial flows and recover stolen copyrighted assets in the digital environment.

3.5 SDG 16.3: Promote the rule of law at the national and international levels and ensure equal access to justice for all.

3.5.1 Conferment of new investigative power to enforcement authorities

The new powers granted to the Assistant Controller of copyright and other law enforcement agencies enable more expedient action against individuals who facilitate copyright offenses and conduct effective investigations under the act. By promoting the rule of law, these powers strengthen the enforcement of copyright laws ensuring that digital piracy is addressed effectively.

3.5.2 The power to search and seize any infringing copies of works that are prohibited in Malaysia

New subsection 39(6) of Copyright (Amendment) Act 2022 empowered any enforcement officers that may include Assistant Controller, police officers not below the rank of inspector or any custom officers to search and seize any infringing copies which are prohibited from being imported into Malaysia with or

without an application made under subsection 39(1) of the Act. Generally, the reading of subsection 39(6) implies power is now given without the right holders having to apply for it.

3.5.3 The power to direct a right holders or any authorized person to make a test purchase for the purpose of determining compliance with the act

The Assistant Controller under the new act is now given power via section 51B to direct the owner of the copyright or any other person authorized to act on behalf of the owner of the copyright to make test purchases of any goods as may expedient for the purpose of determining the compliance with Act. The provision was enacted based on section 52 of the Trade Description Act 2011 when the general reading of section 51B itself implies that a right holders may 'test' purchase any device or components used in part or whole that facilitate copyright infringement in order for enforcement authorities to determine if any individuals are infringing the right holders's work and would take legal action against alleged infringers.

3.5.4 Power to compel disclosure of information

The Assistant Controller is also given a new power under section 52B to require the provision of information from any person that (i) has any information or document or (ii) is capable of giving any evidence upon required and performance of its functions under the act. This provision was enacted based on section 113 of Trademarks Act 2019 (Act 815) ("TM Act 2019) where the power given to the Assistant Controller is compelling in nature. The provision under section 51B of Copyright Act 1987 requires that if the Assistant Controller has any reason to believe that the person has relevant information or document or is capable of giving any evidence, such disclosure is obligatory. Failure or refusal to provide such information or document as requested is subject to a criminal offence under the act.

Section 52B of Copyright Act 1987 further state the procedures on how such disclosure of the information is made with or without written notice issued to any person. Such notice, for example, may specify to the best knowledge and belief of that person, documents or any information relating to the identity of the person may be found. The reason behind introduction section 51B was meant to expand the powers of the Assistant Controller to compel disclosure of information as and when it is required by them. In relation to SDG16.3, empowering the Assistant Controller to compel the disclosure of information enables the effective enforcement of copyright laws, contributes to combating copyright infringement, and strengthens the overall rule of law in the context of intellectual property rights protection as a whole.

3.5.5 Further clarification on compoundable offence

The newly revised version of section 41A of Copyright Act 19871987 which follow suit section 63 of the Trade Description Act 2011 ("TDA 2011") has given the Controller, Deputy Controller, or any person authorized in writing by the Controller the power to compound any offence under the act at any time before prosecution is instituted. The provision has revised the section by specifying the amount of compound which shall not exceeding fifty percent (50%) of the amount maximum fine of the offence which he liable to if he had been convicted to the offence. Here, once the enforcement authorities decided an offense has been compounded, no prosecution shall be made against the person whom the offer of the compound was made.

Any article, vehicle, book, document, copy, or contrivance that has been seized in connection with the offence is at the discretion of the enforcement authorities whether to forfeit or return to the person as they think fit. The provision also stated the procedures on failure to pay such compound within time-frame or such extended date granted through written offer issued by Controllers. If the issued compound was not paid during the time frame provided or such grant of extension has been given in writing, the enforcement authorities may institute prosecution after the lapse of such time. The general reading of section 41A of Copyright Act 1987, in brief, gives flexibility to enforcement authorities to offer infringers to pay compound in order for them to avoid prosecution by a written offer to settle the case in order for them to avoid prosecution. By offering infringers the option to pay a compound and settle the case without

prosecution, it provides flexibility to the enforcement authorities while still holding the offenders accountable for their actions. This approach can contribute to more efficient resolution of copyright infringement cases and promote a fair and accessible justice system in the context of intellectual property rights protection within SDG context.

4. Challenges Ahead

The coming into force of the new Copyright (Amendment) Act 2022 in Malaysia is a significant step toward strengthening copyright enforcement provisions in the country. This comprehensive legislation addresses key issues such as streaming technology, sharing infringing copies online, expanding criminal liability for obstruction of search, and granting new investigative powers to enforcement authorities. By combatting digital piracy and protecting the exclusive rights of copyright owners, these amendments contribute directly to Sustainable Development Goal 16 (SDG16) which aims to promote a just and inclusive society.

Nevertheless, there are a few issues that need to be observed by the Intellectual Property Corporation of Malaysia (MyIPO) and Ministry of Domestic Trade and Cost of Living (MDT) in order to ensure copyright law can be implemented effectively in Malaysia. The issues are as follows:

4.1 Issues relating to contributory liability

The absence of specific provisions addressing contributory liability in the new Copyright (Amendment) Act 2022 presents a challenge in relation to SDG16. The lack of a complementary regime, particularly under section 43AA, hinders the ability to hold landlords liable for contributing to copyright infringement by leasing commercial properties to tenants engaged in activities that facilitate infringement of copyright through streaming technology services.

The absence of specific contributory liability provisions in the Copyright Act 1987 also poses challenges in effectively addressing the involvement of second-tier or indirect infringers who collaborate with primary infringers to facilitate copyright infringement in digital piracy activities.Without clear provisions that establish the liability of these secondary infringers, it becomes difficult to effectively enforce copyright laws and hold all parties accountable for their involvement in infringement and provide access to justice for right holders.

4.2 Issues relating to consumers and copyright end users

In light of the growing advancement of technologies and the internet online, the role of consumers and copyright end users has become increasingly significant in the utilization of copyrighted works in the digital environment. However, this evolution has also given rise to challenges in ensuring a fair and balanced copyright ecosystem that aligns with Sustainable Development Goal (SDG) principles.

The dematerialization and digitization of copyrighted content have enabled a new generation of users to access and consume such works without necessarily considering intellectual property terms or compensating right holders (Dorothy et al, 1999). This phenomenon has led to concerns regarding digital piracy and the need for stricter measures within the Copyright Act 1987 to address consumer and end-user behaviours that contribute to copyright infringement. The regulation of consumer and end-user activities through the Copyright Act 1987 is crucial for controlling and limiting actions that can be deemed as digital piracy. It also serves as a guideline to educate consumers and end-users on what constitutes fair usage of copyrighted content and the boundaries of right holders' exclusive rights. However, it is important to note that the current exceptions and limitations provisions, as stated under section 13(2) of the Copyright Act 1987 lack a clear and specific regime leaving consumers and end-users uncertain about what actions are permissible.

To align with SDG principles, it is essential to strike a balance between protecting the rights of copyright holders and promoting access to knowledge and cultural expression. Clear and well-defined exceptions

and limitations within the Copyright Act would ensure that consumers and end-users have clarity on their rights and responsibilities, fostering a fair and inclusive copyright environment that supports both creativity and the dissemination of knowledge against digital piracy.

By addressing these concerns and establishing a robust regulatory framework, Malaysia can further promote SDG objectives such as SDG 4 (Quality Education) and SDG 9 (Industry, Innovation, and Infrastructure), SDG12 (Responsible Production and Consumption) by nurturing an environment that respects intellectual property rights while fostering innovation, creativity, and the sharing of knowledge for the benefit of society as a whole.

4.3 Issues relating to the enforcement of copyright in a borderless environment

In the digital world, copyrighted goods can be easily disseminated and shared, providing users with convenience and access to a wide range of content. However, the global nature of cross-border sharing of copyrighted material has highlighted the inadequacy of existing copyright laws in Malaysia to address this worldwide concern effectively. One particular challenge arises when trying to apprehend copyright infringers located outside the country's borders.

Manufacturers of illicit streaming devices may be operating within national borders, but individuals who offer or provide digital services related to streaming technology could be situated outside Malaysia. Enforcing the rights of copyright holders becomes difficult for enforcement agencies when trying to track down and address infringers located in other countries. This raises the need for uniformity with international laws and voluntary mechanisms that facilitate the enforcement of copyright across territorial borders. To protect the exclusive rights of copyright owners, it is crucial to align with international laws and establish mechanisms that foster cooperation between countries in combating cross-border copyright infringement aligned with SDG goal 16.A which is to 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.

(iv) Improvements to section 41(1)(k) and section 43AA of the Copyright Act 1987

Section 41(1)(k) of the Copyright Act 1987 lacking a clarification on the method of providing or sharing access to an online location that constitutes copyright infringements. The provision left the word ‘access’ unexplained leaving it open to interpretation. It would be advantageous if regulators would illustrate a scenario on the list of activities including but not limited to hyperlinks that would make it illegal for a person to provide and share to another person without permission such as providing hyperlink or means of illegal access to copyrighted content. It is also suggested that the provision shall follow suit Section 99 of Singapore Copyright Act 2021 (“SCP 2021) by defining ‘online location’ to mean online location that is ‘flagrantly’ used to commit or facilitate copyright infringements by several determining factors stated by SCP 2021.

It is also proposed that section 43AA of the Copyright Act 1987 definition of ‘streaming technology’ would not confine to only programs, devices or components used to facilitate copyright infringement but also include illegal subscription services that are capable of persuading consumers and end-users to stream or download illegal contents from its services that also being recognized under section 150(2) of SCP 2021. The clarity in the definition of copyright infringement activities related to ‘online locations’ and ‘streaming technology’ would help establish a fair and inclusive society by effectively combating copyright infringement in the digital environment. The improvements to the current provision will eventually support another goal such SDG 4 (Quality Education) and SDG 9 (Industry, Innovation, and Infrastructure) by promoting awareness and understanding of copyright laws while fostering innovation and creativity in the digital landscape.

4.4 Roles of intermediaries and online platforms

The implementation of Part VIB, also known as the safe harbor provision, in the Copyright Act 1987 requires a rigorous review in Malaysia. It is essential to modernize the role of intermediaries under this provision to ensure that they are not hosting or facilitating the distribution of copyright pirated content through their sites or services. Clearer liabilities for intermediaries need to be established to hold them accountable for digital piracy activities. One measure to combat digital piracy is seeking a website blocking injunction from the court under section 43C(2) of the Copyright Act 1987. However, the provision only requires ISPs to block access to copyrighted material and terminate specific infringer accounts, rather than removing the infringing content itself. This poses a challenge, as the content may be located on online platforms outside the ISPs' network services, making it nearly impossible to order its removal.

To address this issue, e-commerce platforms, social media platforms, and content service providers acting as online platforms should take proactive measures to self-regulate and promptly remove illicit content appearing on their services. The government can play a role by issuing strict comprehensive guidelines or regulations that direct online platforms to remove alleged illegitimate content swiftly. By promoting responsible behaviour among online platforms and ensuring effective enforcement against copyright infringement, Malaysia can contribute to Sustainable Development Goal (SDG) 16 by creating a balanced copyright ecosystem through updated intermediary liabilities and self-regulation of online platforms that would enable a fair and inclusive society that respects intellectual property rights in the digital environment.

5. Conclusion And Recommendation

The foregoing discussion explored the relationship between copyright protection, digital piracy, and sustainable development in the context of Malaysia's Copyright (Amendment) Act 2022. The enactment of this comprehensive legislation reflects Malaysia's commitment to addressing the challenges posed by digital piracy and aligning with the Sustainable Development Goals, particularly SDG 16: Peace, Justice, and Strong Institutions. The Copyright (Amendment) Act 2022 represents a significant step towards protecting intellectual property rights in the digital environment and advancing sustainable development goals by introduction of new offences aimed at tackling the latest trends of digital piracy on the internet and the conferment of new investigative powers to enforcement authorities to Assistant Controllers in MyIPO and MDT shall be applauded.

However, it is important to acknowledge that there are areas within the new legislation that require further attention and improvement. Issues such as contributory liability, the consumers and copyright end users, the enforcement challenges in a borderless digital environment and roles of intermediaries and online platforms need to be addressed in future amendments to the Copyright Act 1987. By recognizing and resolving these issues, Malaysia can enhance its copyright regime and better tackle digital piracy, thus promoting sustainable development.

In conclusion, the Copyright (Amendment) Act 2022 represents a major milestone towards protecting intellectual property rights in the digital environment and advancing sustainable development goals. By continuously evaluating and updating copyright laws to address emerging challenges, Malaysia can create an environment that fosters creativity, innovation, and economic growth while ensuring the rights of creators are upheld. It is through these efforts that Malaysia can contribute to building a more inclusive, just, and sustainable society for all.

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Towards A Healthy Generation: 'Modifying' or 'Selecting'Embryos Using Gene Therapy or Preimplantation GeneticDiagnosis

Haniwarda Yaakob[1,4], Tengku Noor Azira Tengku Zainuddin[2] and Mohd. Zamre Mohd. Zahir[3]

[1] Faculty of Law, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia
[2] Faculty of Law, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia
[3] Faculty of Law, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia
[4] hani75@ukm.edu.my

Abstract. Having children who are free from genetic diseases will benefit parents and be an asset to the nation. Healthy citizens may contribute towards the development of a nation in many ways. This is in line with Sustainable Development Goals (SDGs), particularly SDG3that aims to promote the well-being and health of citizens of all ages. The advancement in medicine and technology is, arguably, a useful tool that can be utilised in the pursuit of creatinga healthy society. This can be achieved by avoiding the birth of children with genetic diseases by using technologies such as gene therapy and preimplantation genetic diagnosis. Although the ways in which both technologies work differs, the result remains the same, that is, to ensure the birth of children who are free from genetic diseases. Both techniques, however, involve numerous legal and ethical concerns that should be scrutinised before. This is the main crux of this paper where the issues surrounding both technologies are carefully analysed. The aim of this analysis is to determine the appropriate legal framework that can be adopted in Malaysia on the use of these innovations as part of the effort to fulfil SDG3.

Keywords: Law; Bioethics; Gene Therapy; Preimplantation Genetic Diagnosis; Sustainable Development Goals; SDG3.

1. Introduction

The advancement in medical technologies, including in the area of assisted reproductive technology, brings tremendous benefits to individuals and society. Other than offering hope for infertile couples to conceive, assisted reproductive techniques have also pave the way towards producing children who are free from genetic diseases (Haniwarda 2019) [1]. This can be achieved by technologies such as gene therapy and preimplantation genetic diagnosis (PGD). Healthy children will benefit not just their parents, but will also be an asset to the society and nation. Healthy citizens may contribute towards the development of a nation in many ways. This is consistent with sustainable development goals (SDGs), particularly SDG3 that aims to promote the well-being and health of citizens of all ages (United Nations n.d.) [2]. For instance, under SDG3, the World Health Organisation targets to reduce neonatal mortalities and stop avoidable death of new-born babies and children under 5 years of age by the year 2030 (World Health Organisation n.d.) [3].

Assisted reproductive technologies such as gene therapy and PGD are, arguably, a tool that can be utilised in the pursuit of creating a healthy society by ensuring the birth of children who are free from genetic diseases. Nonetheless, both techniques have their own perils. While gene therapy works by 'modifying' embryos, PGD on the contrary, 'selects' the desired embryos. Although theways in which both techniques operate differ, they share some common legal and ethical concerns which are identified and analysed in this paper. The primary aim of this analysis is to determine the appropriate legal framework that can be adopted in Malaysia on the use of gene therapy and PGD as part of the effort to fulfil sustainable development goals (SDG3). First, however, the science of both techniques are briefly

presented. This is followed by a brief analysis of some of the issues surrounding both technologies, focusing on the Malaysian position. Finally, this paper concludes and suggests for the introduction of a suitable legal framework to regulate both techniques in Malaysia.

2. Literature Reviews

Numerous literatures have been found on the ethics of gene therapy and PGD from other jurisdictions. From the Malaysian perspective, several literatures have been written on the ethics and legality of both techniques. For example, Haniwarda (2018) [4] has identified the issues arising from PGD and concluded that the acceptability of PGD in Malaysia should be decided after careful consideration on the benefits and evidence of harm. Several empirical studies have also been conducted on the acceptability of PGD from religious (Olesen, Siti Nurani and Anisah 2016) [5] and public perspectives in Malaysia (Olesen. Siti Nurani and Anisah 2017) [6]. Articles on gene therapy from the Malaysian position have been written by Haniwarda (2016) [7], (2019) [1], Kalidasan and Theva Das (2021) [8] and Loh (2020) [9]. This paper, thus, contributes to the Malaysian literatures on these two technologies particularly by identifying the commons ethical concerns and investigating their potential use as one of ways to achieve SDG3.

3. Methodology

To achieve the objectives of this paper, legal doctrinal and qualitative methods of analysis are employed. Primary and secondary sources of legal and non-legal resources are analysed including statutes, case laws and other legal and medical literatures. The secondary materials referred to are textbooks, journals and non-journal articles, seminar papers, media reports and others. According to Othman (2014) [10], when writing the conceptual and theoretical parts in a research paper, reference must be made to relevant literatures. Lastly, this paper also adopts a comparative method where legal and non-legal materials from other jurisdictions such as the United Kingdom are discussed for comparison.

4. Results and Discussion

4.1. The Science

Gene therapy and PGD work at the embryonic level but not in the same ways. The former is used to modify the DNA of the embryos or cells while the latter merely selects the desired embryo without any alteration to its DNA or other features. In what follows, the science for both techniques is explained.

4.1.1. PGD

PGD can be considered as an alternative to other forms of pre-natal diagnosis such as Amniocentesis and Chorionic Villus Sampling (CVS). Amniocentesis and CVS can be morally problematic as they may result in the termination of pregnancy should the fetus be found to be affected with genetic diseases (Taylor 2008) [11]. To perform PGD, embryos are created *in vitro* where the sperm and ovumare fertilised a petri dish, commonly known as in vitro fertilisation (IVF). Embryos produced via IVF will then be allowed to develop to three to five days after fertilisation before being implanted into the woman's uterus (Medicine Plus n.d.) [12]. In PGD, the next step after fertilisation of embryos is the biopsy stage to screen for the existence of genetic disease or disorder in the embryos (Flinter 2001) [13]. Only healthy embryos that are found not to have any genetic abnormalities will be chosen for implantation into the woman's uterus. PGD, thus, reduces the risks of producing children who will be affected with genetic diseases or abnormalities (Genetic Alliance n.d.) [14].

4.1.2. Gene Therapy

Some diseases are genetic in nature. Gene therapy, thus, works to treat or avoid the disease by addressing the principal genetic problem (Medicine Plus National Library of Medicine 2022) [15]. Rather than using medicine or other medical treatments, gene therapy paves the way for treating diseases by modifying a person's genetic make-up (Medicine Plus National Library of Medicine 2022) [15]. Previously, gene therapy functions in two ways: first, by adding a new gene into cells to treat the disease; or secondly, by inserting a healthy copy of a gene to replace the defective gene that is causing

the disease (MedlinePlus National Library of Medicine 2022) [15]. For example, in the United Kingdom (UK), the first baby to have received gene therapy to cure a genetic disease called metachromatic leukodystrophy (MLD) was reported in February 2023 (Anon 2023) [16]. Gene therapy was used by removing the affected child's stem cells. The faulty gene that causes the disease are replaced and the treated cells are injected back into the patient's body (Anon 2023) [16].

Currently, a new method of gene therapy or also known as genome editing, has been introduced to replace the earlier methods. Genome editing can be achieved in three ways: first, by editing human zygote that results in the creation of genetically modified embryos; second, by altering the human germline cells that is the sperm or the oocyte; and third, by modifying the pluripotent stem cells which can be grown into gametes and fertilised later (Ranisch 2020) [17]. An example of genomeediting is the technique called CRISPR-Cas9 which has changed the approach of gene therapy. This method alters the existing DNA in the cell rather than introducing a new one (MedlinePlus National Library of Medicine 2022) [15]. In short, CRISPR-Cas9 is:

> "a unique technology that enables geneticists and medical researchers to edit parts of the genome by removing, adding or altering sections of the DNA sequence. It is currently the simplest, most versatile and precise method of genetic manipulation and is therefore causing a buzz in the science world." (Anon 2022) [18]

The use of CRISPR-CAS9 on germline cells such as the sperm, oocytes or early embryos, also called germline gene editing, raises ethical concerns that need to be scrutinised (Hammerstein, Eggel & Biller-Andorno 2019) [19]. As such, it is essential to discover whether adequate laws or guidelines have been put in place to regulate these technologies.

a. The Legal Position

Assisted reproductive technologies are largely unregulated in Malaysia where there is currently, no specific law governing the practice. Nonetheless, several guidelines have been formulated by the Malaysian Medical Council (MMC) and the Ministry of Health, Malaysia such as the MMC Guideline on Assisted Reproduction 003/2006 [20] and MMC Guideline on Medical Genetics and Genetic Services 010/2006 [21]. These Guidelines contains provisions concerning gene therapy and PGD. For example, section 14 of the MMC Guideline on Assisted Reproduction regulates the use of PGD by stating that:

> "At present, it is best that PGD be used for only severe and life-threatening genetic diseases. It would be unethical to analyse and select the inherited characteristics of embryos (e.g. intelligence, height, hair and eye colour); any social of psychological characteristics or any other condition which is not associated with disability or a serious medical condition."

However, the definition or scope of "severe and life-threatening genetic diseases" mentioned in section 14 is not elaborated in the Guideline or elsewhere. Similarly, what should be accepted as a "serious medical condition" that warrants the use of PGD is also left to interpretation. This situation is contrary to the legal position in the United Kingdom (UK) where a comprehensive piece of legislation namely, the Human Fertilisation and Embryology Act 1990 (amended 2008) [22] is enacted to govern assisted reproductive technologies in that country. On the use of PGD to screen for genetic diseases, section 1ZA of the HFEA 1990 (amended 2008) states, inter alia:

> "A license…cannot authorise the testing of an embryo, except for one or more of the following purposes-
>
> 1. establishing whether the embryo has a gene, chromosome or mitochondrial abnormality that may affect its capacity to result in a live birth,
>
> 2. in a case where there is a particular risk that the embryo may have any gene, chromosome or mitochondrion abnormality, establishing whether it has that abnormality or any other gene, chromosome or mitochondrion abnormality,
>
> 3. in a case where there is a particular risk that any resulting child will have or develop-
>
> 1. a gender-related serious physical or mental disability,
> 2. a gender-related serious illness, or
>
> 3. any other gender-related serious medical condition, establishing the sex of the embryo, …"

Malaysian laws are also silent on the potential introduction of gene therapy although its breakthrough is anticipated (Zakri 2018) [23]. This is reflected in section 19 of the Malaysian Medical Council Guideline on Medical Genetics and Genetic Services 010/2006 [21] that recognises that: "Issues likely to present health professionals with ethical dilemmas are gene therapy and cloning."

Later in 2009, the Medical Development Division of the Ministry of Health of Malaysia has issued Guidelines for Stem Cell Research and Therapy (2009) [24] which also acknowledge the potential use of gene therapy. Section 2(e) of Guideline for Stem Cell Therapy acknowledges that:

> "Gene therapy to correct genetic disorder e.g. subacute combined immune deficiency disorders (SCID) and thalassaemia is still in developmental phase. The use of lentiviral shall be carried out in a P3 laboratory."

By comparison, in the UK, the use of gene therapy on reproductive cells or also known as germline gene therapy is prohibited (Parliamentary Office of Science and Technology 2005) [25]. According to section 19(1) of the Medicines for Human Use (Clinical Trials) Regulations 2004 [26], clinical trials for medicinal products for gene therapy is allowed "(a) medicinal products for gene therapy and somatic cell therapy, including xenogenic cell therapy;" However, genome editing is currently prohibited in the UK and in most countries around the world (McKie 2023) [27].

The lacuna in the Malaysian law on the acceptability of gene therapy and PGD requires consideration of the ethical issues that these technologies bring. In what follows, some of the common concerns on both techniques are analysed.

b. The Concerns

Although the methods in which both technologies work differ, they share several common ethical concerns. In this paper, two main ethical issues are chosen for analysis namely, the potential harm to the embryos and the child born (through the creation of a 'designer baby').

i. Potential Harm on the Embryos

One of the critics advanced against embryonic testing using PGD is the potential destruction of embryos. To use PGD, multiple embryos are created *in vitro* which are then screened to detect the presence of unwanted traits such as genetic disorders or chromosomal abnormalities or even the sex of the embryos. Embryos found to have these undesired characteristics will have to be discarded or left toperish (Chung 1999) [28]. Hence, critics argue that PGD should not be allowed on the grounds of protecting the embryos (Robertson 2003) [29]. On the other hand, germline gene editing or gene therapy has been hailed as a more acceptable process as the method allows for the modification of

affected embryos which can then be implanted into the uterus. In other words, "By allowing a direct fix, embryos could be transferred that otherwise would have been discarded" (Ranisch 2020: 65) [17]. There is a technical obstacle, however, in performing gene editing. Gene editing needs to be performed as early as with fertilisation or after fertilisation and before the first cell division (Winblad and Lanner 2017) [30]. PGD cannot be performed at this early stage and consequently, all embryos produced will have to undergo gene editing. Consequently:

> "…when not all embryos are affected, one either has to neglect embryo testing and apply GGE 'blindly' at an early stage, thereby risking harming some otherwise suitable non-mutant embryos, or applying GGE later after mutant embryos wereidentified and thereby accepting a loss in efficacy owing to an increased risk of mosaicism. Both options create additional risks of embryos being damaged." (Ranisch, 2020, p. 66) [17].

The objections on discarding embryos in PGD and genome editing on embryos is grounded on the moral and legal status of embryos. While it is accepted that there is no consensus on the moral status of embryos, the legal position in Malaysia needs to be ascertained. The law in Malaysia does not expressly protect *in vitro* embryos as evident in Chin Yoke Teng v William Ui Ye Mein *[2005] 2 MLJ 480* [31]. In this case, the High Court states at page 483 that:

> "And as far as I know 'human being' means a living human, and has never been interpreted to include the unborn child. Thus when our constitution and our laws (of course, these include the Interpretation Acts) speaks of a 'person' (and conferring on the 'person' the various rights, duties and obligations), to my mind, they mean (again putting aside artificial persons) an existing natural persons, an existing human being, and not a yet to be born child being, that is to say, a human foetus in conception."

If the law does not accord legal personality to an unborn child inside the uterus, the same implication can be imposed on *in vitro* embryos which are not even implanted into the uterus. However, there are several available guidelines that safeguard the moral status of embryos as seen in the Malaysian Medical Council (MMC) Guideline on Assisted Reproduction 003/2006 [20]. Section 3 of which provides:

> "As there is no worldwide agreement as to when human life begins or when itacquires moral significance, there is no agreement on the moral status of an embryo. Nor there is any agreement as to whether discarding an embryo with a genetic disorder, prior to implantation, is the equivalent of an abortion. At present, it is best that PGD be used for only severe and life-threatening genetic diseases." (section 14)

Section 15 of the said Guideline, further, provides protection on in vitro embryos by prohibiting research on embryos after 14 days from conception:

> "Under no circumstances shall research be carried out on or using human embryos which are more than *14 days old from the date of conception or the appearance of the *primitive streak, whichever is the earlier, except with the explicit approval of the authorizing authority, which is at present the Ministry of Health."

In summary, both PGD and gene therapy research involves the creation and possible destruction of embryos which requires further analysis due to the moral worth of the embryos. Even if the intervention on embryos can be justified, another issue has emerged on the potential effects of both technologies on the child born.

ii. Potential Harm to The Child Born: The 'Designer-Baby'

Genetic selection of children such as using PGD has been condemned for the fear of the creation of a 'designer baby.' King (1999, p. 181) [32], for example, laments that uncontrolled practice of PGD will lead the slippery slope towards the creation of 'designer babies.'. He contends that:

> "There is likely to be a tendency for parents to select offspring which conform best to social norms, with regards to health and physical ability, appearance and aptitudes…It is also possible to imagine selection on grounds of IQ, skin colour, physical build and facial features etc. It does not seem desirable to allow such forces to operate at the level of selection of who is permitted to be born. Rather, we should combat the social forces which lead us to disvalue some individuals and idealise others…"

Children should not be viewed as a commodity but instead should be received 'unconditionally' as a gift from God to all parents (Stankovic 2005) [33]. The President's Council on Bioethics (2003, p. 759) [34] expresses the view that:

> "Children are not made but begotten. By this we mean that children are the issue of our love, not the product of our wills. A man and a woman do not produce or choose a particular child, as they might buy a particular brand of soap; rather they stand in relation to their child as recipients of gifts."

In addition, King (2003) [35] further argues that:

> "By choosing the characteristics of our children, we turn reproduction into just another consumer experience and this degrades its profound existential significance. Because babies are human beings, not things, it is critical that much is left to chancein their process of coming into being. The act of choosing tends to turn them into just another human-designed consumer object. When we choose or design our children, the relationship becomes one of designer and object, where the latter is inevitably in a subordinate position."

Nonetheless, Robertson (1996) [36] argues that preconception selection of offspring need not necessarily pose a threat of harm to the child born as parents will often select for a positive traits or health of their child. This selection will result in the birth of a "healthier and happier child" who will have a promising future in life than children born with the undesired traits that parents have chosen against. This argument rings true in the case of PGD to select for embryos free from genetic diseases where healthy embryos are selected over those found to be affected with genetic diseases. Thus, only a healthy child is born and no other than that particularly since PGD only allows for the selection of embryos. Embryos cannot be 'modified' using PGD and therefore, it is difficult to defend the claim that PGD turns reproduction and parenthood into 'a consumer-product relationship.' More importantly, technical limitations of PGD makes it impossible for engineer traits in an embryo, thus rendering the making of a 'designer baby' "a myth rather than reality" (Haniwarda 2012, p. 4) [37]. PGD is a screening technique that allows for the detection of the embryo's sex, chromosomal abnormalities, and susceptibility to genetic diseases only (Genetic and IVF Institute, n.d.) [38]. The embryos produced will have the genes from both parents and therefore, according to the President's Council on Bioethics (2004, p. 95) [39]:

> "[O]ne cannot select for genes that are not brought to the embryos by their genetic progenitors; efforts at positive selection will be limited. Thus, the capacity to use PGD

> to select for "superior genotype"- a "designer baby"- is in our estimation not on the horizon."

The concern on potential modification of children is, however, more plausible as gene therapy is on the horizon. As explained earlier, the advent of CRISPR-Cas9 genome editing technique has now paved the way for the modification of DNA in an embryo. Robertson (1996) [36] maintains his stance on the acceptability of therapeutic and non-therapeutic genetic enhancement using gene therapy. According to Robertson (1996) [36], the aim of therapeutic germline gene therapy is to cure diseases and produce a healthy child. As such, if the technique can be proven to be safe and reliable, it cannot be opposed on the grounds of harm to the child as it allows the birth of a healthy child who would not otherwise be born or would be born with aserious disease. A similar argument is advanced for non-therapeutic genetic enhancement where he argues that:

> "Nontherapeutic genetic enhancement also aims to benefit the chid by strengthening and reinforcing its positive characteristics. The aim is to better equip the child for life's perilous journey, and thus to assure that it will be happy and successful." (Robertson, 1996, p. 465) [36]

Although Robertson acknowledges the possibility that parents may use germline therapy to design children with their preferred attributes, he still believes that parents would do so for the benefit and well-being of their children. After all, "The fact that the child would have been just fine without the enhancement does not show that it will be harmed by this extra effort, any more than it would be harmed by extra tutoring or orthodontia" (Robertson, 1996, p. 465) [36]. In addition, parents have been known to make all sort of decisions on the future of their children. As Green (2007, p. 133) [40] rightly stipulates, "Although parents should respect their children's future freedom, they also have the right to shape their children in directions influenced by the parents' own dreams. Parents are both guardian and gardeners." As Nurul Hidayat, Mohd. Zamre and Nabel Mahdi (2023) [41] argue, children are always perceived as vulnerable due to their physical, mental, and emotional development. Thus, they need to be assisted and nurtured by their parents (Nurul Hidayat, Mohd. Zamre and Nabel Mahdi 2023) [41].

Moreover, parental legal rights to make medical decisions for their children has been long established. In most jurisdictions including Malaysia, consent for medical treatment for children below the age of 18 years is vested with the parents or legal guardian (Tengku Noor Azira, Anita & Mohamad Afiq 2013) [42]. Section 2(a) of the Malaysian Child Act 2001 [43] defines a child as a person below the age of 18. Accordingly, the Malaysian Medical Council Guideline on Consent for Treatment of Patients by Registered Medical Practitioner (n.d.) [44] stipulates that children below the age of 18 does not generally have the capacity to consent and therefore, consent should be obtained from a parent or legal guardian (section 6). Parental legal rights to refuse medical treatment for their child has also been recognised by English common law as seen in Re R [1993] *2FLR 757* [45]. Here, the court acknowledged parental decision to refuse medical treatment if the child's condition is not life-threatening. According to Booth J at page 761:

> "(1) In any imminently life-threatening situation…she shall be given blood products without the consent of her parents'.
>
> (2) In any situation which is less than imminently life-threatening, those medically responsible for the child shall consult with the parents and will consider at every opportunity all alternative forms of management suggested by the parents."

Hence, as argued elsewhere, the supremacy of parental autonomy in deciding on matters concerning their children should only be limited when there is proof of harm such as a threat to the child's life. In other circumstances, parental autonomy should not be interfered with by the State (Haniwarda 2013) [46].

Nonetheless, germline genome editing invites further scrutiny on the issue of the lack of consent from future generations whose genes have been altered (National Human Genome Research Institute 2017) [47]. Any alterations to the genes by genome editing will possibly affect future generations who have not consented to such a treatment. Coller (2019) [48] rightly argues that these changes may be less problematic when used to prevent the transmission of serious diseases. But, as this technology advances, the possibility of it being used to boost human abilities or to introduce new DNA sequences cannot be dismissed. Thus, the need to pass law or ethical guidelines on genome editing cannot be undermined (Coller 2019) [48].

5. Conclusion

Technological advances in medicine are usually applauded for the benefits it confers on human beings. The use of medical technologies such as PGD and gene therapy is also suggested as a tool to fulfil SDGs especially SDG3 as these techniques aim to prevent the birth of a child with genetic diseases. It is conceded that both techniques offer huge benefits to humans particularly in ensuring the birth of children without genetic diseases. However, they also raise possible risks of harm to the embryos and the child born. While PGD is now available in this country, gene therapy is still underway. As such, it is timely for suitable laws and/or guidelines to be put in place in Malaysia in order to mitigate these risks as the legal position in the UK. The introduction of law and/or guidelines will serve as a protection to society by resolving the ethical conundrums that they are likely to face from the use of modern medical technologies such as gene therapy and PGD.

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Improvement Of Investment Law Development In IndonesiaBased On Article 22 Law Number 25 of 2007 Concerning Capital Investment and Omnibus Law

Marlina Widiyanti[1], Annalisa Yahanan[2], Febrian[3], Mada Apriandi [4]

[1] Marlinawidiyanti68@yahoo.co.id (Corresponding Author)
[2] Annalisa_yahanan@yahoo.com
[3] Febrian@unsri.ac.id
[4] Madaapriandizuhir@fh.unsri.ac.id

Abstract. Legal development in capital investment is a national legal program to create a goodlegal culture and economic ensure profits for business owners as well as continuity of state development with an impact on society. Article 22 of Law Number 25 of 2007 on Investment stipulates investors are given right to use land rights in territory of Indonesia. Normative legal thisresearch is conducted to identify legal concepts and principles used to regulate economy, especially those used as basic framework investment regulation and research is used to build a legal construction in terms of refinement of investment law development in increasing investment in Indonesia, accordance with global order is guided Presidential Decree Number 29 of 2004 concerning Implementation of Investment in Framework of Foreign Investment (PMA) and Domestic Investment (PMDN) through the One-Stop Service System and Law Number 25 of 2007 concerning Investment, and the agency authorized to coordinate the implementation of investment in Indonesia is the Investment Coordinating Board (BKPM). Approval, licensing and investmentfacility services in the context of PMA and PMDN are carried out by BKPM, based on the delegation of authority from the Minister that fosters the relevant investment business fields through a one-stop service system.

1. Introduction

Efforts to improve legal development in the investment sector are a national legal program, considering that investment law is not only the work of the government but all governments both centraland regional have the responsibility to jointly create a good legal culture and economic culture. The investment climate not only guarantees profits for entrepreneurs and the sustainability of the country's development, but more than that, investment must have an impact on society in terms of economic, social and cultural quality (Sukardi, 2016)

Article 22 of Law No.25 Of 2007 Concerning Capital Investment stipulates that investors are granted the right to use land rights located in the territory of Indonesia. In accordance with the contentsof Article (2), the provisions of this Law apply to investment in all sectors in the territory of the Republicof Indonesia.

Basic Investment Policy Article (4) states that First; The government sets the basic investmentpolicy for:

a) Encouraging the creation of a national business climate conducive to investment to strengthenthe competitiveness of the national economy; and
b) Accelerate the increase in capital investment.

Second: In determining the basic policy as referred to in paragraph (1), the Government:

a) Provide equal treatment for domestic investors and foreign investors while taking into accountnational interests;
b) Guarantee legal certainty, business certainty, and business security for investors since the licensing process until the end of investment activities in accordance with the provisions of lawsand regulations; and
c) Open opportunities for the development and protection of micro, small, medium, and cooperative enterprises.

Third; The basic policies as referred to in paragraphs (1) and (2) are realized in the form of a General Plan for Investment (Article 22 of Law No. 25/2007)

Along with the principle of regional autonomy, the implementation of regional autonomy mustalways be oriented towards improving the welfare of the community as well as the interests and aspirations that grow in society. In addition, the implementation of regional autonomy must also ensureharmonious relations between regions and other regions. This means that the regions are able to improvecommon welfare and prevent inequality between regions. No less important is that regional autonomy must also be able to maintain and maintain the integrity of the country's territory and the Unitary State of the Republic of Indonesia in order to realize the country's goals. The granting of broad authority willfail, if the Regency / City Government is solely competing to increase Regional Original Revenue (PAD), without seeing other impacts, which often causes tensions in the management of their respectiveregions. The target of increasing PAD is the community and investors in general.

District and city governments, wanting to attract more foreign investors to invest in Indonesia,must shorten the bureaucratic chain. Because, the length of bureaucracy will be high cost and uneconomical in addition to being time-consuming, which will ultimately weaken Indonesia's competitiveness in the global market. It is very reasonable if we immediately fix this matter so that we will not be left behind by neighboring countries. The government must be able to inspire confidence inpotential investors to invest in Indonesia.

This trust is highly coveted by investors, especially foreign investors. In addition to restoring this trust, the government must also complete infrastructure. This is because the availability of infrastructure is also a requirement for investment. Another thing that is no less important is industrial relations or labor issues that turn out to have high quality and legal certainty that protects the existenceof investors.

Based on the authority possessed by each Regency / City local government issues Regional Regulations (Perda). In order to increase Local Own Revenue (PAD), such as in the determination of taxes and levies within the Unitary State of the Republic of Indonesia, specifically in the authority to grant approval and facilities and licenses for the implementation of investment. Based on the authority of each Regency/City, the Regency/City government is competing to issue local regulations (Perda) without taking into account other aspects, which may hinder investment in their respective regions. Forexample, there are local regulations that regulate parking retribution, street lighting retribution and licensing in the field of trade industry and investment.

Problems of law enforcement in Indonesia through social analysis and using progressive law asa new paradigm in law enforcement in Indonesia. The assumption used is to make law a social phenomenon. With progressive law, law enforcement must have a progressive perspective so as not to be confined to legal formalism in order to uphold the values of justice in society, including through "lawmakes happy", "punishing is reconciling", "seeing the context behind the text"; and "using conscience in law enforcement".

The use of progressive law, a legal thought introduced and developed by Satjipto Rahardjo, isoffered in this article as a paradigm or approach to answer various problems in law enforcement. Theseare the two reasons behind it;

Law as a social phenomenon. Law and social reality are like two sides of a coin that cannot beseparated. Both go hand in hand for certain purposes. So it can be said, law without social reality is likewalking in a vacuum without direction and purpose. The same thing was said by Lawrence Friedman who illustrated that the legal system does not float in a cultural vacuum, free of space, time and social context, undoubtedly reflecting what is happening in society. In the long run, Friedman assumes the shape of society, like a glove whose mold is the same as the shape of a person's hand.

Law is present in the midst of people's lives, none other than the needs of the community itselfin order to create a peaceful, orderly, and safe life. In other words, the law has a sacred duty to keep social reality in society intact. However, when the law is carrying out this task, it often causes friction with the layers of society. Second, in the face of the worsening legal conditions, progressive law introduced and developed by Satjipto Rahardjo can actually be an alternative and a solution. Moreover,the idea of progressive law actually stems from concerns about the state of law in Indonesia which is increasingly backward and deteriorating. The phenomena of judicial mafia, commercialization, and commodification of law that are increasingly widespread, are conditions that

at a macro level show that the law has never approached the ideal state, which is to make its people prosperous and happy (M. ZulfaAulia, 2018)

According to Philippe Nonet and Philip Selznick, criticism of law has always been directed at the inadequacy of law as a means of change and as a means of realizing substantive justice. That anxietyremains, but today there is a new note struck by repeated references to the crisis of legitimacy. Conservative alarm bells about the erosion of authority, the abuse of legal activism, and the breakdownof "law and order" are being sounded in radical renewal movements focused on the barrenness and corruption of legal order (Philippe Nosnet and Philip Selznick, 2013)

What was expressed by Nonet and Selznick also happened in Indonesia, seeing that the goal ofjustice can be achieved through a system of rules and procedures. As a result, law enforcement in Indonesia still tends to be legal formalistic, and law enforcers use horse glasses to enforce the law in society. The level of development of the society where the law is enacted affects the pattern of law enforcement, because in modern society it is rational and has a level of specialization and high differentiation in the organization of law enforcement and is also increasingly complex and highly bureaucratic (Sanyoto, 2008)

The influence of politics in law, means that it also applies to law enforcement, the characteristics of legal products, and the process of making them. The above can be seen in the fact thatthroughout Indonesia's history, the implementation of functions and law enforcement has not always gone hand in hand with the development of its structure. It is clear that if the measure of legal development in Indonesia is the unification and codification of law, then the development of legal structures has been running well and stable. Because from time to time the productivity of legislation has increased. But from the other side, in terms of legal functions there has been a decline (Artidjo Alkotsar, 1986)

2. Literature Reviews

The Omnibus Law that has been discussed in Indonesia itself discusses the Job Creation Law. The Omnibus Law aims to simplify labor-related regulations that have been overlapping and can causemisunderstandings. To understand more about the Omnibus Law and how it plays a role in fertilizing investment.

There are many conveniences contained in the Omnibus Law (Job Creation Act). The most commonly highlighted convenience is the ease of applying for a business license. If so far taking care of business licensing is synonymous with a complicated and time-consuming process, Job Creation Actmakes the complexity of the business license application process much shorter and simpler. One of thereal proofs is the implementation of OSS RBA which is risk-based instead of regulations as it has been. With the ease of processing business licenses, it is expected that the investment climate in Indonesia will improve. Both local and foreign investors will be interested in investing in the country. Opportunities for new job opportunities are also increasingly open for various sectors.

Another convenience contained in the omnibus law on Job Creation is that it benefits MSMEs (Micro, Small and Medium Enterprises). The Omnibus Law that will be passed has a positive impact onbusiness actors because it can simplify and shorten the licensing process, business tax payments, and regulations regarding employee salary payments. The goal is of course to protect the welfare of MSMEbusiness owners.

In addition to the bureaucracy being transformed into a more practical one, the Omnibus Law will help MSMEs in managing sales results, investment, number of workers, and also fulfillment of net worth indicators (Suriadinata, 2019). Then, the Omnibus Law also encourages positive collaboration between large companies and MSMEs. The government will also assist MSMEs in obtaining the required certification (Ananda and Nurmainiati, 2022). What about MSMEs that lack capital? The government will also prepare collateral loans to support MSMEs. Finally, MSMEs will be one of the priorities in the Special Allocation Fund. As the name implies, the Omnibus Law (Job Creation Law) was drafted with the aim to prosper and help job seekers in Indonesia. Especially in the midst of a pandemic situation where the unemployment rate is increasing. In the Omnibus Law, it is written that the government will increase labor-intensive jobs, namely in the textile industry,

snacks, beauty products, and others (Danendra *et al.*, 2020).

3. Methodology

Normative legal research uses normative case studies in the form of legal behaviour products, for example examining the Law. The subject of study is law which is conceptualised as norms or rules that apply in society and become a reference for everyone's behaviour. So that normative legal researchfocuses on the inventory of positive law, legal principles and doctrines, legal discovery in cases in concreto, legal systematics, the level of synchronisation, comparative law and legal history. Based on the explanation above, the author decided to use normative legal research methods to research and writethe discussion of this research as a legal research method.

4. Results and Discussion

Improvement of Investment Law Development in the Field of Land Reserve and Utilization Every investor who will invest in Indonesia will be given convenience. One of these conveniences is theease of providing services and/or licensing of land rights. Land includes the surface of the earth on landand the surface of the earth under water, including sea water. Land rights are rights to a certain portionof the earth's surface, which is bounded, two-dimensional with length and width. Land rights in the UUPA are divided into property rights; cultivation rights; building rights; right of use; liens; profit sharing business rights; hitchhiking rights; right of lease and others (Salim HS dan Budi Sutrisno, 2008) Article 22 of Law No. 25/2007 on Capital Investment stipulates that investors are granted the right to use land rights located in the territory of Indonesia. Land rights that can beused by investors for their investment activities are: cultivation rights title; building rights; and right of use. (Article 22 of Law No. 25/2007)

Such land rights can only be renewed after an evaluation has been made that the land isstill being used and cultivated properly in accordance with the circumstances, nature and purpose of the granting of the right. The provisions of Article 22 paragraph (3) are in line withthe social function of land as stipulated in Article 15 of the Basic Agrarian Law, Law No. 5/1960, namely that land must be properly maintained in order to increase its fertility and prevent its destruction.

Basically, not all investment companies can be granted land rights, in accordance withthe above period, but investment companies that can be granted land rights must fulfill the conditions specified in Article 22 paragraph (2) of Law Number 25 Year 2007 on Investment. There are five requirements for granting land rights, which can be granted and extended in advance at once for investment activities, namely investment:

a) It is long-term and related to changing the structure of the Indonesian economy to be more competitive;
b) With a level of investment risk that requires a long-term return of capital in accordancewith the type of investment activity undertaken, the risk of return on investment is long; Does not require a large area;
c) Exercise rights over State land; and
d) Does not disturb the sense of justice of the community and does not harm the public interest (Dhaniswara K. Hardjono, 2007)

The improvement of investment law development in Indonesia in accordance with the global order is guided by Presidential Decree No. 29 of 2004 on the Implementation of Investment in the Framework of Foreign Investment (PMA) and Domestic Investment (PMDN)through the One-Stop Service System and Law No. 25 of 2007 on Investment, and the agency authorized to coordinate the implementation of investment in Indonesia is the Investment Coordinating Board (BKPM). The consideration of the appointment of BKPM as the only government agency that handles investment activities in the framework of PMA and PMDN isin order to increase the effectiveness in attracting investors to invest in Indonesia. Therefore, with the one-stop service, it is expected that the service to investors will be faster than the previous implementation.

The One-Stop Service System means that the implementation of investment consists of investment policy and development planning, investment promotion and cooperation, approval services, licensing and investment facilities, investment implementation control, and investment information system management. Services of approval, licensing and investment facilities in the

framework of PMA and PMDN are carried out by BKPM, based on the delegation of authority from the Minister/Head of Non-Departmental Institution that fosters therelevant investment business fields through a one-stop service system.

The most important thing is that the Omnibus Law focuses on equal employment of Indonesian citizens. That is, it is not skewed towards big cities only. These workers will also be paid according to the minimum wage of each province. The hope is that the Omnibus Law will boost investment prospects in Indonesia and fertilize the business climate, so that more jobs will emerge.

It is estimated that the Omnibus Law will open up around 46 million job vacancies once passed. Of course, with the structure of the Omnibus Law that has been designed in such a way,this is not impossible. In fact, the Omnibus Law is considered a definite step from the government to restore economic conditions in Indonesia.

5. Conclusion

Based on the description above, the following conclusions are presented as answers to the problems in writing this scientific work as follows:

The form of refinement of investment law development in Indonesia in accordance withthe global order began with Law Number 1 of 1967 concerning Foreign Investment (PMA) andLaw Number 6 of 1968 concerning Domestic Investment (PMDN), which was then continuedwith the issuance of Presidential Decree Number 29 of 2004 concerning the Implementation ofInvestment in the Framework of Foreign Investment (PMA) and Domestic Investment (PMDN)through the One Roof Service System. The reconstruction of the Investment Law is the issuanceof Law No. 25/2007 on Investment, which regulates domestic investment and foreign investment. The agency authorized to coordinate the implementation of investment in Indonesia is the Investment Coordinating Board (BKPM). The consideration of the appointment of BKPMas the only government agency that handles investment activities in the framework of PMA andPMDN is in order to increase the effectiveness in attracting investors to invest in Indonesia.

Therefore, with the one-stop service, it is expected that the service to investors will be faster than the previous implementation. The One-Stop Service System means that the implementation of investment consists of investment policy and development planning, investment promotion and cooperation, approval services, licensing and investment facilities, investment implementation control, and investment information system management. Services of approval, licensing and investment facilities in the framework of PMA and PMDN are carried out by BKPM, based on the delegation of authority from the Minister/Head of Non- Departmental Institution that fosters the relevant investment business fields through a one-stopservice system.

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Recent Reform of Corporate Environmental Information Reporting Regulation in China – A Preliminary Assessment

LAI YEE CHOY*

The Chinese University of Hong Kong, Shatin, NT, Hong Kong SAR, The People's Republic of China

Email: lychoy@link.cuhk.edu.hk

Abstract China aims to form a mechanism for mandatory corporate environmental information disclosure by 2025. To achieve this goal, the Ministry of Ecology and Environment ('MEE') has put forth two sets of rules (collectively '2022 MEE Regulations') with effect from 8 February 2022. The current research performs a preliminary examination of the 2022 MEE Regulations, inspecting in what ways China's environmental information reporting structure has been improved. The analysis finds that the 2022 MEE Regulations cover a larger scope of companies and involve a higher level of public engagement. The 2022 MEE Regulations adopt a centralized approach to standardize the way of disclosure submitted by all covered companies. The covered companies are required to upload their corporate reports to a national mandatory environmental information disclosure system established by the MEE. Annual disclosure employs a differentiated disclosure approach under which the extent of information disclosed is linked to the nature of the covered companies. A nation-wide environmental governance mechanism is scheduled to be fully implemented by 2025, providing the general public with free access to the environmental information disclosures uploaded to the centralized disclosure system. These reforms are expected to upgrade the quality of environmental information disclosure substantially, alleviating the greenwashing problem.

Keywords: environmental law; corporate social responsibility; environmental information disclosure; regulation; Ministry of Ecology and Environment of China

1. Introduction

As Bowen (2013) points out, the term 'corporate social responsibility' ('CSR') denotes companies' responsibility to bring contributions to the entire community rather than simply maximizing profits. Owing to stakeholders' deeper concern about corporate non-financial information reporting in the past twenty years, companies have started disclosing their CSR information on a voluntary basis (Haller, Link, & Groß, 2017). Despite this, some argue that companies fail to perform their business in a responsible manner when there are no regulations, hence an increasing number of countries set forth mandatory requirements for CSR information reporting (Ioannou & Serafeim, 2017). Today CSR reporting regulations have become a common tool adopted by regulators to balance the interests between private and public parties (Baldini, Maso, Liberatore, Mazzi, & Terzani, 2018).

Laws and regulations act as a key driver promoting corporate CSR reporting. Securities law plays a pivotal role in this regard as reflected by the fact that 69 stock exchanges worldwide have issued written sustainability reporting guidelines as at 21 May 2023 (Sustainable Stock Exchange, 2023a). In particular, 34 stock exchanges require sustainability reporting as a listing rule, governing almost 20,000 listed companies (Sustainable Stock Exchange, 2023b). Nonetheless, the regulatory coverage of stock exchanges is limited to listed companies. Some countries, such as Japan, Argentina, and Macedonia, require corporate disclosure of environmental information via environmental law (Villiers &

* Ph.D candidate, Faculty of Law, The Chinese University of Hong Kong. Email: lychoy@link.cuhk.edu.hk.

Mähönen, 2015). Environmental law governs all companies that undertake operations within the territory of the jurisdiction (Karavias, 2021). As such, the environmental information reporting requirements under environmental law regulate all companies running business in a particular jurisdiction.

This paper focuses on analysing the corporate environmental information reporting requirements under the environmental law enforced in China, the world's biggest greenhouse gas emitter (BBC, 7 May 2021; Regan & Dotto, 3 Nov 2021). Although China has enforced certain environmental regulations and guidelines, the extent of environmental information reporting appears limited (Yang, Craig, & Farley, 2015; Leung, 2021). According to the notice issued by the Ministry of Ecology and Environment ('MEE') of China on 24 May 2021, China aims to form a mechanism for mandatory corporate environmental information disclosure by 2025 to strengthen its environmental governance regime. Toward this end, the MEE laid down two sets of rules (collectively '2022 MEE Regulations') with effect from 8 February 2022, including: (i) the Measures on the Management of Mandatory Corporate Environmental Information Disclosure ('2022 MEE Measures'); and (ii) the Standards for the Format of Mandatory Corporate Environmental Information Disclosure ('2022 MEE Standards'). The implementation of the 2022 MEE Regulations represents an overhaul of the pre-existing corporate environmental information reporting system. Because this reform is in its nascent stage, the significance of the 2022 MEE Regulations remains under-researched. The current research takes an initiative to perform a preliminary examination of the 2022 MEE Regulations, inspecting in what ways China's environmental information reporting structure has been improved.

The rest of the paper is organized as follows. The second section demonstrates the theoretical foundations of regulation of corporate environmental information disclosure. The third section reviews China's climate goals and policies put in force to achieve those goals. The fourth section explains the regulatory regime of corporate environmental information reporting in China. The fifth section presents the research objectives and methodologies. The sixth section analyses the reforms brought by the 2022 MEE Regulations, and the final section concludes with suggestions for future research.

2. Regulation of Corporate Environmental Information Disclosure – Theoretical Foundations

In broader context, regulation of corporate environmental information disclosure touches on two categories of literature: economics and CSR (see Figure 1). This section seeks to provide a brief overview of the theories on the side of information disclosure regulation, placing the focus on environmental information.

Regulation of information disclosure traces its roots to economic theories. The economic theories asserting that financial markets operate efficiently by themselves dominated academic studies in finance in the 1970s (Shiller, 2003). The neoclassical theory and efficient capital market hypothesis ('ECMH') believe that financial markets are able to adjust to the efficient point themselves, therefore regulatory policies on a system-wide level are unnecessary and micro-prudential approach is preferable (Davies et al., 2016). The ECMH postulates that public disclosure of information is key to build up an efficient market (Fama, 1970).

In contrast, behavioral economics suggests that the scope of government intervention should be broadened with the aim of preventing flawed decision-making and this proposition is labeled as 'paternalistic regulation' (Camerer, Issacharoff, Loewenstein, O'Donoghue, & Rabin, 2003). In essence, behavioral economics insists that market participants are not rational and thus regulators should raise disclosure requirements and introduce default rules to resolve behavioral market failures (Kahneman & Tversky 1979). As for disclosure, it is proved helpful to replace or complement other regulatory approaches and improve market competition if the requirements are kept clear and simple (Sunstein, 2014). Information disclosure is intended to be 'concrete, straightforward, simple, meaningful, timely, and salient' (Sunstein, 2014).

In view of escalating climate risk, regulation of corporate information disclosure has been extended to cover CSR and environmental information. As the Task Force on Climate-related Financial Disclosures ('TCFD') (October 2020) observes, climate-related matters may be material for a large number of companies, hence companies with public debt or equity should have a legal obligation to disclose material climate-related financial information in their financial reports. Built on this proposition, Grünewald (2021) suggests that a green macro-prudential policy should start with requiring corporate disclosure of climate-related financial information by regulation. Nowadays, disclosure of trustworthy environmental information is fundamental to effective environmental risk analysis and management (Riso, 2021). As Zadek and Yao (November 2017) conjecture, an effective environmental risk assessment mechanism is founded on three pillars: first, environmental information disclosure; second, public environmental statistical regime; and third, environmental risk evaluation and management framework.

From a regulatory perspective, information disclosure is an important tool to promote CSR, and regulation of corporate information disclosure can be implemented via environmental law (Sheehy, 2019). As Sheehy (2019) emphasizes, environmental law and CSR have become interconnected as a consequence of the unresolved, long-standing issue of corporate pollution. Environmental law is in line with CSR in several aspects – for example, bolstering the principles of 'polluter pays', 'prevention' and 'precautionary', and utilizing information disclosure reporting as a principal enforcement instrument (Sheehy, 2019).

Prior contributions to the CSR literature submit evidence that mandatory CSR disclosure fosters corporate CSR commitment and disclosure quantity. As Mbanyele, Huang, Li, Muchenje and Wang (2022) indicate, companies in countries mandating CSR disclosure raised their green innovation quantity and quality. Companies covered by the 2007 Australian National Greenhouse Energy Reporting Act increased their disclosures compared with their counterparts not covered by the Act (Perera, Jubb, & Gopalan, 2019). The Biesse Group listed on the Milan Stock Exchange became more attentive to CSR strategies and carried on with refining internal processes to strengthen transparency and stakeholders' engagement subsequent to the implementation of compulsory CSR reporting regulation (Aureli, Del Baldo, Lombardi, & Nappo, 2020). These findings grease the wheels for mandatory corporate environmental information reporting regulations.

3. China's Climate Goals and Relevant Policies

China has become the world's largest carbon dioxide emitter since 2006 (Brown, 9 Aug 2021; Regan & Dotto, 3 Nov 2021). In 2019, China's greenhouse gas emissions accounted for around 27% of the world's total, exceeding the combined emissions of all developed countries (BBC, 7 May 2021). Obviously, the world can hardly succeed in combating climate change unless China slashes its emissions, thus its climate policies have drawn global attention (Brown, 9 Aug 2021).

In 2020, China's President Xi Jinping announced the country's dual carbon goals, vowing to peak carbon dioxide emissions by 2030 and arrive at net-zero by 2060 (Brown, 9 Aug 2021). The recent years has witnessed a series of national policies formulated to mitigate carbon emissions. China's 13th Five-Year Plan, a five-yearly blueprint for economic and social development from 2016 to 2020, stipulates its plan to lessen energy consumption per unit of gross domestic product ('GDP') by 15% before 2020 and carbon emissions per unit of GDP by 18% by the end of 2020s (Spring, Shuping, & Shao, 5 Mar 2016). In the 14th Five-Year Plan for the years from 2021 to 2025, China reiterates the dual carbon goals and offers guidance for emissions reduction (Kemp, 20 Mar 2021). For instance, China stated that it would maintain its support to use coal in a clean and efficient way (Kemp, 20 Mar 2021), and scale down the construction of coal-fired power plants (Stanway, 29 Mar 2021). In 2021, China released an action plan to peak greenhouse gas emissions by 2030 (Bloomberg, 26 Oct 2021). The State Council, China's cabinet, stated that the new coal plants should be constructed in compliance with international energy-efficiency standards (Hua, 29 Oct 2021).

Furthermore, in 2023, China's Supreme People's Court, one of the top courts in China, published the first judicial guidelines urging judges to hear cases associated with climate issues and assess carbon impacts when making judgments to help achieve the national emission reduction targets (Kaminski, 7 Mar 2023). Specifically, the guidelines state that courts should lay their eyes on the carbon trading market, which has triggered wide-ranging legal disputes in the past few years (Kaminski, 7 Mar 2023). Contrary to many other nations, climate litigation in China is challenging due to the absence of legislation enacted purposefully to deal with climate change (Kaminski, 7 Mar 2023). On that account, these guidelines signify the judiciary's willingness to cope with climate cases (Kaminski, 7 Mar 2023).

Recently, China's MEE reported on the country's progress of implementing the policies for the dual carbon goals in 2021. Carbon dioxide emissions per GDP dropped by 3.8% in 2021 relative to the 2020 level, with a cumulative total reduction of 50.8% from 2005 (Liu, 23 Nov 2022; MEE, Oct 2022). Moreover, non-fossil fuel energy constituted 16.6% of primary energy consumption (Liu, 23 Nov 2022; MEE, Oct 2022). Notwithstanding these achievements, Sandalow et al. (2023) postulate that China's policymakers will give priority to economic growth and energy security over decarbonization in the short term. Heavy manufacturing industries, which are carbon-intensive in nature, contribute to a notable portion of China's economy (Sandalow et al., 2023). Because the coal industry is critical to the economy of a majority of provinces, China continues to construct a large number of new coal mines and coal-fired power plants (Sandalow et al., 2023). To China, supporting the coal industry is essential to maintain its economic development and energy security, at least in the near future (Sandalow et al., 2023).

4. China's Regulatory Regime Pertaining to Corporate Environmental Information Reporting

China regulates corporate environmental information reporting primarily through two areas of law: securities law and environmental law. As part of the national policies towards environmental protection objectives, Chinese regulators have ramped up supervision of corporate environmental information reporting.

Concerning securities law, the regulation of corporate environmental information disclosure is enforced by the China Securities Regulatory Commission ('CSRC') and two stock exchanges, including the Shenzhen Stock Exchange and Shanghai Stock Exchange. The CSRC, a ministerial-level regulator for the securities and futures market, raised the requirements for environmental information disclosure applicable to particular listed companies in 2021. The CSRC's reporting requirements are stipulated in two sets of standards: one is the Standards for the Contents and Formats of Information Disclosure by Companies Offering Securities to the Public No. 2 – Annual Reports, which govern corporate disclosure in annual reports; another is the Standards for the Contents and Formats of Information Disclosure by Companies Offering Securities to the Public No. 3 – Semi-Annual Reports, which govern corporate disclosure in semi-annual reports. Meanwhile, China's two stock exchanges have heightened corporate environmental information reporting regulations that govern the companies listed on the respective stock exchange (Lu & Abeysekera, 2017). As Chen, Hung and Wang (2018) pinpoint, because both the Shenzhen Stock Exchange and Shanghai Stock Exchange are owned by the government, their tougher reporting regulations stand for governmental policies.

In respect of environmental law, the highest source of law derives from the Environmental Protection Law of the PRC ('2015 EPL'). The current EPL, which has been in effect since 2015, was promulgated by the Standing Committee of the National People's Congress ('NPCSC'), China's top national legislative authority. The 2015 EPL mainly sets out the guiding principles without addressing the detailed requirements. The secondary source of environmental law governing corporate environmental information reporting is the regulations laid down by the ministerial-level authority in charge of environmental issues. The Ministry of Environmental Protection ('MEP'), now replaced by the MEE, put forth the Measures for the Disclosure of Environmental Information by Enterprises and Public Institutions ('2015 MEP Measures') that took effect from 2015 to 7 February 2022. The 2015 MEP Measures aims to boost corporate environmental information reporting under applicable

regulations such as the 2015 EPL (2015 MEP Measures, Article 1). To reinforce the regulation of corporate environmental information reporting, the MEE enforced the 2022 MEE Regulations on 8 February 2022, which repealed the 2015 MEP Measures effective from the same day. To modernize its environmental governance system, China has set the target to develop a regime for mandatory corporate environmental information disclosure before 2025 (MEE's Notice issued on 24 May 2021).

5. Research Objectives and Methodologies

The current study aims to examine the corporate environmental information reporting requirements under the 2022 MEE Regulations, and assess their effectiveness. This research is interested in analysing the 2022 MEE Regulations because they have an important impact on multiple parties and/or stakeholders. Climate watchers have been urging China to step up its plans for decarbonization (Financial Times, 10 Mar 2021). To companies potentially covered by the 2022 MEE Regulations, the new rules may affect their management strategies and planning such as higher cost (Fitch Ratings, 28 Oct 2021). To banks and other financial companies which make corporate loan/ investment paying regard to the companies' environmental performance, the environmental information disclosure pursuant to the 2022 MEE Regulations may provide a more credible source of information. To consumers, they will have more comprehensive understanding of companies' environmental performance, which may influence their consumption preference.

In terms of methodologies, this research adopts doctrinal study and comparative analysis. To understand the significance of the 2022 MEE Regulations, it is necessary to identify in which aspects they have improved in comparison with the pre-existing regulations. In view of this, this paper conducts a doctrinal study of the doctrines and rules concerning the 2022 MEE Regulations and a comparative analysis of the environmental information disclosure requirements under the 2022 MEE Regulations and pre-existing rules. To be precise, this study delves into the 2022 MEE Regulations in nine main aspects, including: (i) types of companies required to disclose environmental information; (ii) determination and announcement of the covered companies; (iii) timeliness of disclosure; (iv) way of disclosure; (v) information required to be disclosed; (vi) disclosure exemptions; (vii) disclosure format; (viii) penalties imposed on violators; and (ix) information transparency.

6. Reforms under the 2022 MEE Regulations

This section first illustrates the corporate environmental information requirements stipulated in the 2022 MEE Regulations in comparison with the 2015 EPL (still effective) and the 2015 MEP Measures (repealed by the 2022 MEE Regulations), and then provide a preliminary evaluation of their effectiveness.

6.1. 2022 MEE Regulations – Regulatory Approach and Major Reporting Requirements

This part examines the major provisions of the 2015 EPL, 2015 MEP Measures, and 2022 MEE Regulations from a comparative perspective.

6.1.1. Types of Companies Required to Disclose Environmental Information

The 2015 EPL requires only one type of companies, known as 'key pollutant discharging entities' ('KPDE's), to disclose environmental information (2015 EPL, Article 55). Yet the 2015 EPL does not clarify what 'KPDE' means. Similarly, the environmental information disclosure requirements under the 2015 MEP Measures only cover KPDEs (2015 MEP Measures, Article 9). Companies are included in the list of KPDEs if they meet one of the following three conditions: (i) companies that are subject to priority monitoring by the competent environmental protection departments at and above the level of cities with districts; (ii) laboratories, hospital above the level of Class-2, or companies engaging in the centralized disposal of pollutants or discharging pollutants causing widespread social concern; and (iii) companies that have experienced serious environmental emergencies or have caused severe social impact due to environmental pollution in the preceding three years (2015 MEP Measures, Article 8). In

accordance with Article 30 of the Constitution of the People's Republic of China, 'cities with districts' (thereafter 'large cities') refer to large cities that are divided into a number of districts.

Relatively, the 2022 MEE Regulations have considerably broadened the regulatory coverage of environmental information reporting, requiring four types of companies that are more likely to produce excessive pollutants to disclose environmental information (2022 MEE Measures, Articles 7-8). They include: (i) KPDEs; (ii) companies on the list of entities subject to compulsory cleaner production examination ('CCPE'); (iii) listed companies and the subsidiaries at all levels within the scope of consolidated financial statements that have been imposed specific penalties due to violation of environmental regulations; and (iv) bond issuing companies that have been imposed specific penalties due to violation of environmental regulations.

Regarding the second type of covered companies, companies are classified as entities subject to CCPE based on three criteria: (i) excessive pollutant discharge; (ii) excessive energy consumption; and (iii) involving toxic and harmful materials in the production process (Law on Promotion of Cleaner Production, Article 27). Companies on the list of entities subject to CCPE are required to examine whether their production and services adhere to the requirements of cleaner production. (Law on Promotion of Cleaner Production, Article 27). Cleaner production means that the entities have executed ongoing measures, such as using cleaner energy, in the process of production, services or use of products to mitigate their pollution (Law on Promotion of Cleaner Production, Article 2).

Concerning the third and fourth types of covered companies, listed companies and bond issuing enterprises are covered if they meet one of the following conditions due to a violation of environmental regulations in the preceding year: (i) they have been held criminally responsible; (ii) they have been fined more than CNY100,000; (iii) they have been punished consecutively on a daily basis; (iv) they have been restricted from production or undergone production suspension for rectification; (v) their ecological and environmental permits have been revoked; and (vi) their legal representatives or main responsible persons have been sentenced to administrative detention (2022 MEE Measures, Article 8).

6.1.2. Determination and Announcement of the Covered Companies

The 2015 EPL does not mention about how the list of KPDEs is compiled. The 2015 MEP Measures provide that the competent environmental protection departments at the level of large cities shall determine the list of KPDEs within their respective administrative regions by late March each year (2015 MEP Measures, Article 7).

In deciding on the list of enterprises that includes the companies required to disclose environmental information, the 2022 MEE Measures introduce a higher level of public engagement. The competent departments of ecology and environment at the level of large cities shall prepare the list of enterprises and publicize the list on the government website for public comments (2022 MEE Measures, Article 9). The period for public comments must last at least 10 working days, and the list of enterprises shall be announced by late March each year (2022 MEE Measures, Article 9).

The 2022 MEE Measures adopt a distinctive centralized approach. The competent departments of ecology and environment at the level of large cities shall submit the list of enterprises to the competent departments of ecology and environment at the provincial level within 10 working days after the list announcement (2022 MEE Measures, Article 9). Then the competent departments of ecology and environment at the provincial level shall submit the list of enterprises in their respective regions to the MEE by the end of April each year (2022 MEE Measures, Article 9).

Though the list of enterprises includes four types of companies required to disclose environmental information, the duration of being on list depends on the type of covered companies. The first type of companies, KPDEs, shall be included in the list of enterprises when they are listed as KPDEs (2022 MEE Measures, Article 10). The second type of companies, companies on the list of

entities subject to CCPE, shall be included in the list of enterprises from the date they are included in the list of entities subject to CCPE to the third year after they have completed the compulsory examination and acceptance for cleaner production (2022 MEE Measures, Article 10). The third and fourth types of companies, covered listed companies and bond issuing companies, shall be included in the list of enterprises for three consecutive years (2022 MEE Measures, Article 10). If they are once again imposed specific penalties due to violation of environmental regulations during the 3 year period, they shall be included in the list of enterprises for another three consecutive years (2022 MEE Measures, Article 10).

6.1.3. Timeliness of Disclosure

The 2015 EPL does not specify the timeliness of disclosure. Under the 2015 MEP Measures, if a company is included in the list of KPDEs, it has to disclose the required environmental information within 90 days after the KPDE list announcement (2015 MEP Measures, Article 11). If there is any new environmental information or changes to the disclosed information, a KPDE has to disclose the new information or changes within 30 days after the date of new information or changes (2015 MEP Measures, Article 11).

The 2022 MEE Regulations require the covered companies to disclose environmental information on two different bases – regular and ad hoc. To be specific, the companies covered have to provide two types of disclosure: annual disclosure (2022 MEE Measures, Articles 12-15; 2022 MEE Standards, Articles 3-25) and special disclosure (2022 MEE Measures, Article 17-18; 2022 MEE Standards, Articles 26-28). For annual disclosure, the covered companies have to disclose the required environmental information from 1 January to 31 December of the previous year before 15 March each year (2022 MEE Measures, Article 19). The covered companies have to make special disclosure on a timely manner in case of specified circumstances. They have to disclose the details within five days after receiving the legal documents relevant to the specified cases, such as a change in environmental licensing, violation of environmental regulations, and agreement on environmental compensation (2022 MEE Measures, Article 17). If a company encountered those specified cases before it is included in the list of enterprises, it has to disclose the relevant information in the form of special disclosure within 10 working days after the list announcement (2022 MEE Measures, Article 20).

6.1.4. Way of Disclosure

The 2015 EPL does not touch on the way of disclosure. The 2015 MEP Measures require KPDEs to disclose the required information via a channel that provides convenient access to the public, such as company website, corporate disclosure platform or local press (2015 MEP Measures, Article 10).

The 2022 MEE Regulations initiate a centralized approach to standardize the way of disclosure submitted by all covered companies. The covered companies are required to upload their corporate reports, including annual disclosure and special disclosure, to a national mandatory environmental information disclosure system established by the MEE (2022 MEE Measures, Article 11).

6.1.5. Information Required to be Disclosed

Pursuant to Article 55 of the 2015 EPL, KPDEs are required to disclose 5 items of environmental information: (i) names of the major pollutants; (ii) ways of emission; (iii) concentration and total volume of the emissions; (iv) whether the emission exceeds the applicable limits; (v) construction and operation of pollution prevention and control facilities.

The 2015 MEP Measures require KPDEs to disclose more information relative to the 2015 EPL, including: (i) basic corporate information, eg. company name, organizational code, legal representative,

production address, contact details, products and scale of production, operation and management services; (ii) pollutants discharged, eg. the names of major pollutants, the ways of discharge, the number and distribution of discharge outlets, the concentration and total volume of pollutant discharge, whether the limits on such concentration and total volume are exceeded, applicable pollutant discharge standards, and the approved total emission volume; (iii) the construction and operation of pollution prevention and control facilities; (iv) environmental impact assessment of construction projects and other environmental protection administrative licensing; and (v) plans for environmental emergencies. If a KPDE is included in the list of enterprises subject to national priority monitoring, it has to disclose its environmental self-monitoring program in addition to the above information (2015 MEP Measures, Article 9).

Contrasted with the 2015 EPL and 2015 MEP Measures, the 2022 MEE Regulations set forth more detailed information to be disclosed, requiring the covered companies to disclose different sets of environmental information in annual disclosure and special disclosure.

Annual disclosure employs a differentiated disclosure approach under which the extent of information disclosed is linked to the nature of the covered companies. Essentially, all covered companies are required to disclose foundational environmental information in seven categories (hereafter 'foundational environmental information'). First is basic corporate information, such as the company's production and services and its commitment to ecological and environmental protection. Second is environmental management policies, including environmental administrative licenses, environmental protection tax, environmental pollution liability insurance, and environmental protection credit evaluation. Third is emissions' generation, treatment and way of discharge, including pollution prevention facilities, discharge of pollutants, discharge of toxic and hazardous substances, and handling of industrial solid waste and hazardous waste. Fourth is carbon emissions, including emission volume and emission facilities. Fifth is environmental emergencies, including plans for environmental emergencies, and emergency response to heavy pollution weather. Sixth is violation of environmental regulations. Seventh is essence of the special disclosure made in the current year. The first type of covered companies, KPDEs, only has to disclose the foundational environmental information (2022 MEE Measures, Article 12; 2022 MEE Standards, Articles 3-25). The second type of covered companies, companies on the list of entities subject to CCPE, has to disclose additional environmental information on top of the foundational environmental information (2022 MEE Measures, Article 14; 2022 MEE Standards, Articles 3-25). Companies on the list of entities subject to CCPE have to disclose additional two items particularly relevant to their operations, including the reasons for being subject to compulsory examination for cleaner production, and the implementation, evaluation and acceptance results of the compulsory examination for cleaner production (2022 MEE Measures, Article 14; 2022 MEE Standards, Articles 3-25). The third and fourth types of covered companies, covered listed companies and bond issuing companies, have to disclose the foundational environmental information plus information relating to their financing (2022 MEE Measures, Article 15; 2022 MEE Standards, Articles 3-25). They must disclose information about the form of financing, financing amount and investment direction, and how their financing or investment facilitates environmental protection if applicable.

In comparison with annual disclosure, special disclosure adopts a standard approach that requires all covered companies to disclose certain environmental information in the situations specified. The covered companies must disclose the relevant information in the form of special disclosure in four types of cases. First, covered companies have to make special disclosure if there is any granting, change and renewal of administrative environmental licensing (2022 MEE Measures Article 17(1); 2022 MEE Standards Article 28). The second type of cases includes legal liabilities pertaining to violation of environmental obligations, such as administrative penalties, administrative detention, criminal liability, and compensation for and agreement on environmental damages (2022 MEE Measures Articles 17(2), 17(3), 17(4), & 17(5); 2022 MEE Standards Article 28). Third is environmental emergencies (2022 MEE Measures Article 17; 2022 MEE Standards Article 28). The fourth type of cases relates to any changes to the information already disclosed (2022 MEE Measures, Article 18; 2022 MEE Standards, Article 28). The covered companies are required to disclose the changes with explanations in the form of special disclosure.

6.1.6. Disclosure Exemptions

The 2015 EPL does not stipulate whether KPDEs have to disclose secret information. The 2015 MEP Measures state that companies are not required to disclose environmental information involving state secrets, business secrets or personal privacy (2015 MEP Measures, Article 6).

The 2022 MEE Measures neither provide general disclosure exemptions for environmental information of particular nature nor explicitly allow the covered companies to withhold disclosure of sensitive information. If the environmental information involves state secrets, strategic high-tech and core technologies in key fields, and business secrets, the covered companies have to comply with the relevant regulations (2022 MEE Measures, Article 6). If the required disclosure involves important environmental information, the covered companies have to seek instructions in accordance with the relevant national provisions (2022 MEE Measures, Article 6).

6.1.7. Disclosure Format

Both the 2015 EPL and 2015 MEP Measures do not mention about the disclosure format.

The 2022 MEE Standards lay down principle-based guidelines to standardize the format of corporate disclosure in many respects, ranging from the general form of expression to specific contents. As a normative principle, the terms used in the disclosures must comply with the relevant regulations and industry norms and practices (2022 MEE Standards, Article 2(2)). For disclosing important data, the measurement methods must comply with the regulations, standards of the relevant fields of environmental protection, and industry norms and practices substantiated with explanations for the method selection (2022 MEE Standards, Article 2(3)). Furthermore, the 2022 MEE Standards specify the requirements on report layout for both annual disclosure and special disclosure. The cover page of the reports shall state the company Chinese name, unified social credit code, reporting year, and report compilation date (2022 MEE Standards, Articles 4 & 26). In addition, the title page of the reports shall include a statement declaring that the disclosures are true and accurate, and the responsible officers will be legally liable for disclosing false information (2022 MEE Standards, Articles 4 & 26). Of particular relevance to annual disclosure, the companies have to present the information in a way that is clear and understandable to the public. The report has to offer easy-to-understand explanations of technical terms (2022 MEE Standards, Article 5). Moreover, it has to provide a summary of the key environmental information, such as compliance with environmental regulations, changes in environmental administrative licenses, pollutant emissions, and carbon emissions (2022 MEE Standards, Article 6).

6.1.8. Penalties Imposed on Violators

Under the 2015 EPL, in case a KPDE breaches its duty to disclose true environmental information, the competent department for environmental protection shall make an order for disclosure, imposing a fine, and releasing an announcement (2015 EPL, Article 62). However, the EPL does not specify the amount of fine. Violators may be subject to administrative processes, and can be placed under administrative detentions for up to 15 days (2015 EPL, Article 63(3)).

The 2015 MEP Measures specify the amount of fine imposed on violators. The competent environmental protection department at or above the county level shall order the violators to make the disclosure, impose a fine of less than CNY30,000 and issue an announcement in below situations: (i) the company fails to disclose the required environmental information; (ii) the company fails to disclose the environmental information by the required means; (iii) the company fails to disclose the environmental information by the deadlines; (iv) the information disclosed is untrue or fraudulent (2015 MEP Measures, Article 16).

The 2022 MEE Measures uphold a punishment system of three levels: rectification order, public criticism, and monetary penalty. Specifically, the competent department of ecology and environment at or above the level of large cities may punish a violator in three approaches: (i) ordering the violator to make corrections; (ii) circulating a notice of criticism; and (iii) imposing a fine of CNY10,000 – CNY100,000 (2022 MEE Measures, Article 28). Concerning the amount of fines, the 2022 MEE Measures specify that the competent department of ecology and environment at or above the level of large cities may impose a fine of less than CNY50,000 in certain circumstances (2022 MEE Measures, Article 29). This applies if the company fails to disclose the required environmental information, fails to disclose the environmental information by the deadlines, or fails to upload the environmental information to the designated corporate environmental information disclosure system (2022 MEE Measures, Article 29).

6.1.9. Information Transparency

The 2015 EPL does not mention about public access to the disclosed information. The 2015 MEP Measures state that the companies are required to disclose information via a means that enables the public to have timely and accurate access to the disclosures (2015 MEP Measures, Article 10).

The 2022 MEE Measures promote public access to corporate disclosures in a more concrete approach. The MEE and competent departments of ecology and environment at or above the level of large cities have to announce the corporate environmental information disclosures uploaded to the centralized disclosure system, providing free access to the general public (2022 MEE Measures, Article 21). The general public are able to acquire the disclosed environmental information conveniently without charge. The 2022 MEE Measures encourage internal information sharing among government departments. The competent departments of ecology and environment have to strengthen the connection between the centralized system for corporate environmental information disclosure and the other information systems of the government (2022 MEE Measures, Article 22). Such inter-departmental information sharing is not limited to environmental information, but extends to non-environmental information such as credit information (2022 MEE Measures, Article 22). Various government departments are able to share information across departments, fields and regions.

7. 2022 MEE Regulations – Preliminary Evaluation

The implementation of the 2022 MEE Regulations is still in its early stage, thus it sounds premature to assess the effectiveness of the new rules in practice. This study attempts to preliminarily analyse how the reforms respond to the deficiencies in the pre-existing disclosure regulation mechanism in light of well-founded regulatory principles and China's political features.

China's climate governance can be characterized as a top-down administrative system under the leadership of the central government (Wu, 2023). Corporate disclosure in China is largely regulatory-driven, meaning that companies are generally reluctant to take action as long as they are not required to do so (Lai, 13 Apr 2021). In the Chinese context, stringent environmental regulation is a vital contributor to raising the level of environmental information disclosure (Li et al., 2021; Zheng, Ge, Li, Duan, & Yu, 2020). Viewed from this angle, the 2022 MEE Regulations will highly likely give rise to finer corporate environmental information disclosure. Before the reform, there were a variety of weaknesses in China's environmental information reporting system, such as unclear reporting format, procedure, submission period and required environmental information, decentralized reporting platforms and insufficient cooperation among government departments (Aoki, 5 Nov 2021). The 2022 MEE Regulations have been designed to close these loopholes.

As discussed in the Section on Regulation of Corporate Environmental Information Disclosure – Theoretical Foundations, behavioral economics posits that information disclosure should be 'concrete, straightforward, simple, meaningful, timely, and salient' (Sunstein, 2014). The 2022 MEE Regulations

have generally reflected on these principles and made substantial improvements in contrast to the 2015 EPL and 2015 MEP Measures. While addressing the reporting requirements in greater details, the 2022 MEE Regulations are properly structured and easy-to-understand. The regulatory scope of the 2022 MEE Regulations covers four types of companies, surpassing that of the 2015 EPL and 2015 MEP Measures. On top of annual disclosure, the covered companies are required to make special disclosure under certain circumstances, raising the timeliness of information disclosure. Moreover, the 2022 MEE Regulations have notably expanded the types of information required to be disclosed. A standardization of disclosure format also allows a more meaningful comparison of environmental performance across companies.

Particularly worthy of note, the 2022 MEE Regulations have enhanced information transparency through establishing a centralized disclosure system and engaging the public throughout the corporate reporting process. The public can not only comment on the list of enterprises prepared by the competent departments of ecology and environment but also have free access to the information disclosed by the covered companies. The study conducted by Wu, Zhang, and Xie (2020) postulates that increased information transparency undermines green-washing. As they observe, if the transparency of CSR information is of low level, consumers are unable to obtain a full picture of a company's CSR commitment. As a result, companies seeking profit maximization are likely to utilize green-washing to imitate the companies truly pursing sustainability for gaining consumer reward. Nevertheless, if the transparency rises to a sufficiently high level, green-washing is ruled out. In China, some banks do not make lending decisions by reference to companies' external environmental disclosure taking into account the concern about green-washing (Xing, Zhang, & Tripe, 2021). Given a higher level of information transparency, the 2022 MEE Regulations are expected to push up the validity of the corporate environmental information disclosed.

As highlighted in the Section on Regulation of Corporate Environmental Information Disclosure – Theoretical Foundations,, reliable environmental information disclosure is crucial to building up an effective environmental risk management system (Riso, 2021; Zadek & Yao, November 2017). The above analysis shows that the 2022 MEE Regulations are helpful to polish up the quality of environmental information reporting and advance the environmental risk evaluation regime ultimately. It is anticipated that the mandatory reporting rules laid down by the MEE will narrow the reporting gap between China and international sustainability reporting practice (Fitch Ratings, 28 Oct 2021). In spite of this, we cannot ignore the downside of the 2022 MEE Regulations. Noticeably, the low fines imposed on violators (i.e. cap at CNY100,000) may constrain the initial influence of the 2022 MEE Regulations, and the actual effect remains to be seen (Fitch Ratings, 28 Oct 2021). Apart from that, it is uncertain how usual the covered companies can be exempted from providing the disclosure based on the ground that the required disclosure involves sensitive information.

8. Conclusion

In the current era, regulators prevalently employ CSR reporting regulation as a devise to balance the interests between private and public parties (Baldini et al., 2018). The present paper has reviewed some of the main literature in economics and CSR that provides theoretical justifications for governmental regulation of environmental information disclosure. In practice, regulators usually require companies to disclose environmental information through securities law and/or environmental law. As part of China's national policies in the climate change fight, regulation of corporate environmental information disclosure has been tightening up. The 2022 MEE Regulations put forth substantive changes to the corporate environmental information reporting regime. The current research undertakes an in-depth examination of how the 2022 MEE Regulations have improved China's environmental information reporting mechanism in various aspects. Precisely, this study compares the 2022 MEE Regulations with the 2015 EPL and 2015 MEP Measures in nine aspects, ranging from the types of covered companies, determination and announcement of the covered companies, timeliness of disclosure, way of disclosure, required information, disclosure exemptions, disclosure format, to punishment for non-compliance and information transparency. Relative to the 2015 EPL and 2015 MEP Measures, the 2022 MEE Regulations cover several more types of companies with a wider range of information required to be

disclosed. The 2022 MEE Regulations have improved the timeliness of disclosure by requiring the covered companies to disclose information on an ad hoc basis in addition to the regular, annual disclosure. To standardize the way of disclosure, the MEE sets up a centralized disclosure system for the covered companies to submit their disclosures. Besides, the 2022 MEE Regulations facilitate a higher level of public engagement, providing the public the opportunity to comment on the list of enterprises drafted by the competent departments of ecology and environment as well as free access to the covered companies' disclosures.

The preliminary assessment finds that the reporting requirements introduced by the 2022 MEE Regulations are concrete, straightforward, meaningful, and timely. The reforms introduced by the 2022 MEE Regulations are, to a high degree, in line with the core principles of effective corporate information reporting regulation. They are likely to upgrade the quality of corporate environmental information disclosure significantly, alleviating the green-washing problem. Nonetheless, the implementation of the 2022 MEE Regulations is still in its infancy, thus we should keep a close watch on its practical impact. This being the case, there are two directions for further research. First, future research can empirically analyse the environmental information disclosed by the covered companies, evaluating to what extent the disclosure requirements under the 2022 MEE Regulations have been fulfilled. Second, it is worth exploring whether, and in what aspects, the reporting companies have encountered difficulty in complying with the new reporting requirements through qualitative research.

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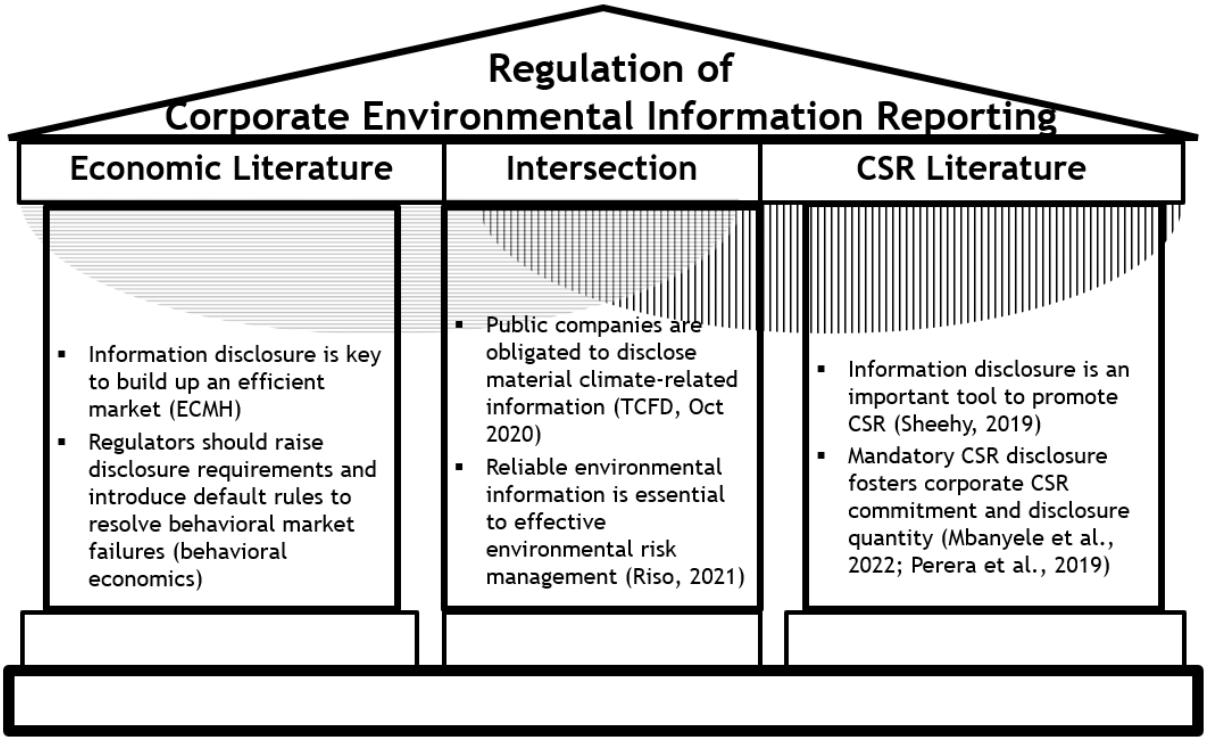
Figure 1. Theoretical foundations of corporate environmental information reporting regulation



Enhancing Sustainable Housing Development in Malaysia:The Role of Cooperative Federalism in Federal-State Collaboration

Hilmy Sazlin Azny Bin Abdul Aziz [1] *, Jady Zaidi Hassim [1], Rasyikah Md Khalid [1].[1] Faculty of Law, Universiti Kebangsaan Malaysia, Bangi 43600, Selangor, Malaysia [2] Faculty of Law, Universiti Kebangsaan Malaysia, Bangi 43600, Selangor, Malaysia [3] Faculty of Law, Universiti Kebangsaan Malaysia, Bangi 43600, Selangor, Malaysia

[4] Corresponding author: Hilmy Sazlin Azny Bin Abdul Aziz; E-mail: p120076@siswa.ukm.edu.my

The concept of sustainable development is the effort to maintain the well-being of the physical environment inhabited by a group of people who will strive to ensure that the physical environment is in good condition and able to meet the needs of life. Sustainable housing development should combine environmental protection, reasonable use of natural resources, protection of economic growth, and social progress. In Malaysia, the government has implemented the concept of sustainable housing development, but it is insufficient and poorly implemented. With the rising levels of urbanization, governments implemented numerous housing programs, laws,and policies. However, attaining sustainable housing development and closing the housing demand-supply gap appears to be increasingly difficult. For example, 183 of 450 certified green buildings are residential (GBI, 2018).Nevertheless, the country has a housing stock of 5.2 million, and 100,000 housing units are added every year to this figure. The problem is that the implementation of sustainable housing development in Malaysia is very low and requires attention and action to address this issue. This article will look into the concept of cooperative federalism to achieve sustainable housing development. This study aims to use and evaluate qualitative legal research methods. An in-depth interview method based on established guidelines will be implemented. Analyse the role and cooperation played by Federal and State Government Departments and make references and comparisons of laws and practices in selected countries such as the United Kingdom, Australia, and Canada regarding the concept of sustainable housing development. The focus of linking this study with the SDG is Sustainable Development Goal 11, Sustainable Cities and Communities. The target is to make housing safe and affordable by 2030. This study will meet development needs along with the concept of sustainable development based on more universal aspects such as social, economic, technological, and Sustainable Development Goals (SDGs) to support development in Malaysia. This study will propose a harmonious cooperative federalism mechanism to ensure sustainable housing development can be achieved in Malaysia. Reviewing laws and policiesregarding sustainable housing development that is being implemented and then suggesting improvements

Keywords: Sustainable Housing Development, Cooperative Federalism, Sustainable Development Goals (SDG's)

Introduction

Pursuing sustainable housing development has emerged as a critical imperative in Malaysia's ongoing commitment to fostering a sustainable future, aligning with the United Nations' Sustainable Development Goal 11 (SDG 11) - "Sustainable Cities and Communities." As the nation grapples with the challenges of rapid urbanization and population growth, the importance of providing environmentally friendly, socially equitable, and economically viable housing solutions has come to the forefront. SDG 11 specifically targets making cities and human settlements inclusive, safe, resilient, andsustainable.

In this context, Malaysia recognizes the pivotal role of cooperative federalism and federal-state collaboration in driving sustainable housing initiatives across the country (Khor & Bin Abu Bakar,2012; Wai et al., 2012). The SDG 11 acknowledges the significance of partnerships and collaborationsbetween different levels of government and stakeholders to achieve sustainable urban development.
The attainment of sustainable housing development is not solely the responsibility of a single governing entity but necessitates a concerted effort among various levels of government and stakeholders (SuzainiZaid & Graham, 2010). By embracing the principles of cooperative federalism, which advocate for collaboration and partnership between the federal and state governments, Malaysia seeks to foster a cohesive and integrated approach to address the complex challenges associated with sustainable housing(Bakar et al., 2011; Pakir et al., 2012; Sulzakimin Mohamed et al., 2015).

This article endeavors to present a comprehensive understanding of the elements essential forenhancing sustainable housing development in Malaysia, particularly emphasizing the role of cooperative federalism in contributing to SDG 11. By exploring relevant literature and international casestudies, the paper aims to shed light on the potential benefits and challenges of cooperative federalism in sustainable housing development.

By bringing together the collective expertise and resources of the federal and state governments, along with other stakeholders, Malaysia endeavors to create a roadmap that addresses thecurrent housing needs of its citizens and ensures the preservation of resources and the well-being of future generations. The success of sustainable housing development, as emphasized by SDG 11, hinges on effective collaboration, integration of sustainable practices, community engagement, prudent resource management, and capacity building.

This paper is structured as follows: Section 2 presents the literature review, and Section 3 outlines the methodology employed in the research. In Section 4, the research results are highlighted. Section 5 is dedicated to the conclusion, addressing the study's limitations and proposing directions forfuture research. The primary objective of this study is to offer valuable insights into the role of cooperative federalism in promoting a robust and sustainable housing sector in Malaysia, in alignment with SDG 11. This is achieved through a comprehensive analysis of various housing policy and practiceelements. By establishing a foundation for effective collaboration between the federal and stateauthorities and fostering an environment of shared responsibility, the nation aims to pave the way for sustainable and inclusive housing initiatives, ultimately enhancing the overall quality of life for all its citizens..

The Significance of Cooperative Federalism in Enhancing Sustainable Housing Development in Malaysia

The pressing need to address sustainable housing development has captured the attention of scholars, policymakers, and practitioners in Malaysia (Khor & Bin Abu Bakar, 2012; Pakir et al., 2012; Suzaini Zaid & Graham, 2010; Wai et al., 2012). Within this context, cooperative federalism has emerged as a pivotal governance model with the potential to catalyze effective collaborations between federal

and state governments and various stakeholders to achieve sustainable housing goals. This section providesan overview of the existing literature on the significance of cooperative federalism in the context of sustainable housing development in Malaysia, shedding light on key themes and insights gleaned fromprevious research (Yip & Mohamad, 2020; Zainudin et al., 2015).

Cooperative federalism, a governance paradigm emphasizing collaborative partnerships and shared decision-making between different levels of government, has garnered widespread recognition as a promising approach to tackling complex and multifaceted challenges that span regional and jurisdictional boundaries (Dahlan, 2021; Rahim et al., 2023). Scholars have underscored the importanceof cooperative federalism in facilitating a more holistic and integrated approach to housing development,bringing together the federal and state governments' collective resources, expertise, and authority to address pressing housing issues (Goh, K. C., Seow, T. W., Goh, 2013).

Policy coordination and alignment are fundamental to successful federal-state collaboration insustainable housing development (Dahlan, 2021; Goh, K. C., Seow, T. W., Goh, 2013). Scholars have stressed the need for harmonizing housing policies to avoid duplication of efforts and to ensure a coherent and unified approach to sustainable housing initiatives. Drawing upon international experiences, research has highlighted examples of countries where collaborative policy frameworks have yielded positive outcomes in sustainable housing development, emphasizing the potential benefitsfor Malaysia's housing context (Roosli et al., 2019; Said et al., 2016).

Resource sharing and allocation have been recognized as pivotal enablers of sustainable housing development through cooperative federalism (Bilal et al., 2019; Ebekozien et al., 2023). By promoting the sharing of financial burdens and leveraging resources from both levels of government, Malaysia can bolster its capacity to implement sustainable housing projects at a larger scale, thus effectively addressing the urgent housing needs of its citizens. Resource sharing also offers opportunitiesto optimize resource utilization and enhance efficiency in sustainable housing initiatives (Abidin et al.,2013; Yassin et al., 2021).

Effective intergovernmental relations have emerged as a critical determinant of successful cooperative federalism in sustainable housing development (Abidin et al., 2013; Karim, 2021; Yassin etal., 2021). Scholars have emphasized the importance of transparent and open communication channels between the federal and state governments to facilitate informed decision-making and cultivate a spirit of cooperation and mutual understanding. By fostering constructive intergovernmental relations, Malaysia can navigate complex governance challenges and promote a collaborative environment conducive to sustainable housing development (Karim, 2021; Said et al., 2017).

Moreover, examining international case studies has yielded valuable lessons for Malaysia's sustainable housing development endeavours (Said et al., 2017; Wong et al., 2022). By drawing insightsfrom countries that have successfully implemented cooperative federalism models in housing initiatives,scholars have identified best practices, challenges faced, and strategies to overcome obstacles (Syed Jamaludin et al., 2018; H. Y. Q. Tan et al., 2020). These international experiences serve as a rich knowledge repository, guiding Malaysia's efforts to tailor context-specific approaches that align with itssocio-economic and environmental conditions.

Methodology:

This study adopts a qualitative research approach to investigate the role of cooperative federalism in enhancing sustainable housing development in Malaysia. Qualitative research is deemed suitable for this investigation as it allows for an in-depth exploration and understanding of complex phenomena, such as collaborative governance, in the context of sustainable housing. By employing qualitative methods, this research seeks to gain insights into the perspectives, experiences, and practices of relevantstakeholders, including policymakers, government officials, housing experts,

and community representatives.

Literature Review:

The study commences with a comprehensive literature review, drawing from academic journals, research papers, government reports, and reputable sources on sustainable housing development and cooperative federalism. The review is the foundation for synthesizing existing knowledge, identifying key themes, and framing research questions.

Case Study Analysis:

To enrich the findings and provide practical examples, the research analyzes international casestudies where cooperative federalism has proven successful in sustainable housing development. Thesecase studies are carefully selected based on their relevance to Malaysia's socio-economic and environmental context. The analysis offers valuable insights into best practices, challenges, and lessonslearned, guiding context-specific recommendations.

Data Collection:

Primary data is collected through semi interviews with key stakeholders involved in sustainable housing development at the federal and state levels. Purposeful sampling is employed to ensure representation from diverse perspectives and expertise. The interviews seek to explore participants' perceptions, experiences, and understandings of cooperative federalism in the context of sustainable housing.

Data Analysis:

The interview data was meticulously transcribed, organized, and subjected to thematic analysis. The qualitative analysis identifies the data's recurring themes, patterns, and connections. Through this iterative process, emerging themes related to the role of cooperative federalism in sustainable housing development are identified and interpreted.

Limitations:

The study acknowledges limitations inherent in qualitative research, including potential subjectivity in interpretation and the limited generalizability of findings to other contexts. Nevertheless, qualitative methods are well-suited for exploring complex and context-specific phenomena, allowing for a deeper understanding of the intricacies surrounding cooperative federalism in sustainable housingdevelopment.

Result

This section presents the findings derived from a research study conducted through semi-interviews, aiming to achieve the research objectives, it serves as a hypothetical illustration of potential findings that could arise from an investigation into the role of cooperative federalism in advancing sustainable housing development in Malaysia.

Collaborative Governance for Comprehensive Solutions

The simulated research reveals that cooperative federalism is pivotal in fostering collaborative governance among policymakers, government officials, housing experts, and community representatives. Participants emphasized that this collaborative approach enables a more comprehensive consideration of environmental, social, and economic factors in housing development, leading tointegrated and sustainable housing solutions.

Participant A (Government Official): "Through collaborative governance, we can bring together the expertise of different stakeholders to formulate housing policies that meet environmental standards and cater to the unique needs of our diverse communities."

Policy Coordination and Alignment as a Catalyst

The simulated research findings highlight the significance of policy coordination and alignment between the federal and state governments. Participants, including housing experts and community representatives, emphasized that harmonizing housing policies enhances the effectiveness of sustainable housing initiatives by avoiding redundancies and promoting coherence.

Participant B (Housing Expert): "When federal and state governments align their housing policies, it allows for a more streamlined approach to sustainable housing development. It also helps avoid conflicting regulations, which can impede progress."

Resource Sharing for Enhanced Capacity

The simulated study indicates that resource sharing through cooperative federalism enhancesMalaysia's sustainable housing development capacity. Participants, including policymakers and government officials, mentioned that pooling financial resources and expertise from both levels of government enables the execution of larger-scale projects, thereby addressing the growing demand for affordable and environmentally friendly housing.

Participant C (Policymaker): "Resource sharing allows us to tap into a broader pool of funds and knowledge, which is essential for implementing ambitious sustainable housing projects that have alasting impact on our communities."

Effective Intergovernmental Relations for Informed Decision-making

The simulated research suggests that effective intergovernmental relations foster informed decision-making. Participants, including community representatives and housing experts, emphasized that open communication channels between the federal and state governments facilitate a deeper understanding of local housing needs, leading to more informed policy decisions and tailored housing solutions.

Participant D (Community Representative): "Having a platform for meaningful dialogue between governments and communities ensures our voices are heard. It helps policymakers make decisions that resonate with the realities of our neighbourhoods."

Lessons from International Case Studies

The simulated study draws insights from fictional international case studies to provide valuable lessons for Malaysia's sustainable housing development efforts. Participants discussed fictional successful models of cooperative federalism from other countries, emphasizing the importance of stakeholder engagement, public-private partnerships, and innovative policy frameworks as potential sources of inspiration for Malaysia's housing sector.

Participant E (Housing Expert): "Looking at how other countries have successfully implemented cooperative federalism in housing development gives us valuable ideas to adapt and innovate in our context. We can learn from their experiences and avoid potential pitfalls."

The Path Towards a Sustainable Future

The hypothetical findings point towards the transformative potential of cooperative federalism in advancing sustainable housing development in Malaysia. Participants, including government officialsand policymakers, expressed optimism that Malaysia can pave a path towards a resilient and inclusive housing future by embracing collaborative governance, aligning policies,

sharing resources, nurturing intergovernmental relations, and learning from international experiences.
Participant F (Government Official): "By fostering collaboration and pooling our resources, we can pavethe way for a sustainable housing sector that not only meets the needs of today but also leaves a lastinglegacy for future generations."

Discussion

The findings presented in this study add to the growing body of research on the role of cooperative federalism in enhancing sustainable housing development in Malaysia. By exploring the perspectives ofpolicymakers, government officials, housing experts, and community representatives, this study contributes novel insights into collaborative governance's potential benefits and challenges in sustainable housing.

Strengthening Collaborative Governance: Building upon Previous Studies

The current study reinforces previous research that underscores the significance of collaborative governance in fostering sustainable housing development. Earlier studies (Ebekozien et al., 2022; Jia Wen et al., 2015; Yee & Ooi, 2010) have highlighted the value of involving diverse stakeholders in decision-making to ensure inclusive and holistic housing solutions. The present findings align with these studies, demonstrating how cooperative federalism empowers diverse stakeholders to contribute their expertise and perspectives, strengthening the foundation of collaborative governance.

Moreover, this study adds to the literature by offering new insights into stakeholders' specificroles and contributions to sustainable housing initiatives. By capturing the perspectives of community representatives and housing experts, the research sheds light on the importance of participatory decision-making and local knowledge in shaping housing policies that truly address the needs and aspirations ofthe communities they serve.

Optimizing Policy Coordination: Leveraging International Lessons

The research findings on policy coordination and alignment resonate with prior studies (Ayompe et al., 2021; Yigitcanlar et al., 2015) that emphasize the need for harmonized housing policiesto enhance the effectiveness of sustainable housing initiatives. Building upon this foundation, the currentstudy extends the discussion by drawing upon international case studies to optimize policy coordination.

While previous studies have acknowledged the value of international experiences (Quoquab et al., 2022; Tateishi, 2018), the present research takes a step further by recommending the establishmentof a centralized platform for policy coordination that facilitates cross-border knowledge exchange. By systematically curating best practices, policy innovations, and lessons learned from various countries, Malaysia can capitalize on global insights to inform its domestic housing policies and adapt context-specific approaches that align with its unique challenges and goals.

Enhancing Resource Sharing Mechanisms: Embracing Innovative Financing

The findings on resource sharing through cooperative federalism align with previous studies (Tedong et al., 2021) that emphasize the potential of pooling financial resources and expertise to addresshousing demands. However, the current research introduces the concept of innovative financingmechanisms as a means of enhancing resource sharing.

By suggesting exploring partnerships with development agencies and private sector

investors,this study offers a novel perspective on diversifying funding sources for sustainable housing projects. Moreover, the emphasis on transparent and accountable resource-sharing mechanisms underpins the importance of equitable distribution of funds to ensure that housing solutions reach marginalized and underserved communities.

Nurturing Effective Intergovernmental Relations: Lessons from Collaboration

The research findings on effective intergovernmental relations build upon previous studies (Mohamad et al., 2022; T. H. Tan, 2008) that stress the significance of open communication channels between federal and state governments. This study enriches the discussion by proposing a more nuancedapproach to nurturing intergovernmental relations.

By emphasizing collaborative problem-solving processes and joint capacity-building initiatives, the research presents a comprehensive strategy for fostering a culture of cooperation and mutual accountability. Drawing inspiration from successful collaborative models (Federal Department of Town and Country Planning, 2016; Masram et al., 2020), Malaysia can strengthen intergovernmentalrelations through shared learning opportunities, ensuring that federal and state governments work towards common housing objectives.

Scaling up Knowledge Transfer: Customizing Global Insights

The current study aligns with prior research on the value of learning from international case studies (Al-Aidrous et al., 2021) to inform domestic housing policies. However, the findings contribute to the literature by emphasizing the importance of customizing global insights to Malaysia's unique context.

By establishing a dedicated knowledge-sharing platform, Malaysia can curate international best practices and innovations and tailor them to its local needs, cultural sensitivities, and environmental realities. By incorporating the perspectives of housing experts and community representatives, this research underscores the significance of ensuring that knowledge transfer is grounded in Malaysian communities' lived experiences and aspirations.

Addressing Challenges and Embracing Opportunities: An Integrative Approach

The discussion on addressing challenges and embracing opportunities echoes prior research (Syed Jamaludin et al., 2020; Tobi et al., 2018), highlighting potential barriers to cooperative federalism. However, this study presents an integrative approach to overcoming challenges by combining institutional reforms, intergovernmental agreements, and targeted capacity-building initiatives.

By adopting an adaptive and proactive stance, Malaysia can navigate bureaucratic hurdles, jurisdictional complexities, and diverging policy priorities. The research findings underscore that by embracing opportunities for collaboration and resource optimization, the nation can capitalize on the transformative potential of cooperative federalism to drive sustainable housing solutions.

Conclusion

This study highlights the critical role of cooperative federalism in advancing sustainable housing development in Malaysia, in alignment with Sustainable Development Goal 11 (SDG 11) - "SustainableCities and Communities." By engaging stakeholders from various levels of government, policymakers, experts, and communities, collaborative governance emerges as a transformative approach that can pavethe way for a resilient and inclusive housing sector. Through cooperative federalism, Malaysia can tap into stakeholders' diverse expertise and perspectives to design housing policies that holistically addressenvironmental, social, and economic aspects. The coordination and alignment of policies become instrumental in maximizing the impact of sustainable housing

initiatives. At the same time, resource sharing allows the nation to effectively respond to housing demands on a larger scale.

Intergovernmental relations foster informed decision-making and facilitate a collaborative environment where federal and state governments can work together toward shared housing objectives.As Malaysia aspires to build a sustainable future, learning from successful international case studies provides valuable inspiration and insights to inform domestic housing policies.

Innovative financing mechanisms can be explored to enhance resource sharing and optimize funding for housing projects to bolster sustainable housing efforts further. By nurturing a culture of cooperation and strengthening intergovernmental relations, Malaysia can leverage the collective effortsof all stakeholders to accelerate progress in achieving SDG 11 and improving the overall quality of lifefor its citizens.

Moreover, customizing global insights through a dedicated knowledge-sharing platform ensures that international best practices are effectively adapted to Malaysia's unique context, consideringlocal needs and aspirations. This approach will enable the nation to craft housing solutions that are both contextually relevant and internationally aligned with sustainable development principles.

In conclusion, implementing cooperative federalism in sustainable housing development represents a promising pathway for Malaysia to create resilient, inclusive, and sustainable communitiesin line with SDG 11. By promoting collaboration, policy coordination, and resource sharing, Malaysia can build a solid foundation for a thriving housing sector that serves the needs of its people while safeguarding the environment and preserving resources for future generations.

Limitations:

The research's scope is limited to a simulated examination of cooperative federalism, and thefindings may not encompass all aspects of sustainable housing development in Malaysia.

Future Studies:

To build upon the findings of this study, future research can consider the following avenues: Longitudinal Studies: Conducting longitudinal studies over an extended period can provide a deeperunderstanding of the long-term impact of cooperative federalism on sustainable housing developmentin Malaysia.

Stakeholder Engagement Studies: Further research can focus on comprehensive stakeholder engagement studies to understand the perspectives of various communities and marginalized groups insustainable housing initiatives.

Policy Implementation and Evaluation: Examining the implementation and evaluation of sustainable housing policies under a cooperative federalism framework can shed light on challenges andsuccesses in real-world scenarios.

Economic Analysis: Conducting economic analyses of resource-sharing mechanisms can give policymakers a deeper understanding of sustainable housing projects' cost-effectiveness and financial sustainability.

Environmental Impact Assessment: While cooperative federalism can foster collaborative efforts in sustainable housing development, future research should incorporate comprehensive environmental impact assessments.

By addressing these limitations and pursuing future studies, Malaysia can further enrich its understanding of the role of cooperative federalism in sustainable housing development and refine its housing strategies accordingly.

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CULTURAL RIGHTS OF ORANG ASLI FROM LEGAL PERSPECTIVES

Muhamad Sayuti Hassan,[1] Rohaida Nordin[2]

[1]Senior Lecturer, Faculty of Law, Universiti Kebangsaan Malaysia, UKM Bangi, Selangor.
[2]Associate Professor, Faculty of Law, Universiti Kebangsaan Malaysia, UKM Bangi, Selangor.

[4] Corresponding author's Email: sayutihassan@ukm.edu.my

Abstract.

The Aboriginal Peoples Act of 1954, which protects the rights of the Orang Asli, is inadequate and out of date. In spite of the fact that the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) provides worldwide recognition of the rights of indigenous peoples, Malaysia does not currently have a comprehensive legal framework that recognises the Orang Asli's right to culture. These legal constraints need a holistic approach to the Orang Asli's right to culture, which incorporates concerns of language, education, identity, customary practice, traditional knowledge, and customary land. As a result, the primary purpose of this study is to analyse the existing legal framework of the cultural right of the Orang Asli people. In addition to that, the current study elaborates the on the rights to the culture of indigenous peoples in accordance with international legal standards. This study employs doctrinal legal research to accomplish the said objectives. This study revealed that the existing legal framework on the cultural rights of Orang Asli is not compatible with international law standards. In conclusion, this paper can substantially contribute to the attainment of sustainable development by advocating for Orang Asli's right to culture, in particular, goal 10 of the Sustainable Development Goals, which aims to reduce inequality, especially target 10.2 to 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 2030.

Keywords: Human rights, indigenous peoples, international law, Orang Asli, rights to culture, UNDRIP.

Introduction

The right to self-determination includes the cultural rights of Orang Asli. With regard to the right to self-determination, Article 3 of UNDRIP recognises the right to self-determination of indigenous peoples. Article 3 provides as follows:

> *"Indigenous peoples have the right to self-determination. By virtue of that right they freely determine their political status and freely pursue their economic, social and cultural development."*

The above provision is identical to Article 1 of both the International Covenant on Civil and Political Rights (ICCPR) and the International Covenant on Economic, Social and Cultural Rights(ICESCR) which recognises the right to self-determination of all peoples. As mentioned in Hassan & Nordin (2020; 2019; 2018), the provision of the right to self-determination covers four main dimensions, such as 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 aligned with the recognition of the right to natural resources.

Daes (2001) explains the right to self-determination of indigenous peoples as independence, integrity and respect for indigenous peoples. In fact, the right to self-determination of indigenous peoples should be defined according to the principles of justice and equality (Hassan & Nordin, 2019). Representatives from the National Aboriginal and Islanders Legal Services Secretariat of Australia suggested that the definition also needs to be based on the principles of equality and non-discrimination (E/CN.4/2000/84). This 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 tested by assessing whether indigenous peoples have the freedom to choose and determine their own way of life (Daes, 2001). This paper argues that the cultural rights of indigenous peoples should be respected, and they have the freedom to choose and determine their own way of life.

The recognition of the cultural rights of indigenous people is significant to achieve Sustainable Development Goals (SDG). The Office of the High Commissioner for Human Rights (OHCHR) has identified four key areas of the 2030 Agenda and the Sustainable Development Goals framework that must be addressed for Indigenous Peoples: "leave no one behind," "human rights," "equality," "participation, " and "accountability." In 2015, most countries reiterated their commitment to achieve and implement the 2030 Agenda for Sustainable Development, including Malaysia by including 17 SDGs and 169 objectives into national development strategies. It requires sub-nationalizing the SDGs, working with stakeholders to mobilize resources and finance, and improving data availability (Economic Planning Unit, 2017). The government must incorporate all segments of society especially the Orang Asli in the initial policy formation to implementation and monitoring in order to be in line with the basic principle of the 2030 Agenda which is "leave no one behind". This article emphasizes that Orang Asli's right to culture is an important component to achieve the SDGs and the 2030 Agenda.

However, the Malaysian state's recognition of the cultural rights of Orang Asli is still inadequate (A/HRC/25/57/Add.2; Hassan & Nordin, 2020, 2018). Orang Asli is one of Malaysia's indigenous populations. The term 'Asli' comes from the Arabic word 'Asali', which signifies origin or native. Orang Asli is comprised of three major groups: Negrito, Senoi, and Proto-Malay (Carey, I. (1976). They constitute 0.6% of Malaysia's total population. The majority of the Orang Asli have been vulnerable and dominated by the majority population. Moreover, the current legal framework on Orang Asli is of British origin and takes a paternalistic approach towards them (Idrus, 2010, Nicholas *et al.*, 2010, Nicholas *et al.*, 2007). However, the inadequacy of the extant legal framework has resulted in obstacles for the Orang Asli. Therefore, the primary objective of this article is to analyse the existing legal framework of the cultural right of the Orang Asli people. The current study elaborates the on the rights to the culture of indigenous peoples in accordance with international legal standards. To achieve the said objective, this study employs doctrinal legal research to accomplish the said objectives. This paper can substantially contribute to the attainment of sustainable development by advocating for Orang Asli's right to culture, in particular, goal 10 of the Sustainable Development Goals, which aims to reduce inequality, especially target 10.2 to 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 2030. This paper has the potential to make a substantial contribution to the attainment of sustainable development by advocating for Orang Asli's right to culture.

A Literature Review of the Right to Culture of Orang Asli

The study of Orang Asli in Malaysia was more synonymous with the field of anthropology, history and social studies. For example, studies by Hunt (1952) and Carey (1976) and Leary (1995) detail the Orang Asli community and history. From the anthropological aspect of the Orang Asli, among the main works referred to by researchers are the work of Dentan (1968) on the Semai tribe, the study of Evan (1968) on the Negrito tribe, the writing of Endicott (1979) which focuses on the life Batek of Negrito tribe. Moreover, Schebesta's (1973) study revolves around the Semang tribe while Hoe Ban Seng (2001) examines the Semelai tribe in Tasek Bera. Anthropological studies like these have high academic value because the data is obtained empirically.

Furthermore, the study by Muhammad Fuad Abdullah et al (2020) focuses on traditional knowledge and the uses of natural resources in the resettlement of Orang Asli. The increasingly rapid development has caused the Orang Asli of the Semaq beri and Bateq tribes to face often land issues such as land ownership and relocation of new settlements. Furthermore, Norwaliza, et al (2020), focuses on indigenous knowledge and cultural tourism among the Mah Meri in Malaysia. The Mah Meri tribe is rich in their unique cultural practices with natural elements including wood carving, mask carving, pandan weaving and dance performances. For example, the Mah Meri tribe in Kampung Sungai Bumbun have carried out wood carving activities originally used for healing ceremonies and developed into economic activities. UNESCO has recognized the uniqueness of Mah Meri wood carvings and the unique dance equipment, Centong Buluh. A study by Lambin, R., Wahab, NA, Choo., GS, Mustapha, R., & Abdullah, R (2018) touches on the knowledge of Orang Asli in traditional medicine. The Orang Asli community of Mah Meri in the Orang Asli Village in Sungai Bumbun often use traditional medical practices to treat various diseases. Moreover, a study by Wan Ahmad Hazman, Aminah Mohsin and Mohd Sharil (2020) on land ownership for Orang Asli in Malaysia is very important in relation to cultural rights. Orang Asli customary land rights can be given to three categories, namely gazetted Orang Asli Reserves, Orang Asli areas that have been approved but not yet gazetted and land that has been applied for gazetted and not yet approved. These studies are closely associated with the cultural aspect of Orang Asli's life style.

In addition, studies on Orang Asli from the legal aspect are more focused on land recognition, political participation, socio-economics and the right to self-determination. For example, some existing studies such as Hassan & Nordin (2020; 2019: 2018), Subramaniam (2013), Wook (2019, 2017), Nordin (2015) focus more on doctrinal studies and legal analysis. Based on the review of the existing literature, these three aspects are still understudied, and a wide gap needs to be filled, especially from a legal and human rights perspective. This study does not cover the education aspect because the study of Nordin et al (2020) and Rosnon & Talib (2019) is seen as sufficient because it examines the right to education from the perspective of policy and legislation.

Research on Orang Asli's cultural rights is still lacking and not comprehensive. Past studies are more focused on anthropology and social science studies. A review of previous studies found that there is a wide gap in studies on the cultural rights of the Orang Asli from a legal perspective. In other words, there is still a gap in the corpus of knowledge regarding the recognition of Orang Asli cultural rights from the context of international law and human rights.

Therefore, this article addresses the legal aspects of the cultural rights of the Orang Asli from the perspective of international law and in accordance with the principles of human rights. The legal reform on the cultural rights of the Orang Asli is very important and able to contribute towards the well-being of the lives of the Orang Asli which can be translated as recognition of the rights of the Orang Asli in line with the principles of human rights and international law. This can directly protect the rights of the Orang Asli as advocated by international law.

Rights to Culture in International Law

In the human rights corpus, various international instruments and guidelines are developed to address cultural rights. For example, article 1 of the International Covenant on Economic, Social and Cultural Rights (ICSECR) recognises the individual right to self-determination, which includes cultural aspects. In addition, cultural rights are also explicitly stated under articles 3, 6 and 15 of the ICESCR. Therefore, it can be concluded that international law recognises the cultural rights of every individual, including indigenous people.

In the context of the Indigenous people, the Declaration on the Rights of Indigenous Peoples (UNDRIP) through the United Nations General Assembly recognised the rights of the Indigenous people on September 13, 2007. Among the important principles and rights in the UNDRIP is recognising the right of self-determination to indigenous people around the world. This right to self-

determination underlies all other rights including the cultural rights of the indigenous people. This means that indigenous people are also eligible to enjoy the rights contained in Article 3 of the UNDRIP.

However, the status of UNDRIP under international law is only "soft law" and is not binding. Charters (2006) described the UNDRIP as only demanding a moral obligation rather than a legal obligation. Although non-binding, the UNDRIP should be used as a standard for recognising and protecting indigenous peoples' rights at the international and domestic levels.

According to Charters (2006), UNDRIP has a significant role for indigenous people, which is to complement the provisions of international legal instruments. This proves that the status of international customary law is persuasive in understanding a law related to indigenous people. In addition, the 2010 International Law Society Conference Report also emphasized the importance of UNDRIP as a mainstream instrument in the UN system, the International Labor Organization and even UNESCO. This emphasis demonstrates that the UNDRIP contains human rights standards and principles of international law.

Cultural rights are one of the important dimensions in the recognition of the right of self-determination of indigenous peoples as stipulated under Article 3, Declaration on the Rights of Indigenous Peoples (UNDRIP). Having said that, Articles 5, 8, 11, 12, 14, 16, 31, 32, and 36 of the UNDRIP also recognise the cultural rights of indigenous people. Cultural rights need to be seen in a wider context by covering aspects of practice and tradition, education, customary land and traditional knowledge. The recognition of the land and customary practices of the indigenous people has been clearly recognised under UNDRIP, such as articles 25, 26, 29 and 32. The recognition deserves attention because Malaysia is one of the countries that supports it (GA/0612, 107th & 108th Meetings).

Right to Culture of Orang Asli: Legal Challenges

Although international law has recognized the cultural rights of indigenous people, recognition at the domestic level is still unclear (Hassan, 2020; Hassan & Nordin, 2019). The Orang Asli, like the majority of indigenous people around the globe, are a vulnerable group whose cultural rights are inadequately recognised (Adrian Lasimbang & Kon Onn Sein, 2021; Subramaniam & Nicholas, 2018). W. A. Amir Zal (2021) described the lack of focus on the Orang Asli causing them to lag far behind.

As evidence, the Human Rights Commission (SUHAKAM) has published a National Inquiry Report on Indigenous Land Rights (2013) with 18 recommendations for the government to consider. The recommendations presented are very closely related to the recognition of the cultural rights of the Orang Asli because it involves their land which is considered as their identity, life and way of life. However, these recommendations are still not implemented by the government (SUHAKAM, 2019). In 2019, Philip Alston, the United Nations Special Rapporteur on Poverty, reported that almost 99 per cent of the Orang Asli are in the B-40 group. In 2014, Olivier De Schutter, the United Nations Special Rapporteur on the Right to Food, reported the situation of the Orang Asli regarding the right to food during his visit on December 9 to 18, 2013.

The cultural aspect was also discussed in the report, specifically in relation to the recognition of the Orang Asli's customary land (A/HRC/25/57/Add.2). The weakness of legal recognition of cultural rights also contributes to poverty, especially when it comes to land recognition crises (Wan Daud et al, 2020). In the 3rd Cycle Universal Periodical Review (UPR), 31st Session in 2018 in Geneva, Malaysia has received several specific improvement proposals on the issue of indigenous people, including the Orang Asli, as follows:

1. *Strengthen the rights of indigenous peoples through the incorporation of the principles of the United Nations Declaration on the Rights of Indigenous Peoples in judicial and administrative procedures (Peru, A/HRC/40/11/Add.1 - Para. 18);*

2. *Ensure the rights of indigenous peoples in law and in practice, in particular regarding their right to traditional lands, territories and resources (Norway A/HRC/40/11/Add.1 - Para. 18).*

These proposals indirectly place an obligation on the government to fulfil its obligation to the Orang Asli regarding cultural rights in accordance with the provisions of international law. In terms of traditional practices and knowledge, Abdullah et al (2020) explained that Orang Asli still uses traditional knowledge to treat diseases, cultivate crops and even for their daily economic activities. Interestingly, the Orang Asli in Terengganu always uses approximately 106 species of plants and herbs, 31 species of animals and 31 species of fish (Abdullah et al, 2020). Nevertheless, Lambin et al (2018) argue that the traditional medicine of the Orang Asli is becoming extinct even though it has great potential to be commercialised.

From a legal point of view, the existing laws and policies are still insufficient to protect the cultural rights of the Orang Asli in Peninsular Malaysia as a whole. It is important to note that Orang Asli is protected by the Federal Constitution and the Aboriginal Peoples Act 1954 (APA), a specific act for the protection and development of Orang Asli. In addition, various policies are introduced by the government to support the protection of the Orang Asli. The APA was enacted to protect the welfare of the Orang Asli. However, existing laws and institutions face challenges in providing comprehensive protection, especially the right to culture and self-determination. The protection of the cultural rights of the Orang Asli is vulnerable due to the absence of any specific laws or policies related to this matter to guarantee and protect them.

The lacuna in the Orang Asli Act (APA) 1954 [Act 134] is one of the factors that lead to the lack of the recognition of Orang Asli rights, such as the recognition of Orang Asli land rights and their economic activities. This is closely related to the protection of Orang Asli's cultural rights. S Samsudin et al (2021) asserted that the government needs to play an important role in resolving the issue of conflict over Orang Asli land because it is closely related to their customs and lives.

The lacuna in the APA also leads to the cultural rights that cover aspects of practice and tradition, customary land, and traditional knowledge cannot be given protection in line with the provisions of international law. The ambiguity of the recognition of cultural rights, in turn, has implications for the protection and development of Orang Asli rights in practical terms. Thus, the development of a robust legal framework on cultural rights covering aspects of practice and tradition, customary land and traditional knowledge that integrates the approach of cultural uniqueness, human rights principles, and international legal standards is seen to be able to deal with the issue of rights recognition Orang Asli culture in particular.

Cultural Rights of Orang Asli: Moving Forwards

In conclusion, the Orang Asli need a comprehensive legal framework for better protection of their rights. In the absence of a specific law or policy guaranteeing and protecting the Orang Asli's cultural rights, their protection has become vulnerable. The lacuna of the APA is one of the factors that lead to the weakness of the recognition of Orang Asli rights, such as the lack of recognition of Orang Asli land rights and their economic activities. This is closely related to the protection of Indigenous cultural rights. The lacuna in the APA also pushes for cultural rights that cover aspects of practices and traditions, customary lands and traditional knowledge that cannot be given protection in line with the provisions of international law.

Therefore, Malaysia must initiate legal and institutional reform to improve the recognition of the right of indigenous peoples. The government should address the lack of mechanisms by introducing a framework to warrant the inclusive participation of indigenous peoples in all decision-making processes. The essential amendment of the APA is one of the most critical measures requiring immediate government attention. The government also should introduce special measures by establishing an appropriate mechanism to protect the rights to the culture of Orang Asli. Proactive

measures must be taken to achieve recognition and enhance the protection of the rights of the indigenous peoples and implement appropriate laws toward indigenous peoples.

In relation to that, UNDRIP and other international law instruments, such as ILO Convention 169, should be the framework to address the target set out in Agenda 2030, in particular, goal 10 of the Sustainable Development Goals, which aims to reduce inequality, especially target 10.2 to 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 2030.

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TRACK 10
Special themes

10a. Sustainability and Africa

Abstracts

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EFFECT OF WOMEN EMPOWERMENT IN AGRICULTURE ON HOUSEHOLD FOOD SECURITY IN KENYA

Mr. Peter Kipkorir[1,2], Dr. Paul Dontsop[3]
[1]Moi University, Eldoret, Kenya. [2]University of Eldoret, Eldoret, Kenya. [3]International Institute of Tropical Agriculture, Bukavu, Congo, the Democratic Republic of the

MR. PETER KIPKORIR

DR. PAUL DONTSOP

Abstract

Agricultural production in Kenya has remained low with relative food insecurity affecting many citizens in most parts of the country because of the increase in population growth in Kenya over the past two decades. Women labour contribute a higher percentage in agriculture labour supply. They are the main players in household food security. Yet, in Kenya, women lack financial support, access to productive resources despite the documented role women play in achieving household food security. The involvement of women in agriculture is indispensable yet their contributions is still low. Therefore, this study aims to analyze the effect of women empowerment on household food insecurity in Kenya. The objective of the study is to the establish the determinants of women empowerment in agriculture in Kenya and to analyze the impact of women empowerment in agriculture on food insecurity in Kenya. The study will heavily rely on Panel data using the household and individual questionnaires from the Kenya 2020 Covid-19 Rapid Response Phone Survey to achieve the stated objectives. The random utility theory and the farm household theory will be employed. The probit endogenous switching regression model will be utilized to control for endogeneity using the Instrumental variables approach for panel data. These preferred techniques will also account for heterogeneity and unobserved effects. Women in most of African countries are the main players in ensuring food security for the family yet their contributions are often undermined by male dominance in the agriculture sector whose main agenda is commercial gains rather than the food security of the household. Thus, the need to treat this current study with urgency. The study findings are expected to inform policy on how women empowerment in agriculture can be re-engineered towards enhanced household food security in the country. This study contributes to SDG 2 and goal target 3 and SDG and goal target 7 and 8. The study also contributes towards the conference especially and improving on the prosperity and people welfare of the 5Ps of SDGs

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Entrenching Climate Mitigation Standards in Extractive industries' contracts for Sustainable Trade and Development in Africa

Mr Ifesinachi Okonji
University of Ibadan, Ibadan, Nigeria

M R I F E S I N A C H I O K O N J I

Abstract

Africa is blessed with abundant natural resources which constitute significant parts of their economies and remain keys to their economic growth. These natural resources include metals such as lithium, bauxite, cobalt, aluminium, tantalum, gold, iron, steel, zinc, titanium, and copper; minerals such as diamonds, gypsum, salt, graphite, coal, uranium, platinum, chromium, phosphate rock; petroleum oil and gas. Trade and development for many African countries depend heavily on the mining, exploration, exploitation, and processing of their natural resources carried out by extractive industries usually consisting of multi-national and international companies from developed countries under contracts. Unfortunately, activities of these extractive industries have caused environmental problems including pollution (air, water and soil), global warming, emission of CO2 and greenhouse gases, loss of biodiversity, damage to ecosystem, improper waste disposal, deforestation, depletion of the ozone layer, acid rain and public health issues which violate right to a healthy environment.

The above phenomenon lay credence to the myth of resource curse in Africa which needs to be demystified by examining what better ways to deal with natural resources, adopting climate change adaptation, resilience and governance for economic prosperity and well-being of the African nation. By way of doctrinal research method, the study seeks to explore provisions of the African Continental Free Trade Area (AfCFTA) and examine Climate Mitigation strategies as Standards for entrenchment in Extractive industries' contracts to ensure adoption of safer and better ways of mining, exploitation, exploration and processing of natural resources sine qua non for a regulated environmental impact and social stewardship that guarantee protection of right to healthy environment, secures sustainable trade and development in Africa. The outcome of this study will facilitate the establishment of a uniform standard of mining, exploration, exploitation and processing of natural resources by extractive industries that guarantee protection and preservation of climate, alleviation of poverty and sustainable development in Africa

The study relates to Sustainable Development Goals 13 (Climate action), and 1 (No poverty). It targets at implementation of social protection systems; and the building of resilience to environmental, economic and social disasters ("SDG + Target: 1.3.5") especially, integrating climate change measures into policies and planning ("SDG + Target: 13.2"). It is worthy of note that the outcome of this study will be of immense and valuable contribution to the topic of the conference, "Half-way through Agenda 2030: Assessing the 5Ps of SDGs (people, planet, prosperity, peace and partnership)", because the proposed contributions addresses the myth of resource curse in Africa, provides a pathway for protection and preservation of the planet while advancing the prosperity of the African continent.

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THE ECONOMICS OF NEGLECTED AND UNDERUTILIZED SPECIES IN UGANDA Douglas Otoo1*, Olawale Olayide2, Mary Gichure3, & Ibrahim Tuzee A. Raheem4 1Gulu University, 2University of Ibadan,3 Chuka University4 Kwame Nkrumah University of Science and Technology Email address: douglasotoo46@gmail.com

Mr douglas otoo[1], Dr. Olayide Olawale[2], Mrs Mary Gichure[3], Mr Ibrahim Tuzee A. Raheem[4]
[1]Gulu University, Gulu City, Uganda. [2]University of Ibandan, ibadan, Nigeria. [3]Chuka University, Nairobi, Kenya. [4]Kwame Nkrumah University of Science and Technology, Accra, Ghana

M R D O U G L A S O T O O

Abstract

Abstract

Neglected and underutilized Species (NUS) or forgotten crops are believed to directly and indirectly benefit agricultural diversification, broadening and diversification in agroecology, reduction of imports, and self-reliance on African food systems. Uganda is one of the many African countries with a number of indigenous neglected and underutilized crops spread across its 9 agroecological zones. The NUS is embedded with vast nutritional, medicinal, and economic potential to transform the African food systems. In spite of the great potential of NUS and matched with two rainy seasons (March-June and August-November) in Uganda, NUS production, utilization, and consumption have remained low. Critically, there is limited information on the potential of such crops. Therefore, the study aims to explore the potential of NUS in Uganda. The objectives of the study are to profile neglected and underutilized crops in Uganda; examine their economic benefits; and assess the market potential of NUS. The results from the study would be used to publish different NUS crops according to their agroecology importance. Additionally, policymakers would pick interest in the promotion of these crops. Lastly, market development both within and regionally would be established. The study deploys a systematic literature review as the research design to retrieve the required information. Web searches on websites like the African Orphan Crops Consortium (AOCC), Forum of Agricultural Research in Africa (FARA), Google Scholar, and web of science. Keywords, abstracts, and lists of publications will then be explored using words such as orphan/neglected/traditional/indigenous crops, production, nutrition, consumption, and market. Only those articles fit for the study purpose will be considered for review and analysis. Preliminary findings reveal the agroecological distribution of NUS by crop type and market potential of neglected and underutilized species in Uganda.

Keywords: Neglected and Underutilized Species, sustainability, Markets, Uganda

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Digitizing National Planning Frameworks for the Coherent Implementation of Global and Continental Commitments

Professor Bartholomew Armah, Dr. Oyebanke Abejirin, Citra Kumala
United Nations Economic Commission for Africa, Addis Ababa, Ethiopia

Abstract

National governments find it imperative to carry out development planning to conceptualize, streamline and ensure the implementation of economic, environmental, social, and spatial growth and development. While countries maintain their independence in planning for what occurs within their borders, many also commit to global and regional goals and frameworks, which if implemented, will also boost economic, environmental, and social development. Some of these include the Sustainable Development Goals (SDGs), Agenda 2063: The Africa We Want, and the Doha Programme of Action for the Least Developed Countries for the Decade 2022 – 2031 (DPoA). The United Nations Economic Commission for Africa (UNECA) works with member states to review and report on SDGs and Agenda 2063 goals' implementation at national and regional levels through its Development Planning Section (DPS). DPS has evolved a toolkit called the Integrated Planning, Financing and Reporting Toolkit (IPRT) that assists African countries to integrate the SDGs and Agenda 2063 in their national development plans and to track and report on the progress on both initiatives. This paper is written in recognition of the imperativeness and challenges of development planning in African Countries. It seeks to understand the development challenges of ECA's member states and the solutions they are using to address it. The paper utilizes surveys to take stock of the utility and efficacy of the IPRT, with a view to increasing its effectiveness in supporting the needs of member states. It commences by providing a background on the IPRT, its key features, evolution, and roll out. The paper features the alignment of the National Development Plans of nine (9) African countries and the Southern African Development Community (SADC) with the SDGs and Agenda 2063. The paper concludes by considering challenges and opportunities in implementing the IPRT, and proposes a way forward in strengthening the support provided to member states.

Full Paper

Entrenching Climate Mitigation Standards In Extractive Industries' Contracts For Environmental Protection And Development In Africa

Ifesinachi Charles Okonji[1]

Abstract

Africa is blessed with abundant natural resources which constitute significant parts of their economies and growth. These natural resources include metals, minerals, petroleum oil and gas. Trade and development for many African countries depend heavily on the mining, exploration, exploitation, and processing of their natural resources by extractive industries usually consisting of multi-national and international companies. Unfortunately, activities of these extractive industries have caused environmental challenges including pollution, loss of biodiversity, depletion of the ozone layer and public health issues which violate right to healthy environment.

The above phenomenon supports the myth of resource curse in Africa which needs to be demystified by examining what better ways to deal with natural resources for environmental protection and prosperity of Africa. By way of doctrinal research method, the study seeks to explore Climate Mitigation strategies as Standards for entrenchment in Extractive industries' contracts for preservation of healthy environment and development of Africa. The outcome of this study will facilitate the establishment of a uniform standard of mining, exploration, exploitation and processing of natural resources by extractive industries that guarantee preservation of climate ("SDG + Target: 1.3.5") and ("SDG + Target: 13.2"), alleviation of poverty ("SDG + Target 1) and development in Africa.

Key words: Climate mitigation standards, Extractive industries' contracts, PANEL principles, Environmental protection

[1] Department of Mineral, Petroluem, Energy Economics and Law, University of Ibadan, Ibadan, Nigeria; ifesinachiokonji@gmail.com

Introduction

Trade and development in Africa is driven by the activities of extractive industries in exploration, exploitation, mining and processing of natural resources such as metals and minerals which said activities are founded upon contracts with governments of the country where such natural resources found are being extracted. These contracts are basically in form of licenses containing the terms of engagement of the extractor by the government of such country. It defines the term of years granted for mining operations, the size of the mass area granted for operation, the name of the extractor, expiration date of the license, terms for revocation of license which includes failure or refusal to pay license fees and other fees or charges as maybe levied; breach of laws or regulations governing the operations of the industry, etc. It is relevant to note that an extractive industry may be sanctioned for violation of laws or regulations governing the industry which is tantamount to breach of contract that can lead to revocation of license.

Mining, exploration, exploitation, and processing of natural resources are usually carried out by extractive industries mostly consisting of multi-national and international companies from developed countries engaged by African countries under contracts. Unfortunately, activities of these extractive industries causes environmental problems such as pollution (air, water and soil), global warming, emission of CO2 and greenhouse gases, loss of biodiversity, damage to ecosystem, improper waste disposal, deforestation, depletion of the ozone layer, acid rain and public health issues which violate right to a healthy environment. Hence, there is a need to develop and incorporate into Licenses issued to extractive industries in Africa, a Uniform Climate Mitigation Standards of operations in Extractive industries' contracts for Environmental protection and Development in Africa. This will ensure stricter compliance of extractive industries with such Standards regulating their operations in order to protect climate, secure healthy environment, lives and economy of present and future generations, while ensuring the desired development.

Literature Reviews

Effects of Extractive Industry Operations on the Environment And Climate Change in Africa

Extractive industries are organisations involved in the business of taking raw materials, including oil, coal, gold, iron, copper and other minerals, from the earth. The industrial processes for extracting minerals include drilling and pumping, quarrying, and mining.[2] Extractive Industries in Africa comprise of multinational and international companies involved in the business of exploration, exploitation,

[2] Open Development Initiative. Retrieved October 11, 2022 from https://opendevelopmentmekong.net/topics/extractive-industries/#:~:text=Extractive%20industries%20are%20the%20businesses,pumping%2C%20quarrying%2C%20and%20mining.

mining and processing of natural resources including metals such as lithium, bauxite, cobalt, aluminium, tantalum, gold, iron, steel, zinc, titanium, and copper; minerals such as diamonds, gypsum, salt, graphite, coal, uranium, platinum, chromium, phosphate rock; petroleum oil and gas. Governments of African countries issue licenses for mining, exploration and exploitation of their natural resources to Extractive Industries (multinational and international companies) in the form of Contracts for extraction of natural resources such as metals and minerals.

The effects of the operations of extractive industries on the environment and climate change in Africa can be seen in degradation of the environment via air, water and land pollution, destruction of farmlands via oil pollution on land and water, destruction of ecosystem and biodiversity and depletion of the ozone layer via emission of greenhouse gases into the atmosphere emanating from activities of mining, exploration, exploitation and processing of natural resources such as minerals and metals. For instance, gold mining operations cover wide areas and thus can inflict environmental damage over a geographically wide area. In gold mining, pristine environment is destroyed, drinking water contaminated, land is polluted with mercury and cyanide endangering the lives of people and ecosystems creating huge negative implications on the environment, from digging out huge pits to disposing of leftover chemicals and tailings. The traditional cyanide leaching technique process particularly adopted in extracting gold, damages the environment, infringes the principle of sustainable development, consumes large quantities of water and energy, contributes to global warming, emits hydrogen cyanide and creates a morass of hazardous waste. Land, water, and air pollution are all a byproduct of gold mining through the cyanide heap-leaching method. Due to the nature and quantities of chemicals used in processing gold, the process disturbs underground water and pollutes water systems, and simultaneously creates mountains of toxic waste.[3] In copper mining, land is degraded, water and air are polluted from sulphuric acid, which severely affect those people residing near the mines.[4] The mining of iron ore is highly energy intensive and causes air pollution in the form of nitrous oxide, carbon dioxide, carbon monoxide, and sulfur dioxide from diesel generators, trucks and other

[3] Clean Earth Technologies. 2022. The Environmental Impact of Gold Mines: Pollution by heavy metals. Retrieved September 23, 2022 from https://www.cleanearth.tech/news-insights/the-environmental-impact-of-gold-mines-pollution-by-heavy-metals#:~:text=Gold%20Mining&text=This%20process%20is%20particularly%20damaging,a%20morass%20of%20hazardous%20waste.

[4] Danwatch, Impacts of Copper Mining on people and nature. Retrieved September 23, 2022 from https://old.danwatch.dk/undersogelseskapitel/impacts-of-copper-mining-on-people-and-nature/#:~:text=Land%20degradation.,affect%20those%20residing%20near%20mines.

equipment; including water pollution of heavy metals and acid that drains from the mines.[5] Natural disasters, especially droughts, floods and storms occur due to vulnerability to climate change emanating from extractive industry activities such as logging which leads to deforestation causing land degradation, exacerbated flooding, coastal erosion (mostly from loss of mangroves) and sedimentation.[6]

It is established that activities of extractive industries, directly result in a wide range of adverse environmental, social and human rights impacts, especially in countries where governance and institutional quality is low.[7] For example, the adverse environmental impacts of oil and gas production in the Niger Delta area of Nigeria has been documented in several studies, including the 2011 report of the United Nations. In many other resource rich countries, petroleum operations and mining have left thousands of sites and cities worldwide contaminated by oil spillage, gas flaring, discharge of heavy metals from mining and associated mine dumps, such as tailings and slag material. Large-scale environmental problems, such as climate change, water pollution, air pollution, loss of biodiversity, trade in endangered plant and animal species, and forced displacements amongst others, resulting from resource exploitation and other industrial activities accentuate the need for greater corporate accountability for environmental harm, especially when operating transnationally.[8]

According to Damilola S. Olawuyi, ever since the 1972 Stockholm Declaration proclaimed that man's natural and man-made environment are essential to his well-being and to the enjoyment of basic human rights, especially the right to life, there has been a general consensus that a clean and healthy environment is an essential condition for the enjoyment of all human rights. The environment consists of water, air, land, plants, animals, humans and other living organisms that make up the ecosystem.[9] It

[5] The World Counts. 2022. Environmental Impact of Steel Production: Mining of Iron Ore. Retrieved September 23, 2022 from https://www.theworldcounts.com/challenges/planet-earth/mining/environmental-impact-of-steel-production

[6] Gunilla Ölund Wingqvist. 2011. Environment and Climate Change Policy Brief – Mozambique. Page 1. Retrieved April 29, 2022 from https://biofund.org.mz/wp-content/uploads/2018/06/1528198263-Mozambique-Env-and-CC-Policy-Brief_20111.pdf

[7] Damilola S. Olawuyi. 2021. Corporate Accountability for the Natural Environment and Climate Change in The Cambridge Companion to Business and Human Rights Law (pp.234-259) at page 234-235. Ilias Bantekas and Michael Ashley stein (Editors) DOI:10.1017/9781108907293.012. Retrieved October 12th, 2022 from https://www.researchgate.net/publication/354506728_Corporate_Accountability_for_the_Natural_Environment_and_Climate_Change

[8] Ibid. 235

[9] Damilola S. Olawuyi. 2021. Corporate Accountability for the Natural Environment and Climate Change in The Cambridge Companion to Business and Human Rights Law (pp.234-259) at page 234. Ilias Bantekas and Michael Ashley stein (Editors) DOI:10.1017/9781108907293.012. Retrieved October 12th, 2022 from https://www.researchgate.net/publication/354506728_Corporate_Accountability_for_the_Natural_Environment_and_Climate_Change

therefore becomes paramount to address the problems, environmental degradation and climate change caused by the activities of extractive industries in Africa.

Uniform Climate Mitigation Standards for Regulated Environmental Impact And Social Stewardship in Extractive Industries Operations in Africa

African countries have developed various different mechanisms to ensure safety of environment, humanity and economy of the society. However, they have not improved the condition for protection of the African environment. Issues of oil pollution of farm lands and fishing rivers from oil spillages, depletion of ozone layers via the emission of green house gases from gas flaring, destruction landscapes, contamination of water supplies, destruction of vital ecosystems via the release of cyanide, mercury, zinc and other substances from activities of gold mining. It is therefore important that a uniform Climate mitigation standards for regulated environmental impact and social stewardship in extractive industries operations in Africa, is created for the realisation of environmental protection and guaranteed development. These has to be developed along Climate ethical lines to ensure justice, protection and preservation of human, environment and economy of both present and future generations. In this vein, Olawuyi proposed the PANEL principles (participation, accountability, non-discrimination and equality, empowerment and legality).[10] These principles formulated from interconnected international human rights norms and principle, when framed as Standards incorporated into extractive industries' contracts, would ensure their enforce-ability under a contractual obligation to be integrated into business planning processes. Hence, incorporating the PANEL principles into Standards of contractual obligations.

Incorporation of the PANEL Principles into Uniform Climate Mitigation Standards in Extractive Industries' Contracts in Africa

Participation

Participation is the right of the public to 'take part in', and 'influence' decision-making processes on activities and projects that may affect them.[11] Taking part simply means having the chance

[10] See UN Practitioners' Portal on Human Rights Based Approaches to Programming, 'The Human Rights Based Approach to Development Cooperation: Towards a Common Understanding Among UN Agencies', available at: ttp://hrbaportal.org/the-human-rightsbased-approach-to-development-cooperation-towards-a-common-understanding-amongun-agencies [HRBA Portal]. See also Scottish Human Rights Commission, 'A Human Rights Based Approach: An Introduction', available at: www.scottishhumanrights.com/media/1409/shrc_hrba_leaflflet.pdf.

[11] D Olawuyi, The Human Rights Based Approach to Carbon Finance (Cambridge University Press 2018) 1–25

to freely express one's views without pressure and manipulation in an authentic deliberative process.[12] Influencing a decision is to have an effect on the final outcome of the deliberative process. Hence, the public's opinion must not just be aired but must be reflected in the actions and steps following the deliberative process.[13]

An authentic participatory process is marked by the concept of free prior informed consent (FPIC). FPIC underlines the idea that consent must be freely given and obtained prior to implementation of activities, and be founded upon an understanding of the full range of issues implicated by the activity or decision in question.[14] Making the principle of Participation a standard under extractive industries' contracts, will require that extractive industries in compliance with their contractual obligations, in their operations and business enterprises to carefully undertake due diligence processes that enable them to understand the full range and impact of their activities on the environment, local communities and indigenous peoples. This would include assessing actual and potential human and environmental rights impacts, integrating and acting upon the findings, tracking responses and communicating how impacts are addressed.

In the conduct of due diligence by extractive industries (for instance, in the mining of gold, coal, petroleum oil and gas business, etc), they should aim at fully understanding, auditing and reviewing prospective projects by measuring their impact on human and environment. Robust low carbon emission sustainability and toxic waste management plans to be adhered by such extractive industry must be put in place before entering or commencing into a proposed transaction, investment or activity relating to the business of extraction of such natural resources. International environmental principles such as prevention, precaution, polluter pays and sustainable development are values that must be incorporated in due diligence. The outcome of due diligence can form the basis for reviewing proposed transactions and investment plans for positive social, environmental and economic viability.[15] For example, if the environmental cost is high, then the enterprise may make an informed decision on whether to proceed with the project, and if so, how to systematically address and lower such adverse social, environmental

[12] See UNEP, UN-REDD Programme Guidelines on Free Prior Informed Consent (UNEP 2012) 7

[13] Damilola S. Olawuyi. 2021. Corporate Accountability for the Natural Environment and Climate Change in The Cambridge Companion to Business and Human Rights Law (pp.234-259) at page 244 to 245. Ilias Bantekas and Michael Ashley stein (Editors) DOI:10.1017/9781108907293.012. Retrieved October 12th, 2022 from https://www.researchgate.net/publication/354506728_Corporate_Accountability_for_the_Natural_Environment_and_Climate_Change

[14] See UNEP, UN-REDD Programme Guidelines on Free Prior Informed Consent (UNEP 2012) 7.

[15] OECD, 'Responsible Business Conduct for Institutional Investors: Key Considerations for Due Diligence under the OECD Guidelines for Multinational Enterprises' (2017), available at: https://mneguidelines.oecd.org/RBC-for-Institutional-Investors.pdf.

and human rights risks.[16] This would also help an enterprise to consistently apply international human rights standards even when operating in countries where environmental and human rights standards are weak.

In addition to the above, Participation as a Standard to be entrenched in extractive industries' contracts will require a conduct of human rights impact assessment (HRIA), prior to the commencement of business activities and projects, to help enterprises to fully understand, anticipate and prevent adverse human rights impacts. For example, HRIAs have been increasingly mandated by international financial institutions such as the World Bank.[17] As rightly defined by the World Bank, HRIA is an instrument for examining policies, legislation, programs and projects to identify and measure their effects on human rights. The HRIA threshold, as an element of the HRBA framework, requires project proponents to flag the likely impact of an energy access project on fundamental human rights, and demonstrate that the PANEL Principles have been complied with in the design, approval, financing and implementation of energy access projects.[18] Different projects are likely to affect certain rights more than others and in different ways. For example, gold mining project may result in destruction of farmlands and pristine environments. This would violate several human rights, including subsistence rights where crops are destroyed, or the right to health where toxic wastes discharged causes the transmission of diseases. In an oil and gas mining project, for instance, where adequate steps have been taken to avoid emission of greenhouse gases by adopting collection of gas instead of flaring, the rights of indigenous communities to use lands for cultural and religious purposes and the right to food may be violated. Through a comprehensive HRIA, project proponents can systematically identify, predict and mitigate the potential adverse human rights impacts of such an investment or project.

By entrenching the principle of Participation into extractive industries' contracts as Standards, compliance is made a contractual obligation which serves to mitigate the climate change challenges.

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[16] Ibid. 245 to 246

[17] World Bank, 'Human Rights Impact Assessment: A Review of the Literature, Differences with other forms of Assessments and Relevance for Development' (2013), available at: http://siteresources.worldbank.org/PROJECTS/Resources/40940–1331068268558/HRIA_Web.pdf. See also European Commission Directorate General for Trade, 'Guidelines on the analysis of human rights impacts in impact assessments for trade-related policy initiatives', available at: https://trade.ec.europa.eu/doclib/docs/2015/july/tradoc_153591.pdf.

[18] J Harrison, 'Establishing a Meaningful Human Rights Due Diligence Process for Corporations: Learning from Experience of Human Rights Impact Assessment' (2013) 31 Impact Assessment and Project Appraisal 107; also International Business Leaders Forum, & International Finance Corporation, Guide to Human Rights Impact Assessment and Management (HRIAM 2010) 1–5.

Failure to comply with this Standard is a breach of contract that might lead to revocation of license which the companies involved would not want to suffer.

Accountability

Accountability concerns the obligation to monitor and demonstrate that a project has been conducted in accordance with agreed rules and standards and to report fairly and accurately on performance results vis-à-vis mandated roles and/or plans.[19] Making the principle of Accountability a Standard under the extractive industries' contracts would create a contractual obligation on the part of extractive industries to disclose and give account of their operations under the licenses they operate. Hence, the UNGPs encouragement of business enterprises to have in place policies, processes and commitment that enable them to show that they respect human rights,[20] would become obligatory. In complying with the Standard of Accountability, extractive industries would be required to measure, review and monitor the level at which human rights, particularly those relating to the environment, are respected and fulfilled in their entire value chain.

Lack of accountability of business enterprises and investors in activities and projects in extractive industries, especially in developing countries have received scholarly attention over the last decade.[21] Acts of failure to monitor and redress human rights and environmental violations in extractive industries business activities of exploration, exploitation, mining and processing of natural resources, etc are matters of concern for the Standard of Accountability.

Compliance with Accountability Standard will include the adoption of clear environmental standards in project design, staff training, supervision, material sourcing and selection, manufacturing processes, delivery, as well as end-of-life activities such as closure and abandonment.[22] Accountability

[19] Damilola S. Olawuyi. 2021. Corporate Accountability for the Natural Environment and Climate Change in The Cambridge Companion to Business and Human Rights Law (pp.234-259) at page 247. Ilias Bantekas and Michael Ashley stein (Editors) DOI:10.1017/9781108907293.012. Retrieved October 12th, 2022 from https://www.researchgate.net/publication/354506728_Corporate_Accountability_for_the_Natural_Environment_and_Climate_Change. See D Olawuyi, The Human Rights Based Approach to Carbon Finance (Cambridge University Press 2018) 1–25. see also, L Catá Backer, 'Unpacking Accountability in Business and Human Rights: The Multinational Enterprise, the State, and the International Community' in Enneking, et al

[20] UNGPs (n. 20) principles 16 to 24

[21] D Olawuyi, 'Fostering Accountability in Large-Scale Environmental Projects: Lessons from CDM and REDD+ Projects' (2015) 6 The World Bank Legal Review 127; N Roht-Arriaza, 'Human Rights in the Climate Change Regime' (2010) 1 Journal of Human Rights and the Environment 211. Backer (n.16)

[22] See generally, D Olawuyi (n.16) 248

Standard will include extractive industries' active commitment to green supply chain management standards such as the CERES Principles[23], Guiding Principles on Reducing Methane Emissions and other voluntary initiatives that aim to reduce waste, promote efficiency and eliminate adverse environmental impacts of extractive activities. It will also include the establishment of internal compliance and review teams responsible for monitoring compliance with their environmental programs and objectives; and empowered to inspect project locations to ensure that projects are being executed based on approved guidelines and methodologies. By complying with Accountability Standards, extractive industries will be reducing environmental harm and contributing to the protection of human rights relating to safe, healthy and satisfactory environment in local communities. Compliance here would be born out of contractual obligation with sanctions for example, revocation of license which the companies involved would not want to suffer.

Non-discrimination and Equality

The principle of Non-discrimination and Equality entails that business enterprises take responsibility to ensure equal rights of participation of vulnerable groups including women and youths in project management, and that no decisions directly affecting their environment are taken without their active participation and informed consent.[24] While the principle of participation is concerned with the process of participation in decision making, the principle of non-discrimination and equality is concerned with involving persons (whether there are proper and adequate representations) taking part in the decision making. For instance, in locating a high polluting factory, communities must be consulted and well informed to avoid inequitable distribution of the benefits and burdens of the project. By Principle 20 of the UNGPs, business enterprises are enjoined to track the effectiveness of their response in order to verify whether adverse human rights impacts are being addressed, which can be determined from measuring and ensuring that the burden of negative environmental consequences does not fall on vulnerable racial, ethnic and socio-economic groups. Though not legally binding principle, these norms accentuate the importance of sharing the environmental burden of investments activities and projects across society.

Implementing non-discriminatory policies in extractive industries would include developing clear internal guidelines and criteria for selecting project locations, conducting vulnerability assessments to determine the adverse human and environmental rights impacts of a project on women,

[23] Coalition for Environmental Responsible Economies (CERES) Principles, available at: www .iisd.org/business/tools/principles_ceres.aspx. See generally, D Olawuyi (n.16) 248

[24] UNGPs (n. 20), Principles 12 and 13.

youths, poor communities as well as other vulnerable groups. To prevent activities that discriminate based on status or gender, there is the need for extractive industries to establish an internal database for assessing risks on the basis of income, gender roles and the constraints operating against their participation in decision-making processes. The issue of non-discrimination can be addressed by ensuring that official data on project location and impact is dis-aggregated, by religion, ethnicity, language, sex, migrant status, age and any other category of human rights. This also includes incorporating vulnerability proofing as part of the wider human rights proofing of all mitigation plans and measures. For example, gender and income-proofing will help to assess the implications for low income people and women of any planned project, the representation afforded to such categories in decision-making and ways to protect the interests of the marginalised either by redesigning the project to avoid harmful impacts or refusing to proceed with it if such impacts cannot be effectively addressed.

Empowerment and Access to Information

Principle 21 of the UNGPs addresses the need for business enterprises to communicate and report formally on how their actions, programs and activities advance human rights. By providing clear and transparent information, members of the local communities will be able to understand how the development of investment projects and activities could affect their lives in the short and long term. The obligations of business enterprises to proactively publish reports that demonstrate compliance with legislation and rules is a fundamental part of the company laws of virtually all countries.[25] The UNGPs however encourage states and business enterprises to integrate environmental, social and human rights compliance into such corporate disclosures and reports.[26]

The importance of corporate reporting as a tool for communicating environmental performance cannot be over emphasised.[27] Generally the public has a right to access information on how activities and projects could affect them in the short and long term. The obligations of corporations to report on environment compliance aligns with increasing demands for transparency and information disclosure at national and international levels. The core elements of access to information (ATI) include maximum disclosure of project information, obligation to publish and disclose new information, establishing processes to facilitate timely access to information at a reasonable cost and increased public education and awareness. Corporate reporting and proactive public disclosure provide opportunities and tools for the public to effectively evaluate projects, understand their potential human rights impacts and evaluate efforts designed by the project proponent to mitigate those concerns. For example, one of the key causes

[25] See C Leuz, 'Different Approaches to Corporate Reporting Regulation: How Jurisdictions Differ and Why', European Corporate Governance Institute Law Working Paper No. 156/ 2010.
[26] Principle 3 (d), UNGPs
[27] MW Allen, CA Craig, 'Rethinking Corporate Social Responsibility in the Age of Climate Change: A Communication Perspective' (2016) 1 Int J Corp Soc Responsibility 1–11.

of environmental pollution in many countries arises from the fact that local communities are hardly provided adequate information on the likely impacts and benefits of projects. Enforcing corporate reporting and proactive self disclosure in extractive industries contract is very important to provide adequate avenues for the public in several developing countries to access project information.

Legality and Access to Remedies

Legality refers to the obligation of business enterprises to comply with all applicable laws and norms relating to human rights. For example, Principle 23 of the UNGPs requires business enterprises to comply with all applicable laws and international human rights norms in their spheres of operations. Many of the environmental concerns facing our current world can be mitigated and addressed if business enterprises including extractive industries take active steps to ensure full compliance with all human rights and environmental legislation and requirements in their spheres of operation. In order to avoid adverse human rights impacts, responsible business enterprises must take active steps to comply with environmental obligations relating to prevention, precaution, use of best available technologies, risk mitigation, polluter-pays and sustainable development as required in many domestic legislation and industry guidelines. As emphasised in Principle 13 of the UNGPs, lack of stringent legislation or enforcement in a jurisdiction should not be a reason for business enterprises to deviate from international environment and human rights principles. For example, the UK Supreme Court in Vedanta v. Lungowe, highlights the obligations of UK companies and their subsidiaries to prevent environmental damage when operating in developing countries.[28]

Furthermore, Principle 22 provides that 'where business enterprises identify that they have caused or contributed to adverse impacts, they should provide for or cooperate in their remediation through legitimate processes'.[29] This recognises the need for business enterprises to avoid unsustainable abandonment of their toxic by-products or wastes without proper clean-up or remediation. For example, many domestic legislation recognise the polluter pays principle which holds a polluting party responsible for the cost of clean-up, remediation and compensation. This also includes obligations of polluters to report pollution and cooperate with relevant agencies in the clean-up verification and inspection processes. However, in some countries, there have been concerns of failure to report pollution in the time prescribed, lack of cooperation by business enterprises in clean-up processes or failure to pay compensation to local communities when so due.[30] For example, unsustainable mine and oil field closures have been rated among the top five operating risks in many parts of the world.

[28] Vedanta Resources Plc and Anor (Appellants) v. Lungowe and Ors (Respondents) [2019] UKSC 20, para. 53
[29] UNGPs
[30] See for example D Olawuyi, Z Tubondenyefa, Review of the Environmental Guidelines and Standards for the Petroleum Industry in Nigeria (Institute for Oil, Gas, Energy, Environment and Sustainable Development, 2019) 1–25. Available at: https://docs .wixstatic.com/ugd/60b422_74da66d41dfa41b2963c73772cffafd1.pdf.

Unsustainable decommissioning of mines and oil fields has resulted in the contamination of lands, water and communities in many parts of Africa. Given the negative implications of environmental damage on human rights, it is important to undertake clean-up and remediation obligations in a fair, timely and effective manner.[31]

Business enterprises including extractive industries must proactively develop holistic and comprehensive guidelines and processes that consider all environmental, social and economic risks in their activities and projects in order to promote good social and environmental outcomes and protection.[32] Responsible business enterprises including extractive industries should put in place detailed corporate risk management processes that provide opportunities for the public to access remedies for any adverse impacts of their activities on the environment.[33] Access to remedies refers to the availability of mechanisms, either formal or informal through which the public can seek compensation, rehabilitation and other legal remedies for human rights violations resulting from business activities or projects. For example, in many countries, business enterprises are often compulsorily mandated by law to contribute assets into environmental restoration funds in the form of surety bond, trust fund, self-insurance or corporate guarantees, prior to the commencement of operations, for the purpose of guaranteeing their environmental obligations throughout the entire project life cycle,[34] to avoid lack of environmental restoration and destruction of the ecosystems of local communities where high polluting factories and industries are located. Maintaining financial assurance mechanisms would enable business enterprises including extractive industries to meet their environmental remediation, rehabilitation and compensation obligations during the entire life cycle of their projects.

Methodology

The doctrinal research method was used to access and assess relevant materials to the research work. Literatures, conventions, cases and other relevant journals were analysed in addressing the environmental challenges created by extractive industries in their operations, and to develop and propose a uniform climate mitigation standards for incorporation into Extractive Industries' Contracts in Africa that will guarantee preservation of environment and development of Africa.

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[31] World Bank, 'Towards Sustainable Decommissioning and Closure of Oil Fields and Mines: A Toolkit to Assist Government Agencies' (March 2010), available at: http://siteresources.worldbank.org/EXTOGMC/Resources/336929–1258667423902/decommission_toolkit3_full.pdf.

[32] ICMM, Integrated Mine Closure: Good Practice Guide (December, 2018) 6–7. Available at: www.icmm.com/website/publications/pdfs/closure/190107_good_practice_guide_web.pdf. 252

[33] Principle 29 of the UNGPs

[34] See for example, s. 121 of the Nigerian Minerals and Mining Act (NMMA), 2007, which establishes an Environmental Protection and Rehabilitation Fund (EPRF) to be funded by contributions by mineral title holders on a yearly basis for the 'purpose of guaranteeing the environmental obligations of Holders of Minerals title'. See also, NMMA (n. 78); see also K Sinding, P Peck, 'Financial Assurance and Mine Closure: Stakeholder Expectations and Effects on Operating Decisions' (2009) 34 Resources Policy 227.

Results and Discussion

African countries should shun the culture of approving projects, exploiting natural resources and promoting foreign investments, without regard to the environmental and human rights impacts on local communities.[35] Incorporating the PANEL principles into extractive industries contracts as uniform climate mitigating standards to create an obligatory duty that will ensure good environmental and human rights outcomes and protection, is key. It will guarantee the realisation of Sustainable Development Goals 13 and 1, climate action and no poverty, respectively. It will enhance protection of the environment and social systems; build a resilient environmental, economic and social disasters ("SDG + Target: 1.3.5") especially, integrating climate change measures into policies and planning ("SDG + Target: 13.2"). It is worthy to note that the result of this study is of immense and valuable contribution to the topic of the conference, "Half-way through Agenda 2030: Assessing the 5Ps of SDGs (people, planet, prosperity, peace and partnership)", because the recommendations address the myth of resource curse in Africa, and provides a pathway for protection and preservation of the planet while advancing the prosperity of the African continent.

The African Union is called upon to develop and adopt this Uniform Climate Change Mitigating Standard of Operations for Extractive Industries in form of a Convention biding on parties signatories to it, to take positive steps to domesticate and apply same in their national laws and operations of Extractive Industries Contracts. It is important to hold extractive industries to account for adverse environmental impacts of their operations in Africa. Several resolutions, declarations and expert reports, such as the Guiding Principles on Business and Human Rights: Implementing the United Nations 'Protect, Respect and Remedy' Framework (the UNGPs) though not legally binding,[36] elaborate that business enterprises including extractive industries have a responsibility to respect, protect and fulfil human rights and environmental protection rights in their operations and investments which affects the environment, especially climate change.[37] Olawuyi[38] rightly identified that there is absence of detailed operational guidelines on what responsible corporations should do to advance business and human

[35] See for example, Shell Energy's Citizens Advice Consumer Service (CACS) and Energy Ombudsman services, available at: www.shellenergy.co.uk/services/how-we-handlecomplaints. See also, for example, Shell Energy's Citizens Advice Consumer Service (CACS) and Energy Ombudsman services, available at: www.shellenergy.co.uk/services/how-we-handlecomplaints.

[36] Guiding Principles on Business and Human Rights: Implementing the United Nations 'Protect, Respect and Remedy' Framework [UNGPs] available at: www.ohchr.org/documents/publications/guidingprinciplesbusinesshr_en.pdf.

[37] Damilola S. Olawuyi. 2021. Corporate Accountability for the Natural Environment and Climate Change in The Cambridge Companion to Business and Human Rights Law (pp.234-259) at page 238. Ilias Bantekas and Michael Ashley stein (Editors) DOI:10.1017/9781108907293.012. Retrieved October 12th, 2022 from https://www.researchgate.net/publication/354506728_Corporate_Accountability_for_the_Natural_Environment_and_Climate_Change

[38] Ibid. 236 to 237.

rights norms relating to environmental protection in their spheres of operations. To fill this gap, he proposed the the implementation of participation, accountability, non-discrimination and equality, empowerment and legality (the PANEL principles) in the design, approval, finance and implementation of their operations and projects, to enable their proactive tackling of environmental risks across their entire business value chain.

Conclusion

While concurring with the above proposition, the writer notes that it is important to for African countries to take a decisive step further for the realisation of these principles by entrenching them in the extractive industries contracts to make them contractual obligations, mandatory and enforceable with sanctions when they are violated. This will demystify the myth of resource curse in Africa and ensure preservation of environment and development of Africa.

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TRACK 10
Special themes

10b. Sustainability and ASEAN

Abstracts

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Integrated River Basin Management Approach towards Effective Climate Change Mitigation and Adaptation in Malaysia

Dr Rasyikah Md Khalid, Dr Hanim Kamaruddin, Dr Muhammad Sayuti Hassan
Faculty of Law, Universiti Kebangsaan Malaysia (UKM), Bangi Selangor, Malaysia

Abstract

Climate related impact, including sea level rise, severe floods and water shortages has posed challenges to all Malaysians. The increasing temperature trends of 0.130C to 0.24oC per decade have been observed and reported in the Malaysia's 2020 Third Biennial Update Report. Greater rainfall intensity is projected until 2050 that would result in an increase of sea water level and severe flooding. The number of affected persons attributed to disasters, mainly floods and seasonal monsoon, increased from 57,946 victims in 2015 to 86,406 in 2019. Terrestrial biodiversity in Malaysian forests remains vulnerable to climate change impacts with 55% of the land remained forested. The greenhouse gas (GHG) inventory described in Malaysia's BUR3 detailed the anthropogenic emissions and removals for the year 2016 in four major sectors: energy (79.4%); industrial processes and product use (IPPU) (8.6%); waste (8.6%) and agriculture, forestry, and other land use (AFOLU) (3.4%). The Ministry of Natural Resources, Environment and Climate Change (NRECC) has been the focal point on climate change mitigation and adaptation. However, as Malaysia is a federation there are matters relevant to climate change which falls under the exclusive jurisdiction of the state government. The study found that two of the major sectors in the GHG inventory, agriculture, and forestry, as well as land use, are within the exclusive jurisdiction of the state and local government. Thus, there are constraints, gaps and needs for fulfilling NRECC's reporting obligation and implementation of climate change strategies. It is proposed that integrated river basin management (IRBM) to be the suitable approach to mitigate and adapt climate change in Malaysia. It requires a close coordination between land use and water resources management so as to ensure sustainable water management that meets the need of the present and future generation. This requires close cooperation between levels of government is pertinent in ensuring effective climate change mitigation and adaptation. This will help NRECC to meet the goals of SDG 6 on clean water, SDG 13 on climate action, SDG 15 on life on land, and SDG 7 on partnership.

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ASEAN Declaration on Heritage Parks and Cultural Heritage: Assessing the Progress Made in Malaysia

Rasyikah Khalid[1], Nor Zalina Haron[1], Nurul Huda Adabiah[2], Suhaimi Ab Rahman[3], Sharina Halim[1]
[1]Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia. [2]Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia. [3]Universiti Putra Malaysia, Serdang, Selangor, Malaysia

Abstract

ASEAN member states have committed to protecting their cultural and natural heritage through two important declarations. Under the ASEAN Declaration of Cultural Heritage, each ASEAN Member Country must identify, delineate, protect, conserve, promote, develop and transmit to future generations the significant cultural heritage within its territory and to avail of regional and international assistance and cooperation, wherever necessary and appropriate. They must also recognize that the national cultural heritage of Member Countries constitutes the heritage of Southeast Asia, for whose protection it is the duty of ASEAN as a whole to cooperate. On the other hand, the ASEAN Declaration on Heritage Parks calls for cooperation to conserve and manage ASEAN Heritage Parks to develop and implement regional conservation and management action plans. This paper will evaluate Malaysia's initiatives and impediments to protecting her cultural and natural heritage in line with the commitments given under the two declarations. The researchers found that the similarity of Malay cultures among ASEAN countries has caused conflict regarding UNESCO listing. At the same time, the jurisdictional divide between federal-state and state-state in Malaysia has impeded several nominations of natural heritage in the country. Better protection of cultural and natural heritage will elevate the protection of life on land under SDG 15 and promotes better partnership among ASEAN countries toward sustainable development under SDG 17.

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Family Development Sessions (FDS) as a Pandemic Response: The Conditional Cash Transfer of the Philippines

Dr. Ana Leah Cuizon
University of the Philippines Cebu, Cebu City, Philippines

DR. ANA LEAH CUIZON

Abstract

This study seeks to account the impact of the Family Development Sessions (FDS), as a conditionality in the conduct of the Pantawid Pamilyang Pilipino Program (4Ps). 4Ps, a conditional cash transfer program, the Philippines' banner program in its goal for poverty alleviation. It has been institutionalized in 2019 through Republic Act 11310, An Act Institutionalizing the Pantawid Pamilyang Pilipino Program. During the pandemic, all sectors of the economy were adversely affected. Filipino families were at the core of this economic struggle, more so, are the families in the margins – the Pantawid households. FDS is the monthly meeting of Pantawid households organized by the municipal links (ML) of the Department of Social Welfare and Development-Field Offices in partnership with the LGU representatives. There are identified modules to be delivered per FDS session, nonetheless the advent of the pandemic allowed these sessions to transition and to innovate. FDS has become an avenue for community initiatives and collaborations as Pantawid households learn to struggle and to survive together. Later, these community initiatives translate to success stories that reflect the significance of FDS beyond being a conditionality towards the availment of the cash grants corollary to being identified as beneficiaries of 4Ps. Thus, FDS became a mechanism of empowerment for the Pantawid households. This study utilizes a qualitative method in exploring the narratives of the Pantawid households during the pandemic (FY 2019-2022) vis-a-vis community initiatives organized through the FDS. On the aspect of empowerment, the analysis will use the framework of Elizabeth Rocha's Ladders of Empowerment. It is revealed that FDS created positive impact on the Pantawid households especially during the economic pandemic struggle. The sessions have given opportunities for convergence of the households in sharing their struggles, exchanging ideas on alternative means of addressing their challenges, tapping different government agencies in the provision for services, and creating new paradigms and decision-making at the grassroots level. In gist, the FDS is effective in engaging the beneficiaries, providing them a sense of personal empowerment as they partake in the community initiatives during the pandemic. This proposal resonates SDG 11 – Make cities and human settlements inclusive, safe, resilient and sustainable; 11.3 by 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries. FDS takes the form of a participatory planning program that prioritizes the integration of technical expertise with the preferences and knowledge of community members in the planning process. It forges consensus building and collective community decision making while encouraging active participation of traditionally marginalized groups in the planning process. It relates to the conference theme as it probes the victories of 4Ps through its FDS. In empowering the community, the final rung of the ladder still remains elusive. Empowerment is still deemed to be personal rather than communal. For genuinely inclusive, safe, resilient and sustainable communities, much still has to be done. But we are moving forward, nevertheless.

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Cross-border grid digitalisation in ASEAN Power Grid: Institutional imperatives for scaling up renewable energy integration

Dr. Weena Gera
University of the Philippines Cebu, Cebu City, Philippines

Abstract

The world's most critical climate imperative today is to accelerate clean energy transition -- the most consequential of which, is to thoroughly decarbonise the electricity sector by mid-century. This means fossil fuel assets, particularly coal power would have to be decisively phased out, with renewables massively scaled-up, integrated in electricity generation systems, inclusively shared, and efficiently utilised. The premise of this paper is that cross-border grid digitalisation is a necessary complement to interconnections, which can facilitate a renewable-driven regional energy trade, and should be a priority if power system integration is to be aligned with decarbonisation agenda. In Southeast Asia, interconnecting and smartening power grids are identified as key strategies to transitioning to renewables, creating efficiency, and strengthening the region's energy security. The call for digitalisation of the energy system is reiterated in the 7th ASEAN Energy Outlook 2022 stating that, "Energy supply trails behind installed capacity by almost half of its value, indicating the efficient utilisation of renewables is a priority… smarter and more flexible grid infrastructures, are required to address higher penetration of RE in the future." Notably however, smart grid development in the region remains to be individual country endeavours. Amid a growing focus on 'low-carbon power integration', 'regionally interconnected green grids' and 'green power corridors' in recent discourses on the APG, there is limited reference on initiating cross-border smart grids in the region. The investment trajectory within the APG also remains focused on electricity interconnections absent a clear institutional framework for integration of distributed generation and emerging technologies into shared power systems. Drawing from policy discourses, technical and news reports, and academic analyses, this paper examines the case of Lao PDR-Thailand-Malaysia-Singapore Power Integration Project (LTMS-PIP). It identifies country policy motivations, incentives and emerging opportunity-paths for cooperation in cross-border grid digitalisation (i.e. cross-border smart grids) between partner countries towards scaling up renewable energy integration into shared power system, and the key institutional constraints that can be negotiated foremost. It then outlines priority regulatory policies and strategies that may lend reference for ASEAN to designing a regional governance framework for cross-border digitalisation towards a low-carbon APG.

1. While the thrust for clean energy transition is all encompassing, the paper responds directly to SDG 7 and all its five targets; SDG 9.1, 9.4, 9.c; SDG 13.2, and 17.3, 17.6, 17.7, 17.14.
2. The paper also responds directly to the theme of the conference. Promoting clean energy transition through decarbonisation and integration of renewable energy resources in electricity systems in the context of regional integration/cross-border cooperation, cuts across the 5Ps of the SDGS. Especially amid the prevailing shallow integration in ASEAN, cross-border requirements compel for parity and coherence in institutional, regulatory and market arrangements to facilitate equity and effective inclusion. How these are reconciled and negotiated pose consequences on people's welfare, protection pf planetary resources, promotion of economic prosperity, of peace, and of sustained partnerships and cooperation.

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An empirical study on the impact of perceiving work as a calling and worship of God on perceived work stress of BPO employees in Cebu City, Philippines.

Prof. Tiffany Adelaine Tan
University of the Philippines Cebu, Cebu, Philippines

PROF. TIFFANY ADELAINE TAN

Abstract

This study explores the relationship between the employees' outlook on work and their perceived work stress. One popular coping strategy is Freud's defense mechanism conception where people tend to avoid or reinterpret negative thoughts. An example of this repressive coping style is to use religion or spirituality to help individuals maintain a positive view of stressful situations. Thus, this current study explores the impact of one's spirituality on perceived work stress. One's view on work measures spirituality in terms of being planned by a higher being, namely God. It focuses explicitly on perceiving work as a calling of God and worship of God. Thus, the hypotheses are (1) Perceiving work as a calling of God impacts one's perceived work stress and (2) perceiving work as worship of God impacts one's perceived work stress. The business process outsourcing (BPO) industry was chosen for this study because of its importance to the Cebu economy. Two BPO companies based in Cebu City, with a combined workforce of 1,250, were invited to participate. Out of the 1,250, 451 employees (36%) agreed to join the study and completed the online survey. In addition to the structured survey, the human resource directors of the BPO companies were interviewed. To test the hypotheses, structural equation modeling was used on the proposed constructs. The results show that only perceiving work as a worship of God impacts the perceived work stress of the respondents while viewing work as a calling of God did not. The mixed results could be explained by the confusion about what 'work as a calling of God' meant for the respondents. Upon examining the demographics statistics, it appears that most of them lack interest in pursuing to know God. For instance, although 92% of the respondents claim to belong to a denomination that believes in God, only 13% attend church every Sunday, 20% attend only once a month, and 35% do not attend at all. When asked about their attendance of church activities outside the Sunday services, 47% said zero, and 64% claim not to attend gatherings that delve deeper into the teachings of God. Thus, if one does not purposively attend activities that teach about God, then how could one know God, let alone God's calling in one's life? A second possible explanation is that the respondents confused work as a calling of God (God-centric) with their need to work for money (need-centric). As the HR directors claimed, the top reason their employees join the BPO industry is the higher salary and benefits. Thus, it's possible they view work as more of a call to fulfill financial needs. Regardless of the mixed results, we know that what we think affects how we feel and how we behave. Thus, working on our perception of work helps lower stress and burnout. This study contributes to SDG 8, Target 5. It is common knowledge that stress is counterproductive. Thus, anything that could lower perceived work stress could contribute to productive employment.

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Open search strategies and innovation performance of young firms: Evidence from Thai manufacturing industries

Associate Professor Phakpoom Tippakoon
Thammasat University, Bangkok, Thailand

Abstract

Open search strategies – search breadth and search depth – have been widely studied in the open innovation literature. However, little efforts have been made to analyze the effects of open search strategies on the innovation performance of young firms. Young firms are important economic actors with their significant contribution to economic growth, employment, and innovation. They need source external knowledge to overcome their resource limitation to generate knowledge in-house. The question is which external knowledge sourcing strategy – search breadth or search depth – is more appropriate for them. This study employs the survey data of 423 manufacturing firms in Thailand and uses the Negative Binomial Regression for the analysis of firms' product innovation. The results show that search breadth is more significant than search depth on young firms' product innovation performance (i.e., number of new products introduced into the markets). It is also found that the effects of search breadth on product innovation tend to be curvilinear taking U-shaped relationship, while the effects of search depth tends to be monotonically negative on product innovation. These results suggest that young firms should adopt the breadth strategy for enhancing their innovative performance, but should be selective in their search for external knowledge in order to avoid the over-search effects.

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CASCADING DEVELOPMENT TO THE MARGINALIZED: THE CASE OF THE BADJAO COMMUNITY IN BRGY. TOTOLAN, DAUIS, BOHOL

Dr. Ana Leah Cuizon, Atty. Cyril Bryan Cuizon
University of the Philippines Cebu, Cebu City, Philippines

DR. ANA LEAH CUIZON

ATTY. CYRIL BRYAN CUIZON

Abstract

This study sought to account the impact of the Kapit Bisig Laban sa Kahirapan - Comprehensive Integrated Delivery of Social Services -National Community Driven Development Program (Kalahi CIDSS-NCDDP) to the improvement of the day to day living of the Badjao community. Further, it traced their history, ethnicity and institutional arrangements as a group of people. This is a purely qualitative study utilizing an ethnographic method of data gathering and analysis. The data gathered was based on actual immersion and observation in the participant's real-life environment. Narrative account of actual observation is a major source of information. Key informants who have had direct access to the Badjao community for over a year and have personal knowledge of the KC-NCDD projects were identified and selected to participate and for the purpose of validation. Personal interview was conducted to the Badjao community leader and/or elders, Municipal Local Government Unit (MLGU) representatives, Municipal Inter-Agency Committee (MIAC) and Civil Society Organization (CSO) representatives. An understanding of the Badjao community's dynamics is a realization that at the core of empowerment lies the needs of the economically and socially marginalized groups. In this light, the Ladder of Empowerment proposed by Elizabeth Rocha in the Journal of Planning Education and Research (1997) is utilized in order to describe the characteristics of the Badjao Community in terms of democratic decision-making vis-à-vis individual and collective forms of community empowerment through the KALAHI-CIDSS NCDD projects. Brgy. Totolan, Dauis, Bohol is among the targeted areas of the program since 2015. The locality hosts diverse people with the presence of the Badjao community (an indigenous group of Austronesian ethnic origin). It has been noted that the participation and involvement of the Badjaos to the program had made positive impact to their daily lives. However, the degree and extent of empowerment may vary across the lens of the different stakeholders. What is positive to note is the personal recognition of the Badjao that they are Filipinos, born in the Philippines, with lives that changed through their participation and involvement to the program.

Keywords - Community Driven Development (CDD), Badjao (indigenous group), community empowerment

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FOOD SOVEREIGNTY AND TRADE LIBERALIZATION TOWARDS RICE SUSTAINABILITY

MS RUBIAH MOHD. AMIN[1], ASSOC. PROF. DR. HANIFF AHAMAT[2], DR. MUHAMAD SAYUTI HASSAN[2]
[1]Faculty of Law Universiti Kebangsaan Malaysia, Bangi, Malaysia. [2]UKM, Bangi, Malaysia

MS RUBIAH MOHD. AMIN

ASSOC. PROF. DR. HANIFF AHAMAT

DR. MUHAMAD SAYUTI HASSAN

Abstract

As a member of WTO, Malaysia needs to hold the WTO policy in trade liberalization of the agrifood sector. However, food sovereignty achievement and the protection of farmers are two main focuses for the development of agri-food regulations. A good agri-food sector for long-term development focuses not only on economic contribution and social well-being but also on the environmental aspects. It is very important to regulate agricultural operations in a way that will minimize the negative impact on the environmental environment, at a level that is considered sustainable. This study analyses and maps the development of agri-food regulations from the current National Agrofood Policy 2.0 where food sovereignty and trade liberalization for rice sustainability. This is a qualitative study using secondary data and social jurisprudence theory. The results show that Malaysia's agri-food regulations support the WTO policy in the liberalization of trade for agriculture which give a negative impact on achieving food sovereignty and a lack of protection for farmers. Since SDG2 is focused to end hunger, achieving food security and improved nutrition, and promoting sustainable agriculture, it recognizes the interlinkages between supporting sustainable agriculture and empowering small farmers, it is recommended that the government to provides policies to strengthen the management of the food system in achieving food sovereignty. The Control of Padi and Rice Act 1994 needs to review in the development of a new Section, including the food sovereignty for people involves in the rice sectors. It can be in a separate chapter explaining the development of people in agri-food from the liberalization of agricultural trade so that they can sustain a global market to achieve sustainable development goals, in this case, competitive rice trade. The government needs to provide policies that strengthen the agrifood management system to support the achievement of food sovereignty. The law should be used as an instrument to support the achievement of this goal.

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The concept of land bank in supporting the protection of sustainable food agriculture land in Indonesia

Dr. Sri Susyanti Nur, Dr Kahar Lahae, magister of law Andi Evi Anggraeni
faculty of law, hasanuddin university, makassar, Indonesia

DR. SRI SUSYANTI NUR

DR KAHAR LAHAE

Abstract

A land bank is an agency that manages land supply and land use in accordance with the physical condition of the land as a supporting natural resource. Agricultural activity is a form of land use, which is very important to maintain in supporting sustainable development, especially food availability. Indonesia as an agricultural country has in several decades maintained a food surplus, by establishing several regulations, including regulations regarding the Protection of Sustainable Food Agricultural Land, and regulations concerning Food Security. Sustainable development in the context of maintaining food availability, one of which is by presenting a Land Bank which guarantees the availability of fertile land/agricultural land, prevents soil damage, increases soil fertility, prevents conversion of functions, and in its management can promote the welfare of farmers in the form of land ownership as a assets (Agrarian Reform).This sustainable development is carried out to ensure the fulfillment of the SGDs which are a series of economic, social and ecological developments. So that with this sustainable development, the goals of the state will be achieved to improve the standard of living and welfare of the people in Indonesia. The purpose of this writing is to find out; 1) what is the concept of sustainable land/agricultural management by the land bank; 2) how to legally maintain sustainable agricultural land/land in preventing the conversion of agricultural land; 3) how to realize the welfare of farmers in the ownership of assets in the form of land/agricultural land in achieving sustainable development. The research method used is Normative legal research method by collecting legal materials in the form of primary, secondary and tertiary legal materials. To then be analyzed qualitatively and presented in a descriptive form. The results are in the form of conclusions, namely; 1) The application of the land bank concept for land/agricultural land cannot be implemented due to constraints on land data and land management; 2) Law enforcement and supervision of the conversion of agricultural land is still weak; and 3) Forms of community participation in registering their land as assets and access to improving their welfare in the context of realizing sustainable development is still low.

Keywords: Land Bank, Agricultural Land, Sustainable Development

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FOOD SECURITY OF ABORIGINAL PEOPLES (ORANG ASLI) OF PENINSULAR MALAYSIA: LEGAL CHALLENGES IN ACHIEVING SUSTAINABLE DEVELOPMENT GOALS

Dr Muhamad Sayuti Hassan[1], Associate Professor Dr Rohaida Nordin[1], Dr Muhammad Faliq Abd Razak[2]
[1]Faculty of Law, Universiti Kebangsaan Malaysia, UKM Bangi, Malaysia. [2]Institut Kajian Malaysia & Antarabangsa (IKMAS), Universiti Kebangsaan Malaysia, UKM Bangi, Malaysia

DR MUHAMAD SAYUTI HASSAN

Abstract

The Orang Asli are indigenous peoples in Peninsular Malaysia who are not classified as homogeneous but rather heterogeneous due to their uniqueness and distinctiveness in perspective, socio-cultural, and psychosocial-cognitive features. However, they are one of the most vulnerable groups in society and remain marginalised due to the control of the majority. From a legal standpoint, laws in Malaysia, including the Orang Asli Act 1954 (Act 134), do not expressly provide food security for Orang Asli. In fact, the National Agrofood Policy 2021-2030 (NAP 2.0) was found to be insufficient because it did not address the issue of Orang Asli's food security comprehensively compared to international legal standards. Thus, the main objective of this article is to analyse issues and laws related to food security for Orang Asli based on human rights principles and international law standards. This study uses doctrinal methods. This study found that the government should have a comprehensive legal framework for food security for the aboriginal peoples in Peninsular Malaysia because it needs to integrate the uniqueness of the customs and aspirations of Orang Asli, human rights principles and international legal standards in one policy document. This effort will offer a complete and practical model to guarantee food security to all Orang Asli. It fulfills the Malaysian obligation related to food security and further helps Malaysia fulfill the second Sustainable Development Goal (SDG) agenda, which is to end hunger, achieve food security, and improve nutrition in particular, the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round by the year 2030.

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CULTURAL RIGHTS OF ORANG ASLI FROM LEGAL PERSPECTIVES

Dr Muhamad Sayuti Hassan, Associate Professor Dr Rohaida Nordin
Faculty of Law, Universiti Kebangsaan Malaysia, UKM Bangi, Malaysia

Abstract

The Orang Asli Act of 1954, which protects the rights of the Orang Asli, is inadequate and out of date. In spite of the fact that the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) provides worldwide recognition of the rights of indigenous peoples, Malaysia does not currently have a comprehensive legal framework that recognises the Orang Asli people's right to culture. These legal constraints require a holistic approach to the Orang Asli's right to culture, which incorporates concerns of language, education, identity, customary practice, traditional knowledge, and customary land. As a result, the primary purpose of this study is to analyse the existing legal framework for the cultural rights of the Orang Asli. In addition to that, the current study elaborates on the rights to the culture of indigenous peoples in accordance with international legal standards. This study employs doctrinal legal research to accomplish the stated objectives. This study revealed that the existing legal framework for the cultural rights of Orang Asli is not compatible with international law standards. In conclusion, this paper can substantially contribute to the attainment of sustainable development by advocating for Orang Asli's right to culture, in particular, goal 10 of the Sustainable Development Goals, which aims to reduce inequality, mainly target 10.2 to 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 2030.

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Sustainable Community Development in Malaysia's Palm Oil Industry: A Case Study

Dr. Shifa Mohd Nor
Universiti Kebangsaan Malaysia, Bangi, Malaysia

Abstract

The rapid growth of palm oil production in Southeast Asia could be seen in Indonesia and Malaysia. These two countries are among the largest producers of palm oil. Palm oil production is an important sector that contributes to the economic development of the country. In ensuring the palm oil industry in Malaysia moves forward according to the SDGs agenda, there is a need to ensure the sustainability of the community that works in the palm oil industry. Sustainable community development is an area that is lacking in this industry. Usually, standards or guidelines emphasize business sustainability. As the corporate social responsibility concept addresses the important responsibility - economic, social and environment, thus community development is also pertinent to achieve sustainability. The palm oil sector faces many challenges from time to time in ensuring a harmonious community to continue its legacy. In Malaysia, job security in this sector would be a major concern as younger generations lost interest to continue the legacy of working in palm oil industries for a more stable work pay. The labour shortage has cost the palm oil industry a huge sum. Hence, the government's initiative is to bring in migrant workers to cover the shortage. There is an intention from several industry players to have 100 per cent local workers in the year 2027. Apart from this, there are also issues on land conflicts, lack of education and experts in particular fields to bring the palm oil industry forward. Therefore, this qualitative study intends to understand the landscape of sustainable community development in the palm oil industry in Malaysia. A semi-structured interview was conducted with several palm oil agencies in Malaysia. The results of the study provide heads-up on several aspects such as collaborative initiatives with the government, corporate sector and community, providing education and training and others. The study also discussed implications to the communities to provide better social control so that companies can implement sustainability strategies in their business processes. The challenges faced may become an opportunity for better community development in future.

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THE ENACTMENT OF BLUE ECONOMY DEVELOPMENT INTO ASEAN: LEGAL PERSPECTIVE

S.H., M.Kn. Moh. Asadullah Hasan Al Asy'arie, S.H., M.H., LL.M. Pulung Widhi Hari Hananto, S.H., M.H. Rahandy Rizki Prananda, S.H., M.H. Gaza Carumna Iskadrenda
Faculty of Law, Universitas Diponegoro, Semarang, Indonesia

S.H., M.KN. MOH. ASADULLAH HASAN AL ASY'ARIE

S.H., M.H., LL.M. PULUNG WIDHI HARI HANANTO

S.H., M.H. RAHANDY RIZKI PRANANDA

S.H., M.H. GAZA CARUMNA ISKADRENDA

Abstract

ASEAN and blue economy are the new bound topic as a response to the migration of the green economy movement instead as well as the new way of alternative concept to optimize the growth of the economy based on the ocean and coastal development. On another side, the implication of climate change on the ocean would be against as the imminent threat to the development of the blue economy, especially in the areas or regions where a lot of states rely on its sea such as ASEAN. These circumstances would be great challenges for the readiness of their member states to adopt the blue economy in terms of a multiverse of legal frameworks and the consensus of its members. As maritime geography plays a significant role in the economy of the region, the enactment instead of the application of blue economy policy has a vital strategy to drive in their region.

This paper applies normative legal research methods and library research. In regard the result, this paper expected to answer the issue of the readiness of the member states to implement the blue economy toward the legal instrument and the norm setting-process at their national level. In addition, the paper also criticizes the framework of the blue economy since not all member states have an area of the sea instead of international waters.

This research aims to test the inconsistency of norm-setting could be identified as the heavily obstacle factor to realise the effective implementation of the blue economy such as IUU fishing, marine pollution, haphazard tourism, and unplanned coastal development. The roadmap of the blue economy should provide a comprehensive strategy that can synchronize social economic and environmental aspects. To meet consensus and integrated Blue economic policy in ASEAN, the member state must pay attention to The Principal of International Law while formulating the national policy. In addition, the execution of the blue economy requires a strong commitment between state members to find a unification perception. As the conclusion, this paper suggest solution that ASEAN as a regional organization must evaluate each the member states readiness to face the blue economy. In addition, ASEAN can make an integrated legal basis for each the member states.

Keyword : Blue Economy, ASEAN, Enactment

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Developing Public Utilisation Fund Mechanism as New Social Protection System in Malaysia

Ms. SITI NORAYU WALUYOB[1], Dr. MUHAMAD AZWAN ABD RAHMAN[2]
[1]Universiti Kebangsaan Malaysia, Selangor, Malaysia. [2]Institute of Malaysian and International Studies (IKMAS), Universiti Kebangsaan Malaysia, SELANGOR, Malaysia

Abstract

Since the 1970s, Malaysia's socioeconomic development is imbalanced. This process creates multi-layered poverty in household heads through distribution policies. It influences by the consistency of good governance practices, a code of conduct in people saving ethics, the direction of responsible expenditure of households and the reaction of locals to a drastic change in the global megatrend. Therefore, this article proposes an innovative mechanism through a certain percentage of employee and employer contribution to the Employees Provident Fund (EPF) with a government subsidy to reduce the cost-of-living issue. The role of the state and ethical theory is used to form an exploratory framework in this article to situate the problem of inequality under the Malaysian development model. A combination of in-depth interviews, engagement in High-Level Meetings and a rapid poll conducted with 340 respondents through online survey determined that this innovative mechanism is the most practical. These findings also demonstrate that the Malaysian government urgently needed to implement this new social protection system policy without forfeiting household head savings or monthly income for sustainable livelihood.

Keywords: inequality, cost of living, inclusive development, Employees Provident Fund, new social protection system; subsidy

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The Development of Dejiao and Its Impact to Malaysian Chinese Community Social Transformation

Mr. Gengye WU
IKMAS, KL, Malaysia

MR. GENGYE WU

Abstract

DeJiao originated in Chaoshan, China in the late 1930s and spread all over the world. It is considered to be an emerging Chinese folk religious organization that integrates the tenets and virtues of five religions, namely Confucianism, Buddhism, Taoism, Christianity, and Islam. Along with the immigrants from Chaoshan, DeJiao spread to Southeast Asia, where it is the most prosperous in Malaysia. Although in the past 30 years, through DeJiao's root-seeking activities and China-Malaysia non-governmental exchanges, DeJiao has re-emerged in mainland China, the power of DeJiao in China is still not comparable to that in Malaysia. Dejiao is based on the ancient Chinese belief that humans and nature are interconnected. This holistic approach to life is reflected in the Dejiao rituals which involve the veneration of ancestors, offering sacrifices to the gods, and maintaining harmony between humans and the natural environment. Dejiao is particularly popular among the Chinese communities of Malaysia. It is a communal tradition that is centred around the family and includes the practice of ancestor worship, the observance of filial piety, and participation in various festivals and rituals. In addition, Dejiao also includes the celebration of traditional Chinese festivals such as Chinese New Year, the Mid-Autumn Festival, and the Qingming Festival. This helps to reinforce the values of family and community among Chinese Malaysians. Many of religion movement in Malaysia were set up to attract the structural layer to support respective agenda. It can be seen many community-based organization in Malaysia particularly religion oriented are derived by the state system and its constitution that facilitate the religiosity activities. Notwithstanding this research will focusing Dejiao as a religion, or it role as a Chinese association in Malaysia, it will thoroughly adopting historical perspective of Dejiao development in discover that current religion movement with Chinese community social transformation in specific aspect. This study will systematically and rigorously examine its achievements in its development, as well as its impact on the Malaysian Chinese social transformation.

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The Joint Development Partnerships of China's Belt and Road Initiative and its Impact to Malaysia

Miss Noor Ilie Zuhaili Binti Yahaya
National University of Malaysia, Selangor, Malaysia

MISS NOOR ILIE ZUHAILI BINTI YAHAYA

Abstract

China has proposed a new Silk Road plan known as One Belt, One Road (OBOR) or also known as Belt and Road Initiative (BRI) a development framework and strategy introduced by President Xi Jinping. Simply expressed, the establishment of the 21st-century Maritime Silk Road and Silk Road Economic Belt concept, it seeks to establish an economic and political sphere of influence on the Eurasian continent through the land and the sea. Specific regulations relating to the BRI idea were made public in May 2013. BRI began as a concept and evolved into more concrete actions throughout time while offering financial aid, technology transfer and many more through BRI's collaboration. It emphasizes communication and collaboration between nations, especially between China and the rest of Eurasia. In 1974, Malaysia became the first nation in the ASEAN to formally recognize the People's Republic of China. Since then, China and Malaysia have enjoyed a strong commercial, investment, and interpersonal interaction that has strengthened bilateral ties between the two nations for decades. With the launch of the BRI, the developing BRI trade network has rekindled interest in researching global trade networks within the context of establishing free, open, and inclusive international trade relations. Malaysia's location at the intersection of land-based and marine East-West trade routes makes it crucial to China's BRI objectives. Malaysia, which borders the South China Sea to the east and the Straits of Malacca to the west, is strategically significant to China's 21st Century Maritime Silk Road. One of the most important maritime routes in the world and one of its busiest waterways is the Straits. The current progress of few projects under Joint Development Partnership under China's Belt and Road Initiative not only benefitted to Malaysia as a beneficiary, but it also comes with significant back breaking that led to new dependency.

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The Treatment of Migrant Workers Post-Covid in the Context of SDG 8: Malaysian and Indonesian Perspectives

Dr Saidatul Nadia Abd Aziz[1], Dr Nurul Hidayat Ab Rahman[1], Mr Riyad Febrian Anwar[2], Ms Rafika Nurul Hamdani Ramli[2]
[1]UKM, Bangi, Malaysia. [2]UNHAS, Indonesia, Indonesia

Abstract

The deadline for achieving the Sustainable Development Goals (SDGs) is approaching. Despite the fact that many countries are executing on their commitments to the 17 SDGs, many have been affected by the Covid-19 saga since 2020. The COVID-19 crisis has a devastating impact on the global economy, markets, and employment. As numerous nations recover from the pandemic, migrant workers are the most vulnerable group left behind during this difficult time. Numerous migrant workers are subject to unemployment, termination, and other forms of discrimination. Some known SDGs objectives speak directly to migrant issues, demonstrating that countries are obligated to protect migrant workers in order to achieve the SDGs. The purpose of this paper is to analyse and compare the treatment of Migrant workers in the context of SDGs (post covid) Goal 8 – Decent Work and Economic growth by examining the policies, laws, practises, and perspectives of two countries that are heavily involved in Labour Migration, Malaysia and Indonesia. Migrants often bring significant benefits to their new communities in the form of skills, strengthening the labour force, investment and cultural diversity. They also play a role in improving the lives of communities in their countries of origin through the transfer of skills and financial resources, contributing to positive development outcomes. However, if migration is poorly managed, it can also negatively impact development; migrants can be put at risk, communities can come under strain and development gains can suffer. As much as migration has an impact on development, migration is also affected by development. The development contexts in which people live, where they move to, and the places they go through to get there play a role in shaping people's resources, aspirations, motivations and opportunities to migrate. Conflict, climate change, labour markets and other development-related factors can all impact the drivers and nature of migration. The 2030 Agenda for Sustainable Development provides an overarching framework to address this complex and dynamic relationship between migration and development and to better understand how migration and migrants can shape development outcomes and vice versa. This paper will then provide a recommendation based on the comparative findings.

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TOWARDS SUSTAINABILITY IN ASEAN: STUDY CASE OF THE MALAYSIAN ANTI-CORRUPTION ACT: ITS PROSPECT AND CHALLENGES

Dr Muhamad Helmi Md said[1], Mrs Grace Emanuel Kaka[1], Mrs Tinuk Dwi Cahyani[1,2], Dr Muhamad Sayuti Hassan[1]
[1]Universiti Kebangsaan Malaysia, Selangor, Malaysia. [2]universitas muhammadiyah Malang, Malang, Indonesia

Abstract

Corruption is the misuse of power for private benefit which occurs both in the public and private sectors. It erodes economic growth and slows development. Many countries across the globe are suffering from the adverse effects of corruption and Malaysia is one of these countries. The development of corruption in Malaysia dates to the Barisan National (BN), a coalition of parties that ruled the country from 1957 after independence to 2018. The purpose of the study is to examine the development of Malaysia's anti-corruption regulations, its prospects and challenges over the years and to proffer suggestions that would strengthen the fight against corruption in Malaysia. The research theoretically analyzed developments of the anti-corruption legislations and reviewed discussions on anti-corruption and measures/strategies developed by government to combat corruption. Corruption is caused by many factors but the most visible ones in Malaysia are money politics, corruption culture, family, and individual as well as institutional opportunities. Although, there exist a comprehensive legislation against corruption – the Malaysian Anti-Corruption Act (Act 694) 2009 with its 2018 amendment and the inclusion of Section 17A, providing a good atmosphere to combat the problem, yet corruption is on the rise in Malaysia with high level corruption perpetrated without restrain. This study further found that leadership/political unwillingness, lack of effective enforcement procedures, symbiotic relationship between politicians and big business owners, as well as public passivity are some of the challenges to achieving success in the fight against corruption. Hence, the study suggest independence of the enforcing bodies like the MACC and the courts to act without fear or favour, as well as a standardized and clear procedure for enforcement so that the existing legal framework can be effectively implemented to minimize the problem of corruption.

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STRENGTHENING VILLAGE-OWNED ENTERPRISES IN EQUITY AND ECONOMIC GROWTH FOR THE REALITY OF SUSTAINABLE DEVELOPMENT GOALS IN INDONESIA

Nurhani Fithriah, Dimas Dwi Arso
Universitas Bengkulu, Bengkulu, Indonesia

NURHANI FITHRIAH

DIMAS DWI ARSO

Abstract

The village is the closest government agent in reaching the community. The government realizes national development, one of which is by gradually carrying out village development. The village is given the authority to implement programs to support the village economy. The existence of a village-owned business entity is an excellent program in the community's efforts to advance their village by carrying out many business activities. with the existence of a village-owned enterprise, the village can manage the natural potential contained therein for the village's progress. It follows the SDG's target, which is to provide space for the community, in this case, to increase the community's standard of living to avoid poverty. One of the villages in Indonesia has natural potential, namely Napal Jungur Village. Napal Jungur Village has a lot of potentials, namely its natural beauty, fertile soil, coffee plantations with abundant yields and so on. The natural beauty potential of Napal Jungur Village can become a tourist spot for tourists who want to enjoy it if it can be appropriately managed. The method used in this research is the qualitative method. Village-owned enterprises are the main key in mobilizing the community to manage their natural wealth. Communities can issue their abilities in managing nature tourism. In this village, it can be developed into a tourist spot for waterfalls, tubing, and it can also sell natural products from its plantations to tourists who come. So, with authority possessed by village-owned enterprises to manage natural wealth in Napal Jungur Village, it can improve the economy of its people. It is in line with what is stated in Law Number 10 of 2009 concerning Tourism Article 5 letter C, namely, tourism is organized based on providing benefits for people's welfare, justice, equality and proportionality. Based on this, the existence of Village-Owned Enterprises as community mobilizers in improving their economy is realizing Village SDGs No. 8, equitable distribution of development results and creating jobs for rural communities, especially in Napal Jungur Village, Bengkulu Province, Indonesia. The results of this study show that Village Owned Enterprises are very important. With good Badan Usaha Milik Desa management, managed capital can be channeled to the community through capital programs and good cooperation, which can improve a prosperous village economy.

Keywords: SDGs; Village Owned Enterprises; Tourism

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Optimizing Village-Owned Enterprises (BUMDes) in Creating Dynamic Village Institutions and Adaptive Culture

Wulandari Wulandari, Kiki Amaliah
University of Bengkulu, Bengkulu, Indonesia

WULANDARI WULANDARI

KIKI AMALIAH

Abstract

The village is given the freedom to manage the village according to the potential that exists in the village, therefore the village needs media to develop the village. One of these media is the Village-Owned Enterprise (BUMDes). Management of Village Owned Enterprises is carried out by the Village Government together with the community. BUMDes management by directly involving the community is expected to be able to encourage the community's economy in improving people's welfare. Businesses managed by BUMDes are in accordance with the conditions and potential that exist in the village. Villages that have natural potential to be used as tourist areas, or products from village community agriculture can be managed by BUMDes. The Village Sustainable Development Goals (SDGs) policy or village sustainable development goals in Indonesia are derivatives of the existing provisions in the Sustainable Development Goals (SDGs). This formulation can be found in point 16 of SDGs Peace, Justice and Resilient Institutions which is then reformulated with Village SDGs in point 8 of Cultural Responsive Village letter b Number 18 namely Dynamic Village Institutions and Adaptive Village Culture. BUMDes which is interpreted as an institution at the village level has several problems, namely, BUMDesa management is not optimal, BUMDesa managers do not understand their duties and responsibilities, lack of good communication between the village government and BUMDesa managers. This research has the aim of strengthening dynamic village institutions and adaptive village culture through optimizing BUMDes in the management of existing businesses in the village, so that it will have a positive impact on village communities. This research is a normative juridical research with a focus on the positive law of the Indonesian state which regulates BUMDes based on the SDGs of the Village and provisions of international law. The results of this study, first is formulate the optimization of BUMDes by looking at the strategies that have been mentioned in the Regulation of the Minister of Village, Development of Disadvantaged Regions and Transmigration Number 3 of 2021, and the second is Optimizing Village-Owned Enterprises (BUMDesa) in Creating Dynamic Village Institutions and Adaptive Culture by using a normative local governance framework for a village-owned enterprise, highlighting the required coordination/collaboration between the village government and the BUMD managers. Furthermore, the research is expected to be useful for BUMDesa managers to be used as a guideline for BUMDes managers so that existing BUMDes can optimized institutional functions as stated in the Village SDGs.

Keywords : Village-Owned Enterprise (BUMDes), Village SDGs, village institutions.

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Exploring the Risk Factors of Corruption in Enhancing Sustainability in Malaysia's Telecommunications Sector

Assoc Prof Dr Hartini Saripan, Ms Nurus Sakinatul Fikriah Mohd Shith Putera, Dr Rafizah Abu Hassan, Mrs Mastika Nasrun, Mr Ahmad Shukree Mhd Salleh, Assoc Prof Dr Normawati Hashim
Universiti Teknologi MARA, Selangor, Malaysia

ASSOC PROF DR HARTINI SARIPAN

MS NURUS SAKINATUL FIKRIAH MOHD SHITH PUTERA

DR RAFIZAH ABU HASSAN

MRS MASTIKA NASRUN

MR AHMAD SHUKREE MHD SALLEH

ASSOC PROF DR NORMAWATI HASHIM

Abstract

The telecommunications sector ceaselessly been subject to regulatory scrutiny. It is an industry that is vulnerable to a numerous economic crime threat, including bribery and corruption due to the intricate interactions with government officials, the potential for the telecommunications network to be used to facilitate illegal activity, and the risk of fraud and misstatement faced by large corporations. This is aggravated by the evolving governmental priorities, political cycles, and changing paradigms of public ownership. Apart from a regular monitoring of anti-corruption policies and exhaustive anticorruption due diligence, it is advocated that at the core of every anti-corruption initiative, lies the need to identify specific risk factors that increase vulnerability and exposure to corruption at both the public and private levels. Therefore, this research aims at identifying and exploring the critical risk factors leading to the risk of corruption in Malaysia's telecommunications sector to further facilitate the design of an effective anti-corruption measures. This is significant in ensuring the sustainability of the telecommunications sector in ensuring substantial reduce or corruption and promoting transparency and good governance as enshrined in the Sustainable Development Goals. Adopting a mixed method approach of quantitative and qualitative research, semi- structured interview questions and questionnaires were employed as the main tools of the research. Thirteen (13) risk factors were inferred from the literature and formed the basis of the questionnaire constructs. This questionnaire was then distributed to 1059 respondents with 390 of the respondents working in the telecommunications sector. A semi structured interview with 18

respondents comprising of representatives from government ministries/department, government-linked companies, telecommunications companies, and academia was also conducted to verify and confirm the findings from the questionnaire survey. Findings from both instruments were subsequently triangulated and analysed using the thematic approach. The research findings indicated the critical risk factors of corruption in the Malaysian telecommunications sector which are Personal Gain, Complex Governance Systems, Political Interference, Competitive Market, Bureaucratic Requirement, Inefficient Organisational Administrative Structure, Low-Income Level, Complex Interactions Between Various Actors in the Industry, Lack of Anti-Corruption Measures in the Organisation, Lack of Monitoring in the Workflow, Weaknesses of the Law and Sanctions Against Corruption, Lack of Awareness on Incidents of Corruption and Lack of Awareness/Understanding on the Laws Against Corruption which are ranked according to the most critical risk factor to the least critical. As one of the ASEAN countries, it is hoped that the exploration of risk factors of corruption in the telecommunications sector in Malaysia aligns with SDG Target 16.5, which aims to substantially reduce corruption and bribery in all forms. By identifying and understanding the specific risk factors contributing to corruption within the sector, effective strategies can be developed to combat these illicit activities in ASEAN. Given that we are halfway through Agenda 2030, this research output focuses on the 5Ps of the SDGs - People, Planet, Prosperity, Peace, and Partnerships and will pave the way for targeted actions and partnerships that promote transparency, accountability, and sustainable development, ensuring progress towards the ambitious goals set for 2030 especially in ASEAN.

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Breaking Barriers, Building Bridges: Women's Political Engagement for Sustainable Development in Malaysia

Dr Norazlina Abdul Aziz[1], Assoc Prof Dr Hartini Saripan[1], Assoc Prof Dr Nur Ezan Rahmat[1], Mrs Azlena Khalid[1], Prof Dr I Nyoman Putu Budiartha[2]
[1]Universiti Teknologi MARA, Selangor, Malaysia. [2]Universitas Warmadewa, Denpasar, Bali, Indonesia

DR NORAZLINA ABDUL AZIZ

ASSOC PROF DR HARTINI SARIPAN

ASSOC PROF DR NUR EZAN RAHMAT

MRS AZLENA KHALID

PROF DR I NYOMAN PUTU BUDIARTHA

Abstract

This study explores the current state of women's involvement in the political and agricultural sector and how this assist in safeguarding their economic rights in Malaysia. Findings indicate that while some progress has been made, women in Malaysia still face significant challenges in achieving equal rights and opportunities. In the political sphere and women are underrepresented in high positions and face barriers to participation in decision-making processes. This impacted their economic rights where women are often paid less than men and are disproportionately represented in low-wage jobs. Additionally, women in Malaysia face significant social pressures, including discrimination and violence. Hence, the main objective of this study is to critically investigate women's rights in politics and decision-making and the extent of women's empowerment through political involvement in Malaysia. Adopting a doctrinal approach, this study focuses on the analysis of both primary and secondary sources of data including the Federal Constitution of Malaysia and various policies at all levels of governance. This study found that more efforts should be geared towards promoting the involvement of women in decision-making process to ensure equal rights and contributions of women are more valued. The prospect of transformation out of these efforts may contribute to the progressive economic growth of a country and reduce issues of discrimination against women. Thus study proposes few recommendations in order to ensure party politics are more inclusive. First, officials should embrace strategies for enlisting equal numbers of women and men. Second, it is important to create methods for tracking gender in politics. Third, training should be implemented in the areas of leadership, decision-making, capacity building, and emotional intelligence. Last but not least, funding ought to be set aside for more analysis of the application and results of gender equality, women's political engagement, and decision-making. In conclusion, the study suggests that while progress has been made, there is still much work to be done to ensure that women in Malaysia have equal access to political,

economic, and social rights. It is hoped that the findings and recommendations of this study will contribute to SDG 5: Gender Equality: Women empowerment in politics and decision-making which is a fundamental aspect of achieving gender equality. This alignment is significant in ensuring that women have equal opportunities to participate in political processes, hold leadership positions, and contribute to decision-making at all levels especially in Malaysia as one of the ASEAN countries. Hence, addressing the target of ensuring women's full participation and equal opportunities for leadership, effectively employing the 5Ps framework is pivotal in making this aspiration a reality. By examining barriers, informing policy, fostering partnerships, monitoring progress, and raising public awareness, this study contributes to accelerating efforts to achieve gender equality and emphasizes the importance of targeted actions and policies to overcome existing challenges, especially considering we are halfway through the SDG 2030 timeline.

Full Papers

Family Development Sessions (FDS) as a Pandemic Response: The Conditional Cash Transfer of the Philippines

Ana Leah D. Cuizon[1]

[1]University of the Philippines Cebu, Gorordo Avenue, Lahug, Cebu City, Cebu, Philippines 6000
[1]adcuizon@up.edu.ph

Abstract. This study seeks to account the impact of the Family Development Sessions (FDS), as a conditionality in the conduct of the Pantawid Pamilyang Pilipino Program (4Ps). 4Ps, a conditional cash transfer program, the Philippines' banner program in its goal for poverty alleviation. It has been institutionalized in 2019 through Republic Act 11310, An Act Institutionalizing the Pantawid Pamilyang Pilipino Program. During the pandemic, all sectors of the economy were adversely affected. Filipino families were at the core of this economic struggle, more so, are the families in the margins – the Pantawid households. FDS is the monthly meeting of Pantawid households organized by the municipal links (ML) of the Department of Social Welfare and Development-Field Offices in partnership with the LGU representatives. There are identified modules to be delivered per FDS session, nonetheless the advent of the pandemic allowed these sessions to transition and to innovate. FDS has become an avenue for community initiatives and collaborations as Pantawid households learn to struggle and to survive together. Later, these community initiatives translate to success stories that reflect the significance of FDS beyond being a conditionality towards the availment of the cash grants corollary to being identified as beneficiaries of 4Ps. Thus, FDS became a mechanism of empowerment for the Pantawid households. This study utilizes a qualitative method in exploring the narratives of the Pantawid households during the pandemic (FY 2019-2022) vis-a-vis community initiatives organized through the FDS. On the aspect of empowerment, the analysis will use the framework of Elizabeth Rocha's Ladders of Empowerment. It is revealed that FDS created positive impact on the Pantawid households especially during the economic pandemic struggle. The sessions have given opportunities for convergence of the households in sharing their struggles, exchanging ideas on alternative means of addressing their challenges, tapping different government agencies in the provision for services, and creating new paradigms and decision-making at the grassroots level. In gist, the FDS is effective in engaging the beneficiaries, providing them a sense of personal empowerment as they partake in the community initiatives during the pandemic.

1. Introduction

The Conditional Cash Transfer (CCT) of the Philippines is popularly coined as Pantawid Pamilyang Pilipino Program (4Ps). It has been institutionalized through Republic Act 11310 in 2019. The said program has two goals: social assistance and social development. These two are complimentary goals as such one heavily relies on the performance or achievement of the other. Projects and activities, which are aimed at the promotion of health and education as well as the over-all being of poor Filipino households are outlined, crafted and implemented to serve as conditionalities (pre-conditions) to receive the cash assistance.

Among these activities is the Family Development Session (FDS). It is a session that 'must' be attended by the beneficiaries that primarily aims to promote, empower, and nurture families . This is a face-to-face encounter spearheaded by the Municipal Link, a representative from the Department of Social Welfare and Development (DSWD) and some local government units' representatives held at the barangay level. Further, this is delivered monthly on a modular basis whereby topics cover mainly on parenting roles and duties especially on providing support for children's health and educational needs. However, when the pandemic happened this conditionality has been suspended along others. The

cash assistance continued but the bigger concern is, are the families in the margins getting sufficient assistance and aid to survive the pandemic considering that all other economic opportunities have also been suspended due to lockdown and other government protocol.

Amidst this backdrop, Purok Proper Parian, Brgy. Poblacion, Samboan, Cebu, Philippines had overcome the pandemic successfully as a community by transforming their FDS session into an economic opportunity session. The members of the Pantawid households eagerly gather at their purok to brainstorm on means by which they can all survive the pandemic. The monthly gathering which is highly hinged on the modules that present various topics on parenting roles and duties have shifted to livelihood discussions as an expression of the community's struggle to survive and to confront their obstacle, food for the family. Along this vein, this study seeks to describe the transition of FDS, as a 4Ps conditionality during the pandemic taking into account the experience of Brgy. Poblacion, Samboan, Cebu, Philippines. It attempts to narrate the initiatives of this community and how said experience may be benchmarked as a new form of the delivery of 4Ps moving forward. This initiative is a strong manifestation of empowerment both at the level of the individuals (4Ps beneficiaries) and the community (4Ps households) as espoused by Elizabeth Rocha's Ladder of Empowerment.

2. Literature Review

2.1 The Pantawid Pamilyang Pilipino Program (4Ps): CCT in the Philippines

The Pantawid Pamilyang Pilipino Program (4Ps) is a flagship human development program by the Philippine National Government that primarily aims to address the deep-rooted poverty issues in Philippine Society. This social assistance program was modeled after the success of Conditional Cash Transfers (CTTs) in Latin America (Velarde and Fernandez, 2011, p.2). Generally administered by the Department of Social Welfare and Development (DSWD), with the support of the different government departments, the Pantawid Program has two major goals: (1) *social assistance*–to provide financial assistance to extremely poor eligible households to alleviate their immediate needs, and (2) *social development*–to end the intergenerational poverty cycle through investing in the well-being of the Filipinos (Cuizon et al, 2021, p.58). This Conditional Cash Transfer program is in response to the Millennium Development Goal of reducing poverty incidences in the world in which the Philippines was seen to fall behind in areas of human development, particularly health, and education (De Jesus and Villanueva, 2023, p. 29).

Thus, the Pantawid Program focuses on providing educational and health support to eligible families provided that such families agree to comply with the conditions of the program. The health grant amounts to Php 500 for every household beneficiary per month and the education assistance amounts to Php 300 per eligible child ages 6 to 14 years old that attends school (Department of Social Welfare and Development, 2017, p.9). However, grants received by the beneficiaries depend on their compliance with the different conditions set by the program which are evaluated during regular monitoring through *Pantawid Pamilya's Compliance Verification System* (CVS). Eligible families are said to be selected through the National Household Targeting System for Poverty Reduction (NHTS-PR).

Launched on February 2008 during the Arroyo administration with 330,000 householdbeneficiaries, 4Ps expanded through the years with over 4 million families benefiting from the program at the end of 2022 (Velarde and Fernandez, 2011, p.2). In fact, the institutionalization of this poverty reduction strategy of the government was signed into law on April 17, 2019, otherwise known as the Republic Act No. 11310 or the Pantawid Pamilyang Pilipino Program Act. Through this, the government seeks to strengthen the fight against poverty, hunger, illiteracy, and malnutrition in the country (De Jesus and Villanueva, 2023).

However, critics point out those investing massive amounts of public resources in Pantawid Pamilyang Pilipino Program can have detrimental and unintended consequences. Oppositions' main point centers on the short-term nature of the program noting that the Pantawid Program is *unsustainable and generates neither income nor transformative changes in the structure of the economy* (Orbeta and Paqueo, 2016, p.7). Whereas it is geared toward reducing socioeconomic alleviation, the 4Ps may actually result in government dependency, mendicancy, and laziness of the beneficiaries. Instead of wasting a huge sum of money on Pantawid, it would be better spent on job creation and livelihood programs that would 'teach the poor how to fish'.

Over the years, several scholars have invested huge efforts to explore whether or not the Pantawid Program has indeed achieved its goals–reducing the poverty incidence in the country. Among these scholars are Aniceto C. Orbeta Jr. and Vicente B. Paqueo (2016) in their work *Pantawid Pamilyang Pilipino Program: Boon or Bane*. Their study generally aimed to examine the effectiveness of the Pantawid Program in terms of decreasing the number of school dropouts, making health services accessible to everyone, and reducing the number of poverty incidences in the country. Based on the findings of the study, *4Ps has kept the children in school* (Orbeta and Paqueo, 2016, p.4). Although it was revealed that the program has no significant impact on students aged 12-17 years old, it has been helpful when it comes to children in preschool and elementary levels. Moreover, due to health conditions set by the program, it was shown that the Pantawid Program resulted in improved access to essential health services. In 2012, more children underwent health and growth monitoring, dewormed, and received vitamins and iron supplementation from the government. Despite the fact that the poverty incidence decreased from 2006 to 2015, a high number of poor Filipino people was prevalent in 2016.

Furthermore, a study conducted by Orbeta, Melad, and Araos (2021) entitled *Reassing the Impact of the Pantawid Pamilyang Pilipino Program: Results of the Third Wave Impact Evaluation* sought to examine whether Pantawid Program still shows desirable impact on health and education outcomes in the third wave. Using a Regression Discontinuity Design, the study found that the program still has positive impacts on education and health outcomes. Surprisingly, the Pantawid Program has also shown significant positive impacts on household welfare, community participation, and disaster awareness. Although there were challenges faced due to the pandemic, this study pointed out that the 4Ps helped in advancing the government's COVID-19 vaccination program. It was also revealed that student beneficiaries were kept focused on their education despite the changes in the modes of learning due to the pandemic (Orbeta et. al, 2021, p.4). Generally, this study found that the Pantawid Pamilyang Pilipino Program remained steadfast amidst the challenges incurred by the pandemic as well as the changes in administration.

2.2 The Family Development Session (FDS)

The Pantawid Pamilyang Pilipino Program provides cash assistance to household beneficiaries given that such household beneficiaries comply with conditionalities set by the program. The Family Development Session (FDS) is one of the conditionalities of the Pantawid Program. It is a session that 'must' be attended by the beneficiaries that primarily aims to promote, empower, and nurture families. Moreover, it seeks to capacitate the household beneficiaries when it comes to parental roles and responsibilities, particularly in the health, nutritional, and educational needs of their children. Additionally, the FDS has modular topics focused on Early Childhood Care and Development, parenting roles and duties, Laws on Parenting, Parent and Children Management, Health and Nutrition, and Home Management, among others (Department of Social Welfare and Development, 2017, p.7) More specifically, the FDS has become an avenue for monitoring, reminding the beneficiaries of the program conditions, fostering social awareness, and encouraging community involvement.

A study by Stanly O. Dy (2018) entitled *Knowledge and Practices on Family Development of 4Ps Beneficiaries in Camarines Sur, Philippines* sought to assess the knowledge and practices on family development among 4Ps beneficiaries. Using a survey, KIIs, and a review of secondary data, Dy (2018, p. 125) found that beneficiaries understand the goals of FDS and pointed out that it has been effective, relevant, and interesting. Accordingly, beneficiaries assert that FDS has been helpful in nurturing parental capabilities and in strengthening familial ties. Among the topics commonly discussed, according to the respondent, related disaster risk reduction and management, good parenting, health and nutrition, and rights of women and their children. Thus, FDS received a high satisfaction rating from the beneficiaries due to its contribution to empowering families as revealed in the study.

Furthermore, in a study entitled *Perceived Effect of the FDS Seminars on Familial Relationship Among Pantawid Pamilyang Pilipino Program (4Ps) Beneficiaries in Bay, Laguna Philippines,* Thessalonica S. Manguiat et al (2018, p.28) sought to capture the changes on the familial relationship of 4Ps beneficiaries in connection to their attendance in FDS Seminar. Through a mixed-method approach, the researchers found that there were only minimal changes that happened to 4Ps beneficiaries due to the fact that FDS focuses more on the proper care of children with very limited content on Marital Relationships. Despite that, it was revealed that most of the parent-beneficiaries underwent significant changes when it comes to parental practices due to their attendance in FDS. This has led researchers to

conclude that although both marital and parental attitudes toward the beneficiaries improved, more significant changes can be observed in their parental attitudes due to the fact that FDS gives more emphasis on Good Parental Practices.

However, the previous studies show the state of Family Development Sessions pre-pandemic. The COVID-19 pandemic resulted in a shift in the modalities of the FDS as quarantine protocols and physical distancing were implemented. More so, the FDS discussions also shifted from promoting positive family values and strengthening marital relationships to post-pandemic economic opportunities, health, and COVID-19 vaccination, and disaster-related topics (Rodriguez and Revilla, 2023, p.5). Amidst the pandemic, the Department of Social Welfare and Development (DSWD) introduced alternative FDS delivery modalities collectively called the electronic FDS (eFDS). From the usual face-to-face, the monthly session shifted to mobile SMS text blasts, social media live streaming, and/or radio and television shows. Whereas several areas in the country suffer from a low internet connection, printed FDS materials, wall posters, and USB flash drives were distributed (Rodriguez and Revilla, 2023, p.5). Additionally, Small Group Neighborhood Sessions (SGNS) were conducted in areas with a minimal number of COVID-19 cases. In terms of discussion, FDS shifted its focus on COVID-19 health and safety measures, sanitation, mental health, and voter's rights (Rodriguez and Revilla, 2023, p.6).

2.3 The COVID-19 Pandemic in Cebu, Philippines

The advent of the COVID-19 pandemic incurred negative impacts on Filipinos, especially the poor. A report by the Philippine Statistics Authority claimed that the number of Filipinos living under the poverty line reached 20 million or 18.1% of the total population during the pandemic (Philippines Statistics Authority, 2022, para. 1). This figure is significantly higher than the recorded poverty incidence pre-pandemic which reached only 16% of the total population. Whereas millions of Filipinos suffered due to this dilemma, the Philippine government seemed unsurprised by the decline in the socioeconomic standing of the country. Accordingly, loss of income and job opportunities come naturally after quarantine measures and physical distancing are imposed amidst the pandemic.

Among the severely affected individuals were the Pantawid Pamilyang Pilipino Program beneficiaries. The COVID-19 protocols resulted not only in the loss of income and job opportunities for poor Filipinos. It has also disrupted the distribution of financial aid to the Pantawid Program beneficiaries as well as the full implementation of the Family Development Session. Due to the delay in the disbursement of the Conditional Cash Transfer, beneficiaries struggled to survive amidst the socioeconomic impacts of the pandemic. A study conducted by Agdeppa et al (2022) entitled Impacts of COVID-19 Pandemic on Household Food Security and Access to Social Protection Programs in the Philippines: Findings from a Telephone Rapid Nutrition Assessment Survey sought to assess the access of poor Filipinos to social protection. Using a total of 5717 households as participants of the study, the researchers found that the primary concern of the household beneficiaries is the money to buy food for their families. Thus, food security during the pandemic became a prevalent issue. Despite this backdrop, participants asserted that the social services provided by the government were inadequate to support even their immediate needs (Agdeppa et al, 2022, pg. 226).

Because of the growing demands for financial aid from the people, the World Bank has lent the Philippines an amount of approximately US$750 million to support the government's social protection programs including those that will benefit poor households as beneficiaries of the Pantawid Program (Aceron et al, 2021, p9). Accountability research conducted by the World Bank demonstrated that the social protection programs of the Government only had a slight impact on the socioeconomic challenges faced by the 4Ps beneficiaries during the pandemic.

3. Methodology

This study employed a descriptive qualitative research method utilizing case study. Case study is a research method that investigates real-life experiences and phenomena through detailed analysis of their specific conditions and relationships (Zainal, 2007, p. 1). They are used to explain complex phenomena and formulate arguments and assumptions that may prove applicable to other cases.

Qualitative descriptive research generates data that describe the 'who, what, and where of events or experiences' from a subjective perspective (Kim et al., 2017, p. 23). The experiences of the 4Ps beneficiaries of Cebu, Philippines particularly, Purok Proper Parian, Brgy. Poblacion, Samboan, a municipality located in the southern tip of the province of Cebu will be taken as the case in this research.

Data mining in the form of recorded interviews in print and social media of the 4Ps beneficiaries in the above mentioned locality is the main source of data. In addition, accounts of 4Ps municipal links and staff both in recorded reports and other data sources provided additional information.

4. Results and Discussion

4.1 Family Development Session (FDS) in 4Ps

One of the key activities in the implementation of the Pantawid Pamilyang Pilipino Program (4Ps) is the Family Development Session (FDS). It is considered as a continuing education program conducted nationwide. Neighborhood-based family psycho-educational activities are conducted regularly among beneficiaries of the Pantawid Pamilyang Pilipino Program. It was crafted to respond to the social needs of the family. The attendance to Family Development Sessions (FDS) is a conditionality to the 4Ps beneficiaries for receipt of cash transfer support. As the educational and psychosocial arm of the 4P's, FDS intends to induce families to invest in their own development through attending sessions on domestic management, hygiene and nutrition, and education. Facilitated monthly, government officials and accredited civil society organizations (CSOs) deliver modular lessons to representative families on targeted core areas by the program or other timely topics to discuss (Department of Social Welfare and Development, 2017, pg.8; Seki, 2015, p. 1265).

Originally, FDS topics focus on encouraging improved domestic management practices of families, in Table 1, a modified presentation of modular curriculum of FDS by the Department of Human Development and Family Studies (2018, pg. 8).

Later, as an application to the recommendatory assessment of commissioned policy reviewers, DSWD incorporated additional topics to fit the times and respond to the growing needs of its beneficiaries.

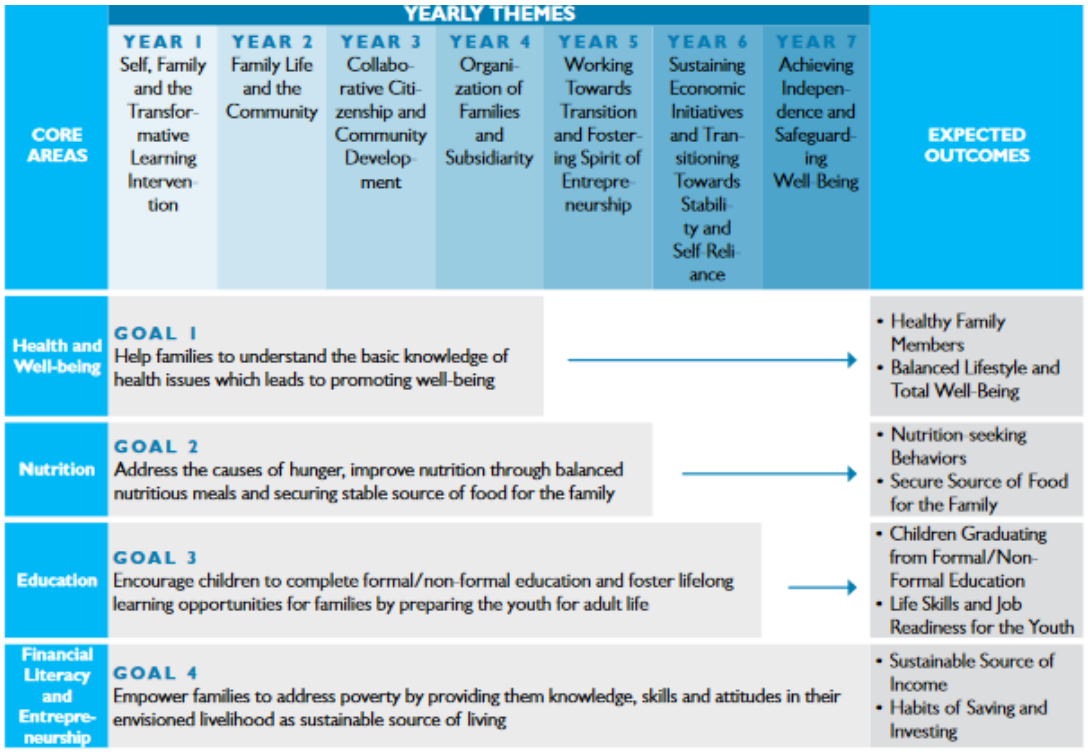
Accordingly, FDS adopted a clear curriculum plan focusing on identified topics. In **Figure 1**, A snapshot from an Assessment Review by the World Bank (Rodriguez and Revilla, 2023, p.29) lays out the FDS 7-year Learning Program adopted after a systematic review of existing curricula in 2017.

Table 1. Family Development Sessions (FDS) Modules as per 2017 Assessment

Family Development Sessions (FDS) Module Topics	
Guide to the Development of the Filipino Family	1) Pagtatatag ng Pundasyon ng Programang Pantawid Pamilya 2) Paghahanda at Pangangalaga ng Pamilyang Pilipino 3) Partisipasyon ng Pamilyang Pilipino sa Gawaing Pangkomunidad
1) Parenting the Adolescent Manual	1) Myself as a Person 2) Myself as a Parent 3) Me and My Adolescent 4) Befriending My Adolescent 5) When Adolescents are in Danger 6) Joining Hands to Protect the Adolescent
2) Manual of Effective Parenting	1) Myself as a Person and as a Parent 2) The Filipino Family 3) Challenges of Parenting 4) Child Development 5) Keeping your child Safe from Abuse 6) Building Children's Positive Behaviour 7) Health and Nutrition 8) Home Management 9) Keeping a Healthy Environment for your Children
3) Appreciating Early Childhood Care Enrichment	1) Understanding Child's Potential 2) Understanding Child's Moral Development 3) Parental Involvement in Early Learning Services

or Early Childhood Care and Development	
4) Family and Community Based Disaster Preparedness Manual	1) Training Preliminaries and Introduction 2) Policy Framework (RA 10121) 3) Overview of Hazards and Understanding Disaster Management 4) Family Disaster Preparedness and Disaster Preparedness Framework 5) Participatory Community Disaster
5) Risk Assessment	1) Early Warning Systems and Communication Protocol 2) Evacuation 3) Contingency Planning
6) Active Citizenship	
7) Module on Disabilities	
8) Module on Proper Sanitation	
9) Child Sexual Abuse Prevention for Parents	
10) Child Sexual Abuse Prevention for Children and Youth	
11) Strengthening Filipino Resources in the Home, School, and Community	1) Legal Bases for Positive Approach to Child Discipline Promotion and Education Orientation 2) Positive Approach to Child Discipline Framework 3) Positive Approach to Child Discipline and the Home 4) Positive Approach to Child Discipline and the School 5) Positive Approach to Child Development and the Community

Figure 1. FDS 7-Year Learning Program



As an improvement, the new core areas of the yearly modular lessons launched in 2021 are topics on ; Health and Well-being, Nutrition, Education, Entrepreneurship, Resilience and Independence . In the presented 7-year plan, themes involved are;

- Self, Family, and the transformative Learning Intervention;
- Family Life and the Community;
- Collaborative Citizenship and Community Development;
- Organization of Families and Subsidiarity;
- Working Towards Transition and Fostering Spirit of Entrepreneurship;
- Sustaining Economic Initiatives and Transitioning Towards Stability and Self-Reliance; and
- Achieving Independence and Safeguarding Well-being

With this curricula, families are expected to observe a balanced and healthy lifestyle and develop nutrition seeking behaviors, encourage parents to invest in their children's formal/non-formal education, and empower families to acquire sustainable sources of income (Rodriguez and Revilla, 2023, p.29).

4.2 Family Development Session (FDS) during the Pandemic

During the height of the COVID-19 pandemic, much of the modular content, delivery, and evaluation has evolved. Distribution-wise, while the cash transfers to identified 4P's beneficiaries continued to operate, in 2020 FDS sessions were temporarily suspended due to COVID-19 restrictions. However, in the next year the DSWD found it necessary to generate alternative program arrangements to revive the activities of the FDS despite the pandemic-restricted conditions. This is with the rationale that with the growing stressors and challenges brought about by the pandemic, the family beneficiaries would need the support of FDS more than ever (Inso, 2020 para. 2; Palaubsanon, 2020, para.1).

Alternative modes of FDS service delivery include, the online delivery of FDS modules through the use of social media platforms, texts, and active engagement in online messaging groups. With the consideration of beneficiaries with no access to online platforms, offline FDS modes of learning were also arranged with strict implementation of pandemic protocols. This includes the distribution of printed topic-by-topic modules to households, or small group neighborhood discussions which are limited to 8

(eight) family representatives per session (Palaubsanon, 2020, para. 4). Another is the on-air mode of FDS delivery utilizing radio programs and livestreaming through radio and television (Department of Social Welfare and Development, 2021, para. 11).

However, despite this adaptation to limited learning mobility, the success of these alternative learning arrangements remains to be seen. In a World Bank Impact Report, Rodriguez and Revilla (2023, p. 10) has identified that only 25% of the beneficiaries were aware of the availability of the online delivery of FDS learning while others were dependent on materials sent by pertinent agencies to facilitate FDS learning. In this Word Bank Group Policy Note, Rodriguez and Revilla (2023, p.19) gives a critical discussion on the Family Development Sessions (FDS) and Youth Development Sessions (YDS) projects under the Pantawid Pamilyang Pilipino Program (4Ps) and the needed improvements to be done to improve DSWD's behavioral change interventions. In this policy note, the authors were able to provide specific points of intervention in moving forward by taking into account the learnings from the program's pandemic experiences for better and future-proof service delivery. Recommendations include; addressing digital gaps of the beneficiaries to adapt to future shocks and beneficiary needs, developing strategic communication channels, connecting core values,and strengthening monitoring, evaluation, and learning for continuous improvement of the program. In moving forward, despite these challenges, FDS was able to continue its mandate with communities adapting to FDS facilitation practices in whatever mode of delivery is most convenient.

4.3 FDS Community Involvement and Livelihood

Aside from the necessary discussion on change in the mode of delivery during the pandemic, the contents of the FDS modules were also modified to tailor the changing needs of the times. Special focus on Health, Vaccination, and Nutrition, Mental Health and Coping, Financial Literacy, among others, were discussed which directly address pandemic-related concerns of the 4Ps beneficiaries.(Inso, 2020, para. 2).

In this, FDS shows its flexibility and its adaptability to rising new problems, capaciting its beneficiaries to deal with new challenges. Significant to mention is how economic and social limitations brought about by the pandemic gave rise to communal collaborative initiatives towards problems of livelihood and decreased civic participation.

This is significant because while there was potential for the cultivation of civic participation and livelihood generation through FDS, it was largely untapped by the program. In the *"Assessment of Family Development Session of the Pantawid Pamilyang Pilipino Program (4Ps): Content, Process, and Effects"* (2017, p.16) it was revealed that during Family Development Sessions (FDS) the need for sustainable livelihood has been commonly identified by FDS participants. However, the program's response to this manifested need is limited to the facilitation of livelihood training and activities which have yet to be formally integrated to the FDS' operational guidelines. This is despite the fact that FDS as a program has been acknowledged to significantly increased the beneficiaries' perception in community involvement. (Department of Social Welfare and Development, 2017, p.14).

In its recommendations, there is a separate provision for the necessity of conducting regular livelihood activities, seminars, and other interventions to help families attain sustainable incomes and financial security. In addition to this , it also emphasized the need to include skilling programs in the FDS learning and instruction content for a holistic approach to domestic improvement. This is especially crucial to help the family participants to be financially and socially secure even after the family has exited from the Pamilyang Pantawid Program.

4.4 Family Development Session (FDS) in Action : The Case of Samboan, Cebu, Philippines

Partner-beneficiaries in Purok Proper Parian, Barangay Poblacion, Samboan present a case of an evolved Family Development Session group , that transcend its intent as a monthly learning session into a space where communal efforts towards a generation of a source of livelihood and resources is realized.

In one of its Family Development Sessions (FDS), the group was able to reach a consensus to develop a communal garden in their community. The 4ps members were able to cultivate a communal garden using a spare lot owned by their Barangay. A variety of vegetable produce such as tomato,

eggplant, bitter gourd, pumpkin, radish, potato, malunggay, lettuce and many more were made available to its residents.

This was met positively as it addressed a number of problems faced by its community. One of their 4Ps members, Lyn Gerzon, a single mother and owner of a family garden shared (Empuerto, 2022, p.3),

> *" I think it is not healthy to always have dried fish as viand. Growing vegetables helped our family to have healthy meals".*

With the availability of a vegetable garden, having plant produce readily available for consumption encourages the family to have healthy food choices and helps lessen the family expenses on food as well. Expense-wise, it also serves as a source for economic relief on residents whose source of livelihood and income has been negatively affected by the pandemic. As manifested by Erlinda Cabag, the group leader and a manicurist in the community, (Empuerto, 2022, para. 20),

> *"The community quarantine affected our livelihood. One cannot easily go out of the house. As a manicurist, I could not anymore do home service".*

In actuality, the communal garden was an unprecedented success, while it was conceptualized during one of their FDS sessions, they did not expect it to become a flourishing garden with a significant number of residents dependent on its produce. Communal effort was also key on why the project flourished, with members of its community contributing to its cultivation. The community members capacitated themselves with basic agricultural skills once unknown to them to nurture their produce. Fertilizers were made out of collected food scraps, leaves, and animal manure and they were also able to gather recyclables such as paint cans and plastic bottles as materials to use as pots for planting. Later, they were able to expand the variety of their crops by planting local medicinal plants and were able to install other agricultural fixtures such as a small fish pond, a chicken coop, and a scenic treehouse.

Additionally, this unprecedented cooperation strengthened community ties and camaraderie among the 4Ps beneficiaries and other members of the community. It also became an avenue of communal sharing, as it provided enough food to share the produce to its members.

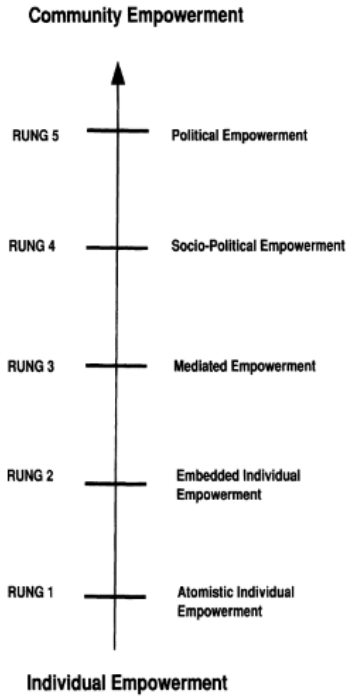
Overall, the success of this grassroots initiative did not go unrecognized, the Purok community was able to garner several awards in barangay, municipal, and even provincial levels. They were able to join the Cebu Provincial Government's SUGBUsog program that encouraged non-farmers to nurture a vegetable garden as an alternative food resource during the pandemic. They were also able to present in different competitions and accumulated 72,000 PHP in their wins. Additionally, they were also recognized in the first DSWD 4Ps Gulayan sa Barangay in 2021(Empuerto, 2021, para. 27).

Currently, this remarkable community initiative is under threat due to the easing of government protocol and the full opening of business establishments. The group leader Erlinda Cabag, who is a manicurist volunteered to lead the group as the pandemic led to the closure of her workplace but when the latest development and adjustment of business activities and transactions in the new normal, Erlinda might go back to working thus leaving the leadership of the communal garden to somebody else. This is also true to other 4Ps beneficiaries who will opt to seek employment in the city.

4.5 Samboan's Community Initiative: Communal Garden in the Lens of Rocha's (1997)Ladder of Empowerment

In the Ladder of Empowerment, Rocha (1997, p.34) provides a spectrum to illustrate how feelings of power and autonomy can be felt by individuals to how it can result in changes in society through efforts of population groups. In her typology, she differentiates five (5) 'rungs' of the Empowerment Ladder classifying them based on intended area of change whether it be individual or communal, methods for empowerment, intended outcomes, and power experiences. An illustration is provided in this paper as **Figure 2**.

Figure 2. Elizabeth Rocha's Ladder of Empowerment (1997)



The first rung points to *Atomistic Individual Empowerment* which pertains to traditional forms of empowerment focusing on the development of one's autonomy and efficacy. This usually applies to individual concerns that do not require systematic interventions to solve the identified problem.

Embedded Individual Empowerment on the other hand, takes into account the individual's relationship to its immediate environment and how he/she fits into a bigger structure. Here, an individual is sufficiently empowered if he is able to navigate one's external context while maximizing one's efficacy and potential. This is usually manifested with little to manageable impediment from external parties (Rocha, 1997, p. 34).

In the third rung, *Mediated Empowerment* transcends but does not exclude the individual focusing instead on how empowerment is reached with emphasis on the presence of an expert or professional as a mediator. The goal is to capacitate individuals or communities to make informed decisions with knowledge coming from experts of the field. This rung of empowerment is further classified into two types, specifically; the prevention model, which views clients similar to children who are wholly dependent on the prescription of the experts in the facilitation of social action programs. This is in contrast to the other classification, the rights model, where the functions of the expert is facilitative , with the expectation that with proper guidance from professionals, communities and individuals will be able to participate in an informed decision-making processes (Rappaport 1981; Gutierez 1990, as cited in Rocha, 1997, p. 37). Overall, this rung acknowledges the merit of learning and exchange between unequal forces to reach a common goal. This power imbalance however, has been negatively perceived by some, pointing out the obvious potential of this arrangement to evolve to a dominant-subordinate relationship.

For the fourth rung of the ladder, Rocha (1997, p.37) labels *Socio-Political Empowerment* as a change in political, social, and economic relations resulting from a communal collaborative struggle against institutional forces. It addresses the powerlessness of marginalized communities and their developed critical consciousness. This model involves the critical reflection of problematic societal conditions by members in the community and the collective action done against them.

Finally, the last rung labelled by Rocha (1997, p.39) as *Political Empowerment* pertains to the process of institutional change as a result of the political processes and policies. Unlike the Socio-Political Empowerment rung, the mobilization of groups is not emphasized, focusing instead on the alteration of a political system to empower formerly silenced marginalized groups and individuals.

This discussion on empowerment and the collaborative effort also resonates with SDG 11 – Make cities and human settlements inclusive, safe, resilient and sustainable; 11.3 by 2030, to enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human

settlement planning and management in all countries. Forms of participatory sustainability initiative prioritizes the integration of technical expertise with the preferences and knowledge of community members in the planning process. It forges consensus building and collective community decision making while encouraging active participation of traditionally marginalized groups in the planning process. It relates to the conference theme as it probes the victories of 4Ps through its FDS.

To contextualize in the case of the 35 household-beneficiaries from *Purok Proper Parian, Brgy. Poblacion, Samboan, Cebu, Philippines* and their success in the establishment of their communal garden winning First Place in the DSWD Regional Contest, individual empowerment from atomistic, embedded and mediated are manifested. In atomistic empowerment some of the household-beneficiaries like Lyn Gerson already have a backyard garden in her own place. She recognizes the relevance of having one's own garden that grows vegetables which is a great help in sustaining the family's needs and health. Further, the FDS is a productive avenue where said beneficiaries are lectured and garnered additional knowledge on parenting as well as educational and health needs of their school children. Individually they have personal insights as they attend and participate in the FDS.

Meanwhile, under embedded empowerment it was during the pandemic that the various household-beneficiaries fortified their intent of implementing the communal garden. Although the idea started during one of the Family Development Sessions in 2019, the urgent needs pushed by the emergence of the pandemic strengthened their collective efforts to make the communal garden flourish and to provide for not only the members of the 4Ps but even to non-4Ps households. They saw that the communal garden has the potential of mitigating subsistence needs in the barangay, so the innovators of 4Ps communal garden had doubled their work to maximize this initiative. They realize that what they do translates to benefits that bear fruit not only for them and their family but to the larger community.

In the rung of mediated empowerment, the personnel, staff and officers of the local government unit(LGU) and DSWD particularly the Municipal Link and LGU links facilitated the full implementation and expansion of the communal garden to include the provision of a fish pond and chicken coop. These technical experts motivated the 4Ps beneficiaries of the purok to make an affirmative action of being able to sustain their communal garden project and to dream big as such, the expansion. Along this capacitation and endorsement by the technical experts of Purok Proper Parian, Brgy. Poblacion in Samboan, Cebu was the latter's decision to join in the first province-wide competition of DSWD on Gulayan sa Barangay 2021, which they won first place. This transcends beyond the intent of 4Ps as a poverty alleviation program, which primarily advocates for individual empowerment translating to ending the cycle of poverty in the household. In this sense, FDS as an avenue for nurturing community initiatives and innovations had pushed the borders toward community empowerment. This is in agreement to communal garden discourses in sustainability literature, of which they have been identified to play an important role in the promotion of social inclusion and camaraderie, promotion of urban health, encouragement active and voluntary of civic participation, and promotion of sustainable living in cities (Turner et al., 2011, p.490)

In Rocha's Ladder of Empowerment, this phase is gradually transitioning to socio-political empowerment, the first rung in the fulfillment of a full-circle community empowerment. In Purok Proper Parian's experience, the collaboration of the stakeholders both 4Ps and non-4Ps members as well as the government and other civic society organizations resonates the community's awareness of the problem they are confronted with and how best they can work as a team toward finding a solution to said problem. There is a collective action as exhibited by the establishment of the communal garden, their alternative to livelihood and source of food during the pandemic. However, the full step in socio-political empowerment has to be secured with sustained conditions in the community. Currently as in the case of Purok Proper Parian, the dispersal of some community leaders back to the city may have served as a risk to what had already been started.

Finally, the last rung - political empowerment may seem elusive as of the moment but with the right leadership, it will be achieved. New arrangements and structures can only be institutionalized under a transparent and accountable leader. After all, corruption and inefficiency in public services are linked to weak governance and leadership. As such, a country's political and economic environment determines, to a large extent, the standard and quality of its public services and administrations. Apparently, leadership makes or breaks a community.

4.6 The Prospects of FDS: A Vision of the Community

With the new normal, FDS has to be multifold. It has to be flexible taking in various formats in order to be adaptive and responsive to the current realities on the ground. The delivery of modular topics is highly dependent on the arising needs of the households -beneficiaries. It may not follow rigid construct, form or order and even structure. It is fluid. It can be presented and shared across different times of the month or year and in varied time and space. It has to be borderless. Those who preferred to resettle back in the cities must be provided with equal and same access to the learning resources and materials including delivery of FDS as those who remain in the rural communities. In sum, community initiatives manifest in myriad forms, not only through the establishment of communal garden. The utilisation of available resources and tapping of individual capacities of the members can commence promising frameworks in innovative strategies of problem resolution. This is what participatory planning from the grassroots is - collaborative, authentic, and organic, an essential corollary in enhancing inclusive and sustainable cities. FDS is not a mere conditionality of the 4Ps cash grant but rather a tool in participatory deliberation at the grassroots level.

5. Conclusion

The Family Development Session (FDS), conditionality in the grant of cash assistance for 4Ps has aided the member and household-beneficiaries to a degree of empowerment that transcends into the community level. During the pandemic, FDS has become an avenue for collective action that translates into an alternative-solution to an emerging problem shared by the community.

FDS has evolved from an isolated session undertaken as a mere conditionality that follows a predetermined set of topics laid out by module, into a voluntary act of community engagement- a clear manifestation of empowerment. In Rocha's Ladders of Empowerment, Purok Proper Parian, Brgy. Poblacion in Samboan, Cebu, Philippines is in the initial step of the rung of socio-political empowerment. This is due to the collaborative efforts of the different household beneficiaries in their efforts of establishing a communal garden and then the fish pond and chicken coop, as expansions. Nonetheless, the threat to this success continued to loom as the easing of government protocol and adjustment in the new normal led to the dispersal of community leaders back to the city. Only the right brand of leadership can propel and direct this aspiring community to the full attainment of empowerment manifested in new political arrangements. As such, the government is challenged to begin with retooling the FDS to be more updated and responsive; cognizant of its crucial role in facilitating individual and community empowerment.

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An empirical study on the impact of perceiving work as a calling and worship of God on perceived work stress of BPO employees in Cebu City, Philippines

Tan, Tiffany Adelaine, Ph.D.
*

University of the Philippines Cebu
Cebu City, Philippines

Corresponding e-mail address: tgtan@up.edu.ph

Abstract. This study examines the relationship between employees' perspectives on work and their perceived work stress, drawing from Freud's defense mechanism concept, where individuals tend to evade or reinterpret negative thoughts. Specifically, it focuses on the use of spirituality to uphold a positive outlook during stressful circumstances. Hence, this study investigates how spirituality influences perceived work stress, with hypotheses stating that perceiving work as a calling of God and perceiving work as worship of God impact perceived work stress. 451 employees from two Cebu City-based BPO companies participated through an online survey, complemented by interviews with the HR directors of these BPO firms. Structural equation modeling was employed to assess the proposed constructs. The findings reveal that perceiving work as an act of worship to God influences the respondents' perceived work stress, whereas considering work as a calling of God does not. The mixed outcomes could be clarified by the respondents' uncertainty about the concept of 'work as a calling of God.' A plausible explanation is that respondents confused 'work as a calling of God' (God-centric) with the necessity to work for financial reasons (need-centric). Despite the mixed results, it is evident that our thoughts influence our emotions and actions.

Keywords: Organisational citizenship behaviour; worship of God; positive psychology; stress; turnover

1. Introduction

The emergence of the COVID-19 pandemic has triggered unprecedented turnover rates on a global scale, with stress serving as a significant catalyst. To illustrate, Cook (2021) and his research team, drawing from a dataset of 9 million employee records from over 4,000 American organisations, observed that in 2021, the highest turnover rates were attributed to mid-career professionals. These individuals were seeking better financial prospects and had reached a breaking point due to work-related pressures and burnout. Furthermore, recent reporting by Horowitz (2022) indicates that elevated turnover rates are also evident in countries like France, Australia, and the United Kingdom, with projections suggesting a continuation of this trend in 2023. Fatigue and a sense of undervaluation stand out as the primary drivers prompting professionals to exit service-oriented industries. This pattern of heightened turnover is equally applicable to the Philippine Business Process Outsourcing (BPO) sector, which is susceptible to stress due to factors like job insecurity, work-life balance challenges, social issues, night shifts, extended working hours, repetitive tasks, ambiguous roles, and unrealistic performance targets (Giridhar, Scholar and Malyadri, 2019).

Lazarus and Folkman (1984) characterized stress as a psychological state wherein individuals perceive unfavourable circumstances as overwhelming, thereby jeopardizing their well-being. They proposed that managing stress involves a dynamic interplay of cognitive and behavioural efforts aimed at navigating these challenging conditions. Consequently, the act of coping is a conscious and purposeful engagement with perceived stressful situations (Biggs, Brough, and Dummond, 2017: p.353).

* Professor, School of Management, University of the Philippines Cebu. Email: tgtan@up.edu.ph

Given the diversity in how individuals perceive stressful circumstances, the strategies employed for coping can also vary. Krohne's (2002) review of coping theories identifies two primary classifications: trait-oriented versus state-oriented and microanalytic versus macroanalytic. The former classification contrasts the behavioural inclinations (traits) against the actual behaviours (states) individuals adopt to cope with stress. In contrast, microanalytic approaches encompass a broad spectrum of specific coping strategies, while macroanalytic approaches operate at a more abstract level, focusing on fundamental constructs (Krohne, 2002, p. 15166).

An illustrative coping strategy adopting a state-oriented, macroanalytic perspective is Freud's defense mechanisms framework (Krohne, 2002), which involves mechanisms like repression and intellectualization. Repressive coping involves cognitive biases intended to avoid or reinterpret negative thoughts and stimuli (Swan and Halberstadt, 2021: p. 404). Swan and Halberstadt (2021) suggest that this coping style facilitates the construction of positive and relevant supernatural concepts capable of sustaining belief. When faced with distressing events such as war rumours, earthquakes, powerful typhoons, and future pandemic concerns (Dreisbach, 2021), individuals might experience helplessness and anxiety about the world's future. A state-oriented, macroanalytic approach to these uncontrollable situations might entail either denying their existence or rationalizing them to mitigate apprehension. Notably, amid escalating global volatility, there is an observable surge in prayer messages and appeals to 'God.' These events, deemed beyond human control, imply that in times of heightened stress and perplexity, people often explore the intangible realm in search of solace, significance, and purpose (e.g., Niewiadomska et al., 2021). This sentiment of being connected to a larger purpose is defined as spirituality by Byrne, Morton, and Dahling (2011).

In alignment with the state-oriented, macroanalytic approach, a repressive coping style involves utilizing religious or spiritual practices to foster a positive outlook in the face of stress. For instance, Garssen, Visser, and Pool's (2021) meta-analysis of 181 longitudinal studies reveals a modest yet positive impact of religion or spirituality on mental health. The study indicates that participants' perceptions of religion (e.g., level of importance) and engagement in religious activities significantly influence mental well-being. Similarly, in a sample of 312 participants, Ho et al. (2016) identify negative correlations between spirituality—manifested as sensing the presence of God, deriving strength and comfort from one's faith, and expressing love for God—and burnout, depression, and anxiety among healthcare professionals in Hong Kong. Moreover, Perera, Pandey, and Srivastava (2018) emphasize the pivotal role that religion and spirituality play in managing stress within the nursing profession.

However, it is crucial to distinguish between spirituality and religion, as the terms are not interchangeable (Tackney et al., 2017). Religion denotes an organized belief system, while spirituality reflects an inner yearning for a higher power. Religion pertains to group affiliation, whereas spirituality involves a personal relationship with a divine entity. In this study, the focus centres on individual spirituality, excluding religion.

Oxarart, Houghton, and Neck (2022) highlight the need for further exploration in this realm, given that much of the existing literature remains theoretical (e.g., Garssen et al., 2021; Lee, Lovelace and Manz, 2014) and lacks empirical substantiation. Moreover, a comprehensive search of recent literature indicates that most studies on spirituality and work stress focus on healthcare workers within the context of the COVID-19 pandemic. This study endeavours to bridge this gap, contributing empirical evidence concerning the nexus between spirituality and perceived stress within the BPO industry. Additionally, this research contributes to the stress management literature, particularly from the perspective of an emerging economy. As such, the primary objective of this study is to examine how spirituality influences the perception of work-related stress among BPO employees.

The subsequent section provides a brief overview of positive psychology and work stress, subsequently delving into the impact of spirituality on shaping perceptions of work and, consequently, perceived work-related stress. The literature review culminates in the formulation of hypotheses. Section 3 and beyond detail the research methodology, data collection procedures, results, and discussions. The concluding section encapsulates final insights, implications for management, and study limitations.

2. Literature Review

2.1. Positive Psychology

Phrases like "Think positive," "Love yourself first," "Focus on what you have," and "Be grateful" resonate as rallying calls for individuals grappling with negative thoughts and anxiety. These expressions encapsulate the essence of positive psychology—a field that investigates factors influencing individuals' health and well-being. Gable and Haidt (2005) defined positive psychology as the exploration of conditions and processes fostering positive and optimal functioning in people, groups, and institutions. They advocated for practices that evoke joy, altruism, and the nurturing of robust families and institutions, positioning them as countermeasures against stress and adverse outcomes (p. 105).

For instance, Valikhani, Ahmadnia, Karimi, and Mills (2019) studied 315 Iranian male soldiers, revealing that cultivating gratitude or directing attention toward life's positive facets significantly diminishes perceived stress and anxiety, thereby influencing overall quality of life. Gratitude, a positive psychological trait, instils a favourable life perspective (p. 44). Similarly, the act of forgiveness has been correlated with noteworthy improvements in quality of life. Drawing from a sample of 773 Italian adolescents, Barcaccia et al. (2019) discovered a negative relationship between forgiveness and indicators of depression or anger-proneness. Another instance of positive psychology's efficacy is found in laughter's ability to attenuate stress and anxiety (e.g., Akimbekov and Razzaque, 2021; Lee and Lee, 2020). Gratitude, forgiveness, and laughter all exemplify positive life perspectives.

This study proposes that spirituality could function as a 'condition' with the potential to positively influence individuals' perceptions of work, thereby reducing perceived work-related stress. The subsequent sections provide succinct overviews of work-related stress, expound upon the proposed dimensions of spirituality, and conclude with the formulation of hypotheses.

2.2. Work Stress

Stress is characterized as “a condition in which an individual is aroused and made anxious by an uncontrollable aversive challenge…(which) leads to a feeling of fear and anxiety… The magnitude of stress and its physiological consequences are influenced by the individual’s perception of their ability to cope with the stressor” (pp. 4 – 5, Fink, 2016). Several key observations emerge from this definition. Firstly, stress manifests as the body's reaction to a stimulus, spanning from everyday nuisances like traffic jams or incorrect orders to life-threatening events like the COVID-19 pandemic or rumours of war. Secondly, individuals respond variably to such stimuli. For instance, in a sample of 665 respondents, Smith, Barratt, and Hirvo (2020) found that their respondents’ personalities (e.g., resiliency and under or over-controllers) influenced their work engagement and burnout. Lastly, stress emerges as a response to the perceived threat posed by a particular event. A separate study of 957 South African adults demonstrated that perceptions of COVID-19 infection risk and childhood trauma triggered depression in 14.5% of respondents (Kim, Tawanda, and Mendenhall, 2020).

Despite the general conception of stress as an external stimulus, others interpret it as "the response rather than the stimulus" (Van den Bergh, 2021, p. 6). Lazarus and Folkman (1984) framed stress as a dynamic interaction between individuals and their circumstances. In the realm of organisational behavior (OB), stress is often linked to change. For example, an unscheduled office meeting could be stressful for someone with an important family event, because the additional time spent in the office could cause delays or missed gatherings. Changes in administrative leadership or organisational structure can trigger anxiety among employees due to perceived threats. In this case, the anxiety stems from employees' negative responses to change, rather than the change itself. While certain instances of stress might be beneficial, stress is predominantly defined as "an unpleasant psychological process that occurs in response to environmental pressures" (Robbins and Judge, 2017, p. 659). Thus, in this study, stress pertains to the response triggered by perceived threats to the status quo.

Undeniably, perception significantly influences behaviour. Across numerous studies, OB scholars have established that attitudes toward perceived threats or stimuli shape behaviour. For instance, research has revealed that people's perception of COVID-19 risk directly impacts travel anxiety and subsequently shapes

their travel plans (e.g., Bratić et al., 2021; Parady, Taniguchi, and Takami, 2020). In a study involving 394 employees, SimanTov-Nachlieli and Bamberger (2021) discovered a substantial link between perceived justice (process and outcome pay), negative emotional states, and counterproductive workplace behaviour. These studies underscore the notion that altering specific behaviours hinges on transforming how people perceive threats or stimuli.

Given that certain stress responses encompass exhaustion, feelings of undervaluation, burnout, anxiety, and diminished work engagement, it is imperative for managers to be vigilant about stress' impact. Moreover, stress can detrimentally affect employee loyalty, engagement, organisational performance, and customer service (Arnetz et al., 2013).

Since stress is a psychological state, this study's focus centres on investigating the influence of an individual's spirituality on their perception of work-related stress. This study adopts a two-dimensional iteration of the State-Trait Anxiety Inventory developed by Spielberger and colleagues in 1983 (Parady et al., 2020). The two dimensions encompass state anxiety, reflecting reactions to specific adverse situations, and trait anxiety, representing "a more stable tendency to experience anxiety in a myriad of situations" (p. 2). Parady et al. (2020) streamlined this version to reduce response burden. Numerous studies across different nationalities and contexts have employed these scales in various forms (e.g., Bonanno, Maccallum, Malgaroli and Hou, 2020; Forte, Favier, Tambelli and Casagrande, 2020; Lemée, Fleury-Bahi and Navarro, 2019).

In exploring how spirituality aids individuals in coping with work-related stress, it's pertinent to note that an idea's impact on behaviour stems from the individual's perception of that idea as a reality. The accuracy of the idea appears secondary to an individual's belief in it. For instance, God is not only a concept but a reality to most people. This reality can result from an individual's familial and educational background, giving rise to the proliferation of religious groups. Within these communities, individuals not only believe in a higher power but also seek to establish a living, meaningful relationship with this divine entity. This study's focal group is the latter—those who aspire to connect with something larger than themselves, what Tackney et al. (2017) define as spirituality: "the innate human need to be connected to something larger than ourselves, something we consider to be divine or of exceptional nobility" (p. 4).

The next section operationalizes spirituality and culminates in the formulation of proposed hypotheses.

2.3. Spirituality

Interest in exploring the impact of spirituality on stress management within service organizations has been steadily growing. Notably, Saxena, Garg, Punia, and Prasad (2020) provided empirical evidence of a negative correlation between spirituality and stress in a sample of 202 Indian employees working in the oil and gas sector. Their study defined spirituality as deriving meaning from one's work. Likewise, Kuchinka (2021) conducted a study involving 105 health workers and found a significant relationship between spirituality, stress, and overall well-being. In this study, spirituality was defined as the pursuit of a connection with a higher power, accompanied by a sense of purpose in life. Both investigations underlined how individuals' spirituality influenced their perceptions of their job and work environment, specifically in relation to a higher power. Saadatyar, Poursalimi, Al-Tabbaa, and Iannotta (2020) analyzed data from 550 respondents and established a substantial, positive connection between workplace spirituality and employee work commitment and performance. Additionally, Arnetz et al. (2013) studied 649 participants and observed that spiritual values in the workplace, encompassing activities like prayer and maintaining a positive outlook, notably reduced work-related stress, and fostered mental well-being. In a meta-analysis of 78 empirical studies on workplace spirituality spanning from 2000 to 2015, Vasconcelos (2018) found a consensus among multiple studies that spirituality can mitigate work-related stress. Numerous studies have also investigated the role of spirituality within the realm of positive psychology (e.g., Phan et al., 2020; Rye, Wade, Fleri, and Kidwell, 2013). The promotion of workplace spirituality aligns seamlessly with the tenets of positive psychology, which examines the "conditions and processes that contribute to the flourishing or optimal functioning of people" (Gable and Haidt, 2005, p. 104).

While scholars examining workplace spirituality have employed various metrics, certain commonalities emerge. Arnetz et al. (2013), Kuchinka (2021), Saadatyar et al. (2020), and Saxena et al. (2020) all consider inner life or recognition of spiritual power and finding purpose in work as integral aspects of spirituality.

Building on this consensus, the present study defines spirituality as an individual's relationship with spiritual power or a higher being, thereby deriving their life purpose from that relationship. This definition presupposes the individual's acknowledgment and acceptance of an uncreated, perfect, and sovereign God. It posits a state of dependence of the created upon the Creator, the helpless upon the Perfect, and the seeker upon the Sovereign.

The famous quote attributed to mathematician and philosopher Blaise Pascal regarding the discontentment in people's hearts. "There is a God-shaped vacuum in the heart of each man which cannot be satisfied by any created thing but only by God the Creator, made known through Jesus Christ" (e.g., Hagedorn and Moorhead, 2010). This sentiment highlights how individuals attempt to fill this 'vacuum' with various pursuits but often find it unfulfilled. Pascal's insight aligns with the Bible, which states, "for we are His workmanship, created in Christ Jesus for good works, which God prepared beforehand so that we would walk in them" (New American Standard Bible, 1995, Ephesians 2:10). Undoubtedly, this verse suggests two truths about individuals: God designed humanity and intended them for specific work. Hence, if work is planned by God, then work is a calling by God.

Duffy, Dik, Douglass, England, and Velez (2018) defined calling as an approach to work reflecting a pursuit of purpose and meaning, aiming to assist others or contribute to the common good, driven by either external or internal summons (p. 426). Similarly, Neubert and Halbesleben (2015) characterized "spiritual calling" as a divine summons to approach work with purpose and a commitment to excellence (p. 860). Without God's calling or vocation, work becomes a mere job or career pursued for financial gain, potentially lacking in fulfilment. Thompson and Bunderson's (2019) review of work as a calling emphasized its robustness, aligning with the concepts of life meaning and purpose. To perceive work as designed by God is to perceive it as a divine calling or vocation, and such work becomes an act of worship and devotion to God.

While the pandemic might have triggered "The Great Resignation" in 2020-2021, burnout and a lack of purpose are deemed the driving factors (Horowitz, 2022). Acknowledging oneself as a creation is crucial, implying recognition of a Maker, and thus, a purpose behind the creation. Esteemed pastor and author John Piper (2013) expounded on being created as synonymous with being an image-bearer. He contended that being created by God means reflecting His nature and radiating His essence, which calls attention to the brilliance of God's glory. This perspective resonates with the Bible:

> "Whoever speaks, is to do so as one who is speaking the utterances of God; whoever serves is to do so as one who is serving by the strength which God supplies; so that in all things God may be glorified through Jesus Christ, to whom belongs the glory and dominion forever and ever. Amen" (New American Standard Bible, 1995, 1 Peter 4:11).

Another passage reinforces this principle:

> "Whatever you do, do you work heartily, as for the Lord rather than for men, knowing that from the Lord you will receive the reward of inheritance. It is the Lord Christ whom you serve" (New American Standard Bible, 1995, Colossians 3:23-24).

These verses unambiguously affirm that the primary purpose of work is to serve God, not to pursue personal gains such as wealth, position, promotion, or pleasure.

Furthermore, viewing work as worship of God implies giving one's best at work and being excited about doing it. For instance, when a BPO employee, who sees her work as a calling and worship of God, encounters a disgruntled caller, her priority would be to look for ways to resolve the caller's issue without letting the situation stress her out. The employee's response is how she would respond to a God who has a plan for her, and not to an irate customer who is demanding service. In this instance, the employee's response is toward the one who has a plan for her life, God. On the other hand, someone who perceives work as solely a means to make money and pay for expenses may view the disgruntled customer as an inconvenience and a stressful situation. Such a response is pointed towards the stressful event, the customer.

It is, therefore, argued that individuals who perceive their work as a calling and an act of worship to God are likely to exhibit reduced negative reactions and emotions when faced with stressful work situations.

H1A: one's perception of work as a calling of God negatively correlates with state anxiety.

H1B: one's perception of work as a calling of God negatively correlates with trait anxiety.

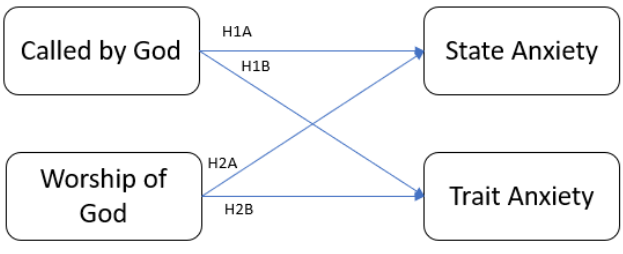
H2A: one's perception of work as worship of God negatively correlates with state anxiety.

H2B: one's perception of work as worship of God negatively correlates with trait anxiety.

2.4. Research Framework

Figure 1 illustrates the proposed relationship between the variables. The conceptual framework delineates the independent variables of calling and worship of God, juxtaposed against the dependent variables of perceived work stress.

Figure 1. Proposed conceptual framework.



3. Methodology

3.1. Research Design

The research methodology employed in this study is survey research. The survey encompasses questions about spirituality (comprising two proposed dimensions) and perceived work stress. Furthermore, standard demographic information was collected, including age, assigned sex at birth, marital status, religious affiliation, frequency of monthly church attendance, range of net monthly income, and highest level of educational attainment.

3.2. Survey Questionnaire

Two dimensions, namely "work as a calling of God" and "worship of God," were chosen to measure spirituality in this study. The "calling of God" dimension was operationalized using the transcendence calling scale developed by Dik, Eldridge, Steger, and Duffy (2012). This measurement has been successfully applied across different cultural contexts, including a study on 2,617 Chinese doctors (Zhang et al., 2020), 398 American employees at Amazon (Choi et al., 2020), and 294 registered nurses in Pakistan (Afsar, Umrani and Khan, 2019), with Cronbach's alpha values indicating good internal consistency (0.78 to 0.82).

The "worship of God" dimension was defined through a Delphi method involving three Bible experts. These experts were tasked with defining the dimension based on specific Bible verses, including Ephesians 2:10, 1 Peter 4:11, and Colossians 3:23-24. The proposed statements were iteratively refined until a consensus was reached among the experts, ensuring the construct's accuracy and alignment with spiritual principles. Additionally, a content validity assessment was conducted by a panel of four experts, affirming the relevance of the proposed items to the constructs. The Content Validity Index (CVI) demonstrated high agreement and validity among the experts.

To further validate the instrument, the Pearson Product Moment Correlation was employed. The analysis confirmed the instrument's validity through correlations (rxy) that exceeded the critical value based on the *r*-distribution table (with alpha = 0.025 and n = 451) and achieved statistical significance ($p < 0.05$) for all items. The results showed that all the correlations have values greater than 0.1094 and are significant. Therefore, all the items are valid.

Thus, the following statements were used to measure the proposed dimensions:

1. Calling of God: "I believe that I have been called to my current line of work (C1)." "I was drawn by something beyond myself to pursue my current line of work (C2)." "I am pursuing my current line of work because I believe I have been called to do so (C3)."

2. Worship of God: “I believe that I honour God in the work I am doing (W1).” “I am pleasing God when I do well in my work (W2).” “I give my best in my work because God is my ultimate employer (W3).”

The questions concerning perceived work stress were adapted from Parady et al. (2020) and tailored to the research context. The following dimensions and questions were used to measure perceived stress or anxiety:

1. State anxiety: "I feel anxious about work (S1)." "I feel nervous about work (S2)." "I am worried about work (S3)."
2. Trait anxiety: "I feel that work difficulties are piling up so that I cannot overcome them (T1)." "I am inclined to take work issues hard (T2)." "Some unimportant thoughts concerning work run through my mind and bother me (T3)."

Respondents answered a total of 12 Likert scale questions corresponding to the two proposed dimensions of spirituality as independent variables (work perceived as a calling of God and worship of God) and the two dimensions of perceived work stress as dependent variables. Participants were asked to indicate the extent to which they believed the statements accurately described their feelings. The scale used for responses was as follows: 1 = not at all true of me; 2 = somewhat true of me; 3 = mostly true of me; 4 = absolutely true of me.

3.3. Participants

The study's participants consisted of individuals employed within the BPO industry in Cebu City. Notably, the Cebu BPO sector is among the city's most significant employment contributors. Even at the height of the COVID-19 pandemic in 2020, this industry consistently provided employment for an estimated workforce ranging from 180,000 to 190,000 individuals in Cebu (Lorenciana, 2021). Thus, it is worthy of attention.

Employing a sample size calculator (www.calculator.net/sample-size-calculator.html), the study aimed to secure a sample comprising no less than 385 participants, ensuring a robust 95% confidence level even with an unlimited population size. To achieve this targeted sample size, the assistance of two HR managers was enlisted. Their combined reach extended to approximately 1,250 individuals within Cebu City's professional landscape, as of this writing. Participating respondents were offered compensation amounting to 75 pesos (approximately $1.35), a gesture of appreciation for their involvement in the study. It's important to note that this token of gratitude was optional, with participants given the liberty to decline it should they prefer not to accept it.

3.4. Data Collection

The study employed a convenience sampling technique to gather participants. Among the workforce of the two chosen BPO firms, a total of 451 adults, accounting for approximately 36 percent of the total, actively participated in the survey. Notably, the involvement of employees in the study was strictly voluntary, with the HR managers overseeing the process. The survey was efficiently conducted through an online platform, specifically Google Forms, for the sake of convenience.

It's noteworthy that participants were duly informed that their decision regarding participation would not in any way impact their employment status within their respective companies. This assurance was extended to allay any concerns or reservations regarding non-participation in the study.

3.5. Data Analysis

Structural equation modeling (SEM) was utilized to explore the relationships between the proposed dimensions of spirituality and perceived work stress. SEM proves to be a suitable statistical tool for testing the anticipated connection between observed and latent variables (Huang, Sung, Chen, and Liu, 2021). To validate the model, the goodness of fit indices and RMSEA were generated, while the Cronbach alphas were the basis for the instrument’s reliability. In addition, confirmatory factor analysis was used to determine the relationships of the items to the latent constructs based on the selected Bible verses.

3.6 Ethical Considerations

In adherence to ethical requirements, participants had to give their consent before engaging in the questionnaire. The respondents were provided with written information about:

1. The study's purpose and objectives;
2. Their potential contribution to the study's advancement through participation;
3. Assurances of data confidentiality;
4. Their rights as research participants and offered compensation; and
5. Researchers' contact details for inquiries, queries, or comments.

4. Results and Discussion

Table 1 presents a summary of the descriptive statistics for the study participants. Out of the 451 subjects, approximately half (228 respondents) are female, while 66 percent (296 respondents) are single. Moreover, 65 percent (296 respondents) are under the age of 30 and earn a monthly income of less than ₱25,000 (approximately $450). In terms of educational attainment, around 60 percent (268 respondents) have obtained at least a bachelor's degree, whereas 18 percent (82 respondents) have completed high school, and the remaining individuals have pursued some college (20%, 90 respondents) or vocational (2.5%, 11 respondents) units. Furthermore, 76 percent (344 respondents) identify as Roman Catholics, while the rest identify as Gospel-Based Christians (12%) and other affiliations (12%).

Table 2 displays the mean and standard deviation of the two dimensions under study. The respondents exhibit greater agreement with perceiving work as a calling of God (M = 2.976, SD = 0.841) and as an act of worship to God (M = 3.185, SD = 0.887) within the spirituality dimension. Conversely, the average level of agreement is lower for perceived work stress, specifically for state anxiety (M = 2.212, SD = 0.996) and trait anxiety (M = 2.133, SD = 0.940).

Table 3 provides the results of the confirmatory factor analysis (CFA), which was conducted using the AMOS 24 statistical package. The standard coefficients' magnitude and t-values (ranging from 0.55 to 0.86, with t-values > 2.000 and $p < 0.001$) indicate significant and strong correlations between each item and its corresponding latent construct. Additionally, the fit indices confirm the good fit of the proposed model: CMIN/DF = 2.564, CFI = 0.978, RMSEA = 0.059, and p-close = 0.127. Meeting the thresholds proposed by Hair, Black, Babin, and Anderson (2010), the factor loading should be at least 0.50, CMIN/DF should be < 3, CFI should be ≥ 0.95, RMSEA should be < 0.08, and p-close should be ≥ 0.05. Lastly, Table 4 displays the results of the scale reliability assessment for both the spirituality and perceived work stress dimensions. The calculated Cronbach alphas (ranging from 0.804 to 0.877) indicate strong internal consistency for the proposed scales.

Table 1. Descriptive statistics of the respondents, n=451.

Gender	# (%)	Age	# (%)	Educational Attainment	# (%)
Male	177 (39)	Less than 25	191 (42)	High School	82 (18)
Female	228 (50.5)	26 to 30	105 (23)	Some College	90 (20)
LGBTQ+	39 (9)	31 to 35	68 (15)	Vocational (Tec Voc)	11 (2.5)
Prefer not to say	7 (1.5)	36 to 40	47 (10)	College/Bachelor's	250 (55.5)
		41 to 45	22 (5)	Master's Degree	18 (4)
		46 to 50	8 (2)		
		Above 50	10 (2)		

Marital Status	# (%)	NET Monthly Income	# (%)	Church Denomination	# (%)
Single	296 (66)	Less than ₱25K	295 (65)	Roman Catholic	344 (76)
Married	76 (17)	₱25K to 40K	124 (27)	Gospel-Based	52 (12)
Live w/ a Partner	43 (9.5)	₱40K to 55K	18 (4)	Christianity	
Separated	33 (7)	₱55K to 70K	6 (1)	Iglesia ni Cristo	19 (4)
Others	3 (0)	70K to 85 K	6 (1)	Non-Christians	30 (7)
		more than 85K	2 (0)	None	6 (1)

Table 2. Mean and standard deviation of the spirituality and perceived stress dimensions, n=451.

Variables	Mean	Standard Deviation
Calling of God	2.976	0.841
Worship of God	3.185	0.887
State Anxiety (Stress)	2.212	0.996
Trait Anxiety (Stress)	2.133	0.940

Table 3 presents the coefficient estimates derived from the structural equation modeling. However, not all path coefficients were statistically significant and aligned with the hypothesized direction. For example, although the path coefficient from state anxiety to calling is significant (p-value = 0.048), it does not follow the expected direction, thus failing to support hypothesis 1A. Similarly, the coefficient estimate for trait anxiety does not exhibit the anticipated direction and lacks statistical significance (p-value = 0.170), hence not supporting hypothesis 1B. Conversely, the results regarding the worship of God path reveal that perceiving work as an act of worship significantly reduces state anxiety (p-value = 0.048), thus confirming hypothesis 2A. Nevertheless, while the expected direction is observed, the coefficient estimate for trait anxiety and worship of God remains statistically insignificant (p-value = 0.170). Consequently, the findings strongly endorse hypothesis 2A (indicating that perceiving work as worship of God negatively correlates with stress anxiety), while failing to support hypotheses 1A, 1B, and 2B.

Table 3. SEM results of the spirituality and perceived work stress dimensions.

Measurement	Standard Coefficient	t-value	Cronbach Alpha
C1 <-- Calling	0.55	14.794*	
C2 <-- Calling	0.58	15.508*	0.804
C3 <-- Calling	0.68	14.794*	
W1 <-- Worship	0.79	20.313*	
W2 <-- Worship	0.79	20.429*	0.877
W3 <-- Worship	0.88	20.313*	

S1 <-- State	0.81	20.459*	0.874
S2 <-- State	0.86	21.207*	
S3 <-- State	0.84	20.459*	
T1 <-- Trait	0.81	19.207*	0.833
T2 <-- Trait	0.76	17.700*	
T3 <-- Trait	0.80	19.207*	
State Anxiety <-- Calling	9.20	1.981**	
Trait Anxiety <-- Calling	13.68	1.373	
State Anxiety <-- Worship	-9.20	-1.977**	
Trait Anxiety <-- Worship	-13.67	-1.373	

Note: **t*-values significant at $p < 0.001$; ***t*-values significant at $p < .05$

The mixed outcomes concerning the first hypothesis can be explained by potential confusion among respondents regarding the concept of 'work' as a calling of God. Despite the high proportion (92 percent) of respondents identifying with a denomination that believes in God (refer to Table 1), many do not consistently engage in religious practices. Specifically, Table 4 demonstrates that only 13 percent (58 respondents) attend church every Sunday, while the majority attend either once a month (20 percent) or not at all (35 percent). Furthermore, when questioned about their frequency of attending church activities beyond Sunday masses or Sabbath services, 47 percent indicated no attendance. Similarly, 64 percent do not participate in other church gatherings aimed at deeper exploration of God's teachings, such as bible studies. These results suggest a lack of enthusiasm for seeking a deeper understanding of God. Consequently, if individuals do not actively attend church services or events to learn about the divine call, how can they comprehend God's calling in their lives? This phenomenon aligns with a bishop's assertion regarding the religiosity of Filipinos, noting that although many profess faith in God, this belief often fails to translate into godly conduct, as evidenced by issues such as corruption and lack of social concern (Saludes, 2021).

Table 4. Respondents' spiritual practices, n=451.

Particular	#Resp	%
Frequency of church attendance in a month		
0 [does not attend church at all]	159	35
1	91	20
2	99	22
3	44	10
4 [regularly attends Sunday services/mass]	58	13
Frequency of attending other church gatherings in a month aside from Sunday mass or Sabbath services		
None	210	47

1	88	20
2	33	7
3 or more	120	26
Attendance of other church gatherings		
Yes	162	36
No	289	64

A second plausible explanation pertains to respondents' potential confusion of 'work as the calling of God' (God-centric) with their need to work for financial sustenance (need-centric). It is common knowledge that prominent benefits of BPO employment encompass competitive salaries and improved perks compared to other job sectors in the country. Furthermore, BPO positions do not necessarily require a bachelor's degree, unlike various other Philippine industries, such as education, banking, and hospitality. Remarkably, as indicated by the descriptive statistics in Table 2, around 40 percent of the participants lack a bachelor's degree, and 42 percent are below 25 years of age. Moreover, the starting remuneration in BPO firms often surpasses that of several private companies in Cebu, irrespective of educational attainment and age. Hence, it is plausible that the respondents in this study primarily pursued BPO employment to address their families' economic necessities rather than in response to a divine calling.

In light of the aforementioned discussion, the study's results align coherently with the BPO industry's high turnover rate. This scenario can potentially be attributed to burnout syndrome, which the World Health Organization ("Burn-out an occupational…," 2019) defines as an occupational issue rather than a medical condition. The phenomenon is characterized by exhaustion, increased detachment from one's work, and decreased professional effectiveness. This manifestation of burnout occurs when the disparity between personal aspirations and actual work becomes pronounced. As confirmed by the HR managers involved in this study, financial incentives, bonuses, and career growth constitute the foremost reasons for employees joining BPO firms. This indicates that many respondents might have engaged in BPO employment primarily for financial incentives. While this motivation is valid, it might not adequately address stressful situations. Consequently, when individuals perceive that they are 'obliged' to work solely out of economic necessity, their perceived work anxiety can amplify during unfavourable circumstances like night shifts, increased quotas, mandatory overtime, or missed family gatherings.

Regarding the second hypothesis, the prevalence of the concept of worship of God surpasses that of calling. Several explanations can shed light on the mixed results for hypothesis 2. Firstly, worship is ingrained in the Filipino culture. Martin's unpublished dissertation (2021) delves into Filipinos' cultural disposition to engage in image-based worship as a means of expressing their faith. His research identifies factors such as tradition, cultural and religious devotion, personal experiences, and the essence of meaning as the cornerstones of Filipino worship practices. Furthermore, scholars like Bautista (2021) and Martin (2021) highlight the Filipinos' unwavering devotion to *Santo Niño* (a representation of the child Jesus) as a pivotal aspect of religiosity in the Philippines. Notably, Cebu City, where the current study took place, annually hosts the '*sinulog*' festival, dedicated to *Santo Niño*. This celebration features vibrant music and dancing to honour *Santo Niño*. Consequently, the concept of worshiping God, whether through spiritual contemplation or veneration of sacred images, is far from unfamiliar to Filipinos, distinguishing it from the more elusive notion of a divine calling. Furthermore, this devotion aids individuals in managing life's anxieties, including those stemming from work, as Roman Catholics believe that the sacred image of *Santo Niño* possesses the ability to answer prayers and provide solace during challenging circumstances (Brion et al., 2018).

Secondly, despite an increase of 1.4 percentage points or roughly 2.3 million individuals living in poverty in 2021 due to the pandemic ("Pandemic pushed millions…," 2022), the Philippines remains the second happiest country in Southeast Asia and ranks 60th among 146 nations in 2022 ("PH ranks 2nd happiest…," 2022). An extensive study conducted on 1,200 Filipinos nationwide by Porio and See (2017) uncovered that 71 percent of respondents expressed substantial satisfaction with their overall lives. Interestingly, Cebu City respondents reported greater satisfaction levels than their counterparts in Metro Manila (the capital of the Philippines). Notably, although slightly over half (58 percent) conveyed

satisfaction with their employment and job security, 84 percent asserted contentment with their family life, and 83 percent claimed to enjoy good relationships with friends. These findings from Porio and See (2017) suggest that Filipinos tend to compartmentalize their emotional states, effectively separating stable emotions such as happiness and work-related stress from work and family domains. Similarly, it is plausible that when Filipinos encounter work-related anxiety, this sentiment is confined to the moment of work (state anxiety) and may not necessarily extend to a sustained perception of work when in the family context (trait anxiety). This phenomenon can be attributed to the deeply ingrained Filipino value of family, where family members find robust support from one another.

5. Conclusion

This study delves into the impact of spirituality on perceived work stress, exploring how belief in a higher power (God or Creator) can provide individuals with a sense of purpose and tranquility, attributing events to a greater plan. Consequently, the hypothesis posits that perceiving work as both a calling and worship of God could potentially alleviate perceived work stress or anxiety.

Nevertheless, the findings indicate that only when individuals perceive their work as an act of worship to God does their perceived work stress or anxiety diminish. This observation gains significance in light of the fact that the majority of respondents do not attend regular religious services. Moreover, among the two dimensions of work stress outlined in this study, statistical significance is attributed solely to state anxiety, reflecting immediate reactions to specific situations. Conversely, the link to trait anxiety, which represents longer-term generalized anxiety, lacks statistical significance. This outcome underscores the short-term nature of stress. Consequently, the findings exclusively endorse Hypothesis 2A, while failing to support Hypotheses 1A, 1B, and 2B.

Several implications emerge from this study. Primarily, recognizing that religious beliefs impact cognition and emotions (Perera et al., 2018), BPO companies could consider fostering an environment conducive to exploring and practicing faith. Given the predominantly Christian character of the Philippines, BPO firms might encourage employees to deepen their understanding of Christianity. This could encompass organising Bible studies within the workplace. Additionally, advocating for more spiritually-centred coping mechanisms is advisable. Establishing an environment that encourages employees to transcend worldly concerns through spirituality could involve providing designated spaces for prayer and reflection. Furthermore, devising activities enabling call center agents to openly discuss work-related anxieties with a spiritual mentor could yield constructive strategies for addressing these challenges. The objective is to empower Christians to fortify their relationship with God, utilizing faith as a catalyst to surmount stressors, a technique proven effective (Perera et al., 2018).

Secondly, as per the World Health Organization's perspective, burnout stems from a dissonance between employees' aspirations and their actual tasks. A wider disparity amplifies the risk of burnout. In response, BPO companies could foster and champion workplace spirituality, as research underscores its protective role against burnout (Khari and Sinha, 2021). Cultivating an organizational culture that values individuals' spiritual well-being, coupled with a sense of societal contribution through their work, could narrow the perceived disconnect. When recruiting, companies might emphasize the broader purpose beyond financial incentives. Monetisation should be ancillary, not the primary motivation for joining BPO firms. Crafting a company mission statement centred on a higher purpose could elucidate that God's calling transcends mere financial obligations. By fostering an understanding that their contributions align with a greater mission, Christian employees can cultivate a stronger connection with the company, potentially mitigating burnout's impact (Khari and Sinha, 2021) and potentially bridging the perceived gap.

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Cascading Development to the Marginalized: The Case of the Badjao Community in Brgy. Totolan, Dauis, Bohol

Ana Leah Dungog-Cuizon, DPA[1] and Cyril Bryan Dosdos-Cuizon, MPA[2]

[1] University of the Philippines Cebu, Gorordo Avenue,
Lahug, Cebu City, Cebu, Philippines 6000
[1]adcuizon@up.edu.ph

[2] University of the Philippines Cebu, Gorordo Avenue,
Lahug, Cebu City, Cebu, Philippines 6000
[2]cdcuizon@up.edu.ph

adcuizon@up.edu.ph

Abstract. This study sought to account the impact of the Kapit Bisig Laban sa Kahirapan - Comprehensive Integrated Delivery of Social Services -National Community Driven Development Program (Kalahi CIDSS-NCDDP) to the improvement of the day to day living of the Badjao community. Further, it traced their history, ethnicity and institutional arrangements as a group of people. This is a purely qualitative study utilizing an ethnographic method of data gathering and analysis. The data gathered was based on actual immersion and observation in the participant's real-life environment. Narrative account of actual observation is a major source of information. Key informants who have had direct access to the Badjao community for over a year and have personal knowledge of the KC-NCDD projects were identified and selected to participate for the purpose of validation. Personal interview was conducted to the Badjao community leader and/or elders, Municipal Local Government Unit (MLGU) representatives, Municipal Inter-Agency Committee (MIAC) and Civil Society Organization (CSO) representatives. An understanding of the Badjao community's dynamics is a realization that at the core of empowerment lies the needs of the economically and socially marginalized groups. In this light, the Ladder of Empowerment proposed by Elizabeth Rocha in the *Journal of Planning Education and Research (1997)* is utilized in order to describe the characteristics of the Badjao Community in terms of democratic decision-making vis-à-vis individual and collective forms of community empowerment through the KALAHI-CIDSS NCDDP. Brgy. Totolan, Dauis, Bohol is among the targeted areas of the program since 2015. The locality hosts diverse people with the presence of the Badjao community (an indigenous group of Austronesian ethnic origin). It has been noted that the participation and involvement of the Badjaos to the program had made positive impact to their daily lives. However, the degree and extent of empowerment may vary across the lens of the different stakeholders. What is positive to note is the personal recognition of the Badjao that they are Filipinos, born in the Philippines with lives that changed through their participation and involvement in the program.

1. Introduction

The buzzword in Kalahi CIDSS-NCDDP is Community Driven Development (CDD). The merit of CDD schemes in empowering indigenous communities have been recognized by other countries and development-oriented organizations. The World Bank (2016, para. 10) shares its existing partnerships with different localities across countries from Nepal, Vietnam, Myanmar, among others in facilitating CDD efforts.

Being community-based, as its nomenclature suggests for CDD, local communities are empowered in the identification and implementation of projects they need the most. Community-identified projects had reaped success in benefiting its target municipalities thereby enhancing governance and improving public satisfaction. Community volunteers have emerged as catalysts of change in further stimulating and strengthening such projects. CDD operates on the principles of transparency, participation, local empowerment, responsiveness to community needs, greater accountability to communities on the part of project implementers, and enhanced local capacity (Austria-Young, 2018, p.3).

Kalahi CIDSS-NCDDP needless to emphasize, has centred its service to its targeted poor municipalities across the region. And beyond this, it has taken into consideration the cultural backdrop, ethnicity and uniqueness of its beneficiaries. According to Austria-Young, J. (2018, p.5), **"**the Department of Social Welfare and Development (DSWD), for its part, has taken concrete steps to contextualize CDD principles and approaches so they fit within a culture-sensitive framework based on indigenous peoples' cultural identity and unique situation."

Brgy. Tutolan in the Municapility of Dauis, Island of Bohol is among the local government units (LGUs) that have been a recipient of the KALAHI-CIDSS-NCDDP. The diversity of the people in the said locality proves to be an interesting focus of this study. In particular, a growing community of the Badjao people had been thriving in the area for a considerable time now. They too had participated and benefited from said projects. It is interesting to note that there had been observable changes in their attitude towards dealing with the outsiders (of their community) and a notable sense of empowerment in them as they welcome the program.

2. Literature Reviews

2.1 The Badjaos

The word Badjao is a Malay-Bornean term that means 'man of the seas'. They are a distinct ethnolinguistic community that can be found in Eastern Indonesia, Sabaj, and the Southern Philippines. In the Philippines, they are more popularly known as the 'Sea Gypsies' (Sather 1997 as cited in Anacio & Simondac, 2013, p. 9) to relate to their natural ability in sea diving. Thus, it is not surprising that their primary source of livelihood is fishing. On the other hand, they earn a living from being navigators, pearl divers, boat builders, and mat weavers (Anacio & Simondac, 2013, p.10). Aurora Roxas-Lim in her study Marine Adaptations and Ecological Transformation: The Case of the Bajau and Samalan Communities describes the Badjaos as 'nomadic, subsistence-based fishing and foraging communities, residing in relatively tiny, rural enclaves, far from commercial, industrial, and government hubs'. The community's social structure is based on the central family, close blood, and affinal kinsmen.

The Badjaos used to settle in the Southern part of the Philippines. However, due to the constant and violent dispute between the government forces and the Moro National Liberation Front (MILF) armed groups during the 1970s, the Badjaos moved to several parts of the country. Thus, some of the Badjaos decided to settle in Totolan, Dauis, Bohol to search for a better life. Although they migrated, Badjao remained to make a living from the sea (Bracamonte et al, 2011, p 287). Migration caused by disputes and loss of livelihood has led the Badjao community to change some of their traditions, culture, and ethnic identity to adapt to the new social and environmental conditions. The shift in Badjao's traditional culture is seen by thinkers as evidence of ethnogenesis, or the formation of new ethnic groups (Daug et al, 2013 as cited in Anacio & Simondac, 2013, p.10).

Over the years, the Badjaos remain searching for a place they can call their own. Migration has become part and parcel of their lives. In contrast to other Indigenous People (IPs) in the country, who are in a constant struggle to reclaim their ancestral lands, the 'Sea Gypsies' are in a constant search for their ancestral seas. With the different issues faced by the Badjao community as mentioned by Bracamonte et al (2011, p.288) in their study From the Seas to the Streets: The Bajau In Diaspora in the Philippines– (a) non-classification of the community as part of the IPs, (b) the distribution of the Bajao in many cities in

the country manifests a national issue that should be dealt through legislation, and (c) political and cultural concerns–Anacio & Simondac (2013, p.11) posited that there is indeed a need to formulate alternative interventions anchored on the institutionalization of the collaborative efforts from key policymakers.

2.2 The Current State of Badjaos

A study conducted by Kuraiza Usman and Rowena DT. Baconguis (2016, p.154) entitled Persistence of Poverty among the Badjaos of Bongao, Tawi-Tawi, ARMM, Philippines aimed to assess the Badjao people's state, significantly the community's persistence in poverty, in Tawi-Tawi, Autonomous Region of Muslim Mindanao (ARMM), Philippines. It sought to examine the educational background, psychological outlook, economic, nutrition, and health conditions, political and social capabilities, and access to government services of the Badjaos. In this paper, Usman & Bacongauis (2016, p.152) posited that the Badjaos are recorded to be the poorest among the communities in the region. Known to be Sea Gypsies of Sulu and Celebes seas, Badjaos are scattered in different places in the Philippine archipelago. Using the narratives from the two Badjao communities in Bongao, Tawi-Tawi, the study found that the Badjao people are currently struggling with what they call a 'deprivation trap' a state or condition that tames people in the darkness of poverty. Moreover, it was also found through a semi-structured questionnaire that the Badjaos are marginalized when it comes to the conditions that facilitate or hinder mobility in society such as education and health conditions. Due to this, Usman & Bacongauis (2016, p. 170) recommended a model for program implementation that focuses on informative, persuasive, participatory, and formative interventions to the problems faced by the Badjao communities. Such a model puts emphasis on collaboration, networking, and cultural sensitivity.

Another study that puts emphasis on the current condition of the Badjao people is the study by Danesto B. Anacio and Suzette C. Simondac (2013) entitled Natural Resource, Economic Opportunities and Population Dynamics among Badjao Informal Settlers in Batangas City, Philippines. This study generally aims to determine the population, resource, and environmental dynamics of the Badjao informal settlers in Batangas City. Anacio & Simondac (2013, p.3) asserted in this study that the dynamic formation among the Badjao communities has implications for sustainable development and social well-being. With their one-on-one interviews with key informants, the researchers found that Badjao migration from the Southern to the different parts of the country was caused by the peace and order situations during the 1970s. Furthermore, it was also revealed that some minor factors such as poverty, lack of livelihood opportunities, and the like in their prior settlements forced the Badjaos to move from one place to another. Specifically, the loss of their traditional fishing grounds due to the existence of big commercial fishing businesses became another driving factor of Badjao migration. With the hope to seek greener pastures, Badjao communities migrated from places-to-places in the Philippines. However, through the years, Badjao people seemed to remain marginalized in areas such as education and economic opportunities (Anacio & Simondac, 2013, p. 9).

Informed by the struggles and current state of the Badjao people, a study by Ma. Rosario B. Tamayo and Imelda L. An (2019, p.66) entitled Interventions to Improve the Quality of Life of the Badjaos in Batangas City, Philippines measured the effectiveness of the programs implemented to address the problems faced by the community. Through a descriptive correlational design, the study revealed that the programs implemented by the Batangas City government were effective in health areas such as massive birth registration, maximum hospital discounts, supplemental feeding program, and EBD Health Card. On the contrary, it was found that programs were less effective when it came to education and practical skills development. Although the implementation of the programs on health and education led to a great extent of impact on the quality of life of the Badjaos, the community remains struggling socially and economically. Furthermore, programs such as teenage pregnancy reduction were found less effective since teenage pregnancy cases among Badjao communities increases from 2016 to 2019 according to the records of the city government.

Anchored on these backdrops, Tamayo & An (2019, p.73) recommended a plan of action containing interventions to enhance the implementation of the different programs that aim to improve the quality of life of the Badjao people. The study also recommended that the City Government has to identify which of the problems faced by the Badjaos need the highest consideration in creating programs and interventions.

2.3 Badjaos' Social Integration and Involvement

With the current collective struggle that the Badjaos are facing, there is a need to look into social integration and involvement among them. A study by Vanessah Valle-Castillo (2018, p.56) titled Social Integration of Badjao Migrants in the Local Community of Barangay Malitam, Batangas City, Philippines sought to find out the ways in which Badjao Migrants are socially integrated into the local community in terms of the local community's accommodation of the Badjao migrants and Badjao's acculturation of social life in the local community. Through descriptive research, it was found that the social integration among Badjaos is centered on the accommodation of them by the local community and the acculturation of the Badjaos of the social life in the community. Specifically, in the case of the Badjaos in Barangay Matalim, Batangas City, Philippines, efforts from the local community and from the Badjao themselves were found to be evident to make the Badjaos legitimate members of the community. Furthermore, Badjaos' social integration includes assigning community leaders for Badjao, participating in intermarriage and learning the dialect, providing Badjao children with free education, including Badjao families with government financial assistance, allowing Badjaos to vote, improving their health and sanitation, addressing young marriages and family planning, providing livelihood, settling community problems, handling calamities, and building partnerships.

On the other hand, Badjaos are also encouraged to foster social involvement in return for people's efforts of integrating them into the community. Nevertheless, the Badjaos learn to speak Tagalog while also speaking their dialect as a primary effort to make themselves socially involved. They are also encouraged to abide by the policies of the local community, practice family planning, join socio-civic organizations, embrace Batangueno culture, and establish good relationships with others (Valle-Castillo, 2018, p.58). Social integration and involvement amongst the Badjaos would result not only in the betterment of the lives of their lives. It will also lead social harmony and collective development.

3. Methodology

An ethnographic method of data gathering, and analysis was employed in this purely qualitative research. Ethnographic research looks into the people's lives within their communities using a cultural lens (Hammersley and Atkinson, 2007; Fetterman, 2010 as cited by Eriksson and Kovalainen, 2007, p. 149).

The data gathered was based on actual immersion and observation of the researchers in the participant's real-life environment. Narrative account of actual observation of the researchers is a major source of information.

Further, select key informants (those who have had direct access to the Badjao community for over a year and have personal knowledge of the KC-NCDD projects) were identified and selected to participate in order to validate some accounted and recorded day- to-day activities. Personal interview was thereby conducted. This group of research participants includes the Badjao community leader and/or elders, Municipal Local Government Unit (MLGU) representatives, Municipal Inter-Agency Committee (MIAC) and Civil Society Organization (CSO) representatives.

Finally, in order to describe the characteristics of the Badjao Community in terms of democratic decision-making vis-à-vis individual and collective forms of community empowerment through the KALAHI-CIDSS NCDDP, the Ladder of Empowerment proposed by Elizabeth Rocha in the Journal of Planning Education and Research (1997) is adapted.

3.1 Data Gathering Procedure

The researchers made actual immersion in the community of the Badjao group in Brgy. Totolan, Dauis, Bohol for a number of days deemed sufficient to gather needed information through participant observation.

An interview was conducted with the group's leader or elders who form part of the key informants of the study. The major observations of the day were logged in a personal diary of the researchers for validation to key informants after their immersion with the community. The researchers then described with full details in the diary, the information needed for the sub-queries to be addressed. Once done with the immersion, the researchers endeavored to account the writing of the narrative report, which served as the major data of this study.

4. Results and Discussion

The Badjao People: History, Ethnicity and Institutional Arrangements

Quite noteworthy, the Badjao is regarded as the most marginalized among all the other indigenous peoples in the Philippines. Digging deeper into the root of the marginalization of the Badjao community requires at the onset, a recognition of its historical context and a thorough examination of the social exclusionary processes that Badjao people experience which springs from their social and spatial location in the Philippine society. The Philippine Center for Investigative Journalism (PCIJ) cited that even given the 'high correlation between ethnicity and poverty among indigenous peoples, compounded by a long history of discrimination and prejudice,' 'regrettably relations between these peoples and more powerful populations ashore (such as the Tausug and Maguindanao in the Southern Philippines) are not founded on mutual respect, and everywhere, the Badjao, as a sea people, have been marginalized, excluded from holding positions of power, detested, and confined to the lowest rungs of the social ladder'(PCIJ, 2007, para. 3).

A known narrative of a Badjao tribe in Barangay Totolan who had settled for some time now is a story of unceasing struggle for survival in the areas of livelihood, literacy and on being type casted as an "outcast." Every five to seven only, out of 25 Badjao kids attending Day Care make it to pre-school and a majority (more than 90%) of the entire population of almost 500, including adults, are unfortunately, illiterate. This is the sad reality faced by the Badjao tribe, according to Chieftain Mario Cuham in an exclusive interview during the ocular visit of a 15-man group of professors, students and consultants from different Manila-based colleges and universities taking public administration pertaining to special issues of social development. In particular, Two Day Care sessions a day - one in the morning and another in the afternoon - are being held just for Badjao children aged 2-4. The sessions are held in a hall erected within the shoreline of barangay Totolan, Dauis, Bohol. (Bohol Sunday Post, 2011, para.1).

In the actual immersion, Marina Guba, the Chieftain's eldest daughter posited that: "We originated from Zamboanga. But we were born and we lived in Totolan." Further Guba said: "From Zamboanga, in the 1970s our ancestors travelled." This information of how the Badjaos of Totolan came to be was elaborated by Eden Grace Adaptar (Focal for Badjaos Community), she stressed:

> *"We cannot tell for sure the exact date when they arrived in Bohol. According to our Badjao Elders and other residents in our place, it was in the 1970s when they arrived in Dauis. They arrived in Bohol from Zamboanga on board their boats which are referred to as 'pelang'. They travelled together with their family, across the islands, arrived at Camiguin for barter trade until they arrived at Jagna. Some of the members of the group went directly to Tagbilaran."*

Some of them arrived in different periods though within the same year, as mentioned above. When asked how did they become a community in Brgy. Totolan, Dauis, Bohol, this is what they had to say:

- *"All have arrived and they have married here."*

Upon their settlement in the said area, they already claimed the place as their very own. The Badjao community is having common shelter with "poor home condition, usually with one room that serves as living room, bedroom, dining and kitchen altogether," with "poor sanitation where trash and garbage are just thrown and bowled under their houses raised above sea level," according to the paper, Prosperity Program for Badjao Tribe. The situation, the paper noted, "customarily stimulates for incestuous relationship." On the aspect of livelihood, 75% are engaged in fishing, only earning between PhP1,000 and PhP1,500 per catch. A meager number (6%) are into vending, selling "borloloy" ("fashion accessories") and roughly 13% are engaged in mendicancy, children are exploited to become a "tourist attraction" or "tourist irritation." They are regarded by some, as "eye-sores." On the aspect of education, 49 out of 175 children are in the elementary; seven in high school and only one in college being aided by Panaghoy Children Foundation, a local NGO. The Department of Education has detailed one teacher in the Alternative Learning System (ALS) enrolled some 18 out-of-school youth and adults.

These concerns, struggles, and challenges were resonated in the sharing of the Chieftain's eldest daughter:

> *"We find no problem before in terms of governance. But now, we were asked of documents as to our origin. Before our children went to school, they have no birth certificate."*

There is recognition that the time now is different from when they first arrived in the area. There are much documents needed to prove pertinent facts, also about their ethnicity – their identity.

The Focal Person narrated:

> *"The Badjaos are Indigenous People from Mindanao. They believe in the Almighty God, they also believe in the preaching of Quran. They follow certain rituals in the community.*
>
> *The Badjaos of Dauis are a mixed breed, there are Badjao of the Seas, Badjaos who reside in the land and there are Badjaos who married Non-Badjaos.*

Based on the talk with other Badjaos, what is important to them is to sustain their daily needs, if there is extra they will use it to buy the things that they want. This means that most Badjaos only look for the needs of their own family. Only some devote their time to help other Badjaos in rendering assistance in giving birth, registration of live birth, death certificate, and giving guidance in terms of education and health. But they are just a few. *Yes, they believe that the Badjaos are Filipinos because they are born in the Philippines.*

As a people, they have a strong sense of "taking life by its daily struggle not minding what the future holds". Their sense of belongingness as one community is evident in their willingness to extend a hand whenever their fellow tribe mate is in need. They might have difficulty in providing for documentary requirements to prove who they are and where they come from but for them, they are Filipinos, born in the Philippines with most of their relatives already here.

Finally for their institutional arrangements, there is already a system for livelihood, mortuary and governance with a Chieftain on the lead and cluster leaders as co-leaders for seven (7) clusters. Yet, the Focal Person noted that*, "Based on my observation, they still don't have a strong system of governance within the Badjao Community."* This observation suggests that there is still room for improvement on the aspect of governance.

Badjaos' daily life is highly routinary as noted from this observation:

> *"Fishing methods for the males are already considered a routine while the females are left in the house. In my observation, they are left to tend off their separate lives without interfering with the lives of others."*

Fishing is the main livelihood of most men in the family while the women are left at home to care for the children and household, a typical Filipino home set-up. Economically, each household tries to be sufficient but comes in to aid their tribe mates in other civic aspects.

In terms of dispute, they refer to their tribal law. Nevertheless, when the conflict goes out of hand, the Chieftain refers the matter to the Barangay, a sign of recognition of the existence of the formal law outside their tribe.

4.1 Extent of Badjao Community Participtation

By nature, community-driven development (CDD) draws the identification and implementation of local projects from the communities, thus aims at arriving at responsive programs that are needs based, in order to promote community empowerment. Most researches focusing on the impact of CDD, in this case the KALAHI-CIDSS, towards all the facets of development, be it in governance, social capital, and in terms of socio-economic welfare. This has changed the dynamics on the ground, as the community are called to take charge of their own development.

As to the Badjao Community participation on all activities of the KALAHI-CIDDS-NCDDP, Brgy. Totolan Captain emphasized:

" Only a few will participate. Sometimes they cannot attend because of lack of fare or other times for no reason at all. They can be organized easily if an assembly will be called for, for as long as it is within their area."

Figure 1. Cycle 1 average household participation rate on Barangay Assemblies

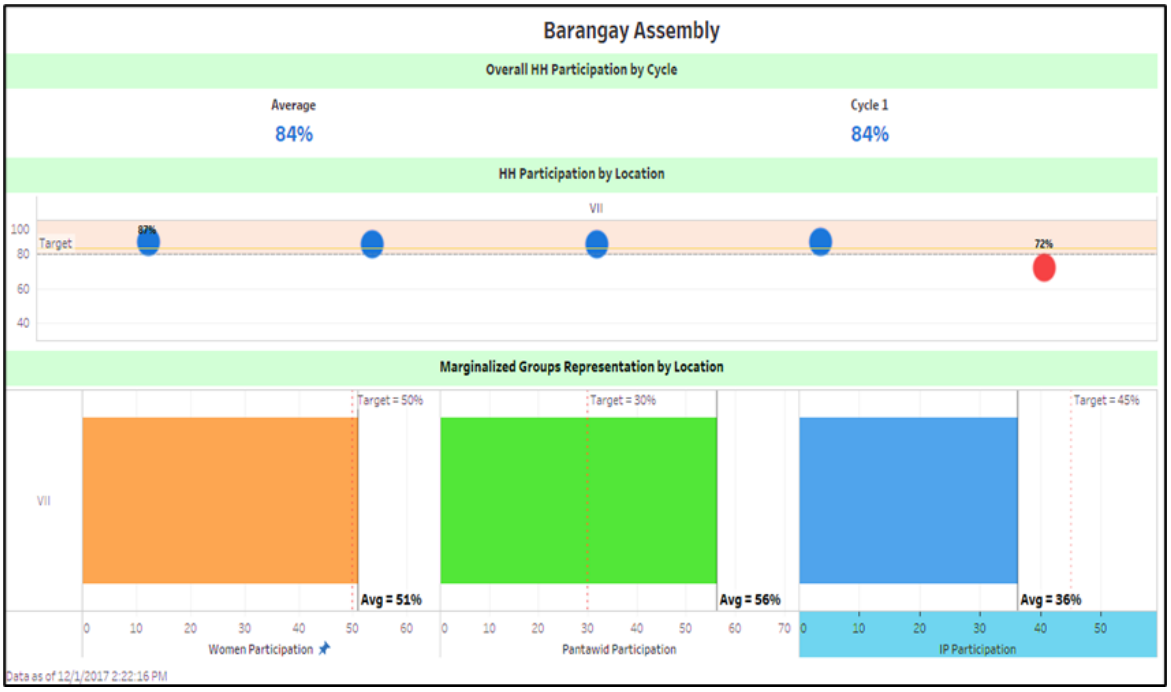

Figure 2. Cycle 2 average household participation rate on Barangay Assemblies

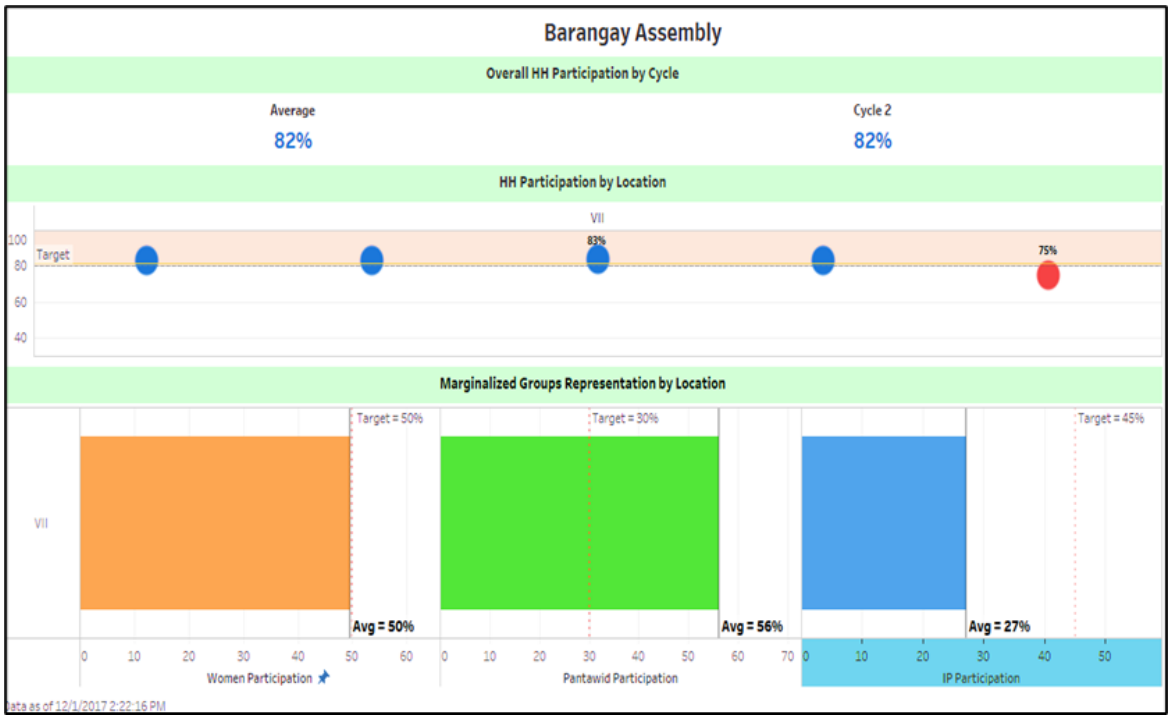

Figure 1 shows a decrease in the participation of the Badjaos to the above-mentioned activities. Thus, the trend of household participation in barangay assemblies is generally declining. Please see Figure 1 shaded in blue. In cycle 1, the average household participation rate in all 5 barangay assemblies is at 36%.

In **Figure 2** cycle 2, the average household participation rate in all 5 barangay assemblies had decreased to 27%. So, this brings the average participation rate for two cycles at 32%.

Moreover, the Brgy. Captain elaborated that:

> *"Only good in terms of attendance and participation but not in action. They are not interested to volunteer, they need an allowance. They only wait to be called, wait if*

there are freebies, not really active in participation. They only listen during the activities."

It is evident that there is participation on the part of the Badjao though it has been diminishing in the last two cycles. There is also an acknowledgement from the Brgy. Captain himself that the Badjaos listen during the assemblies but do not have yet the capacities to share ideas and volunteer thus, the nature of their participation is often based on encouragement rather than initiated.

At the on-set, participation is seen with the beneficiaries as the end-users being the recipients of the projects. The project implementers more often consider the beneficiaries of development aid only as mere receivers of the programs they offer, with little to no involvement in the identification of projects which are supposedly reflective of the actual situation and the needs of their communities.

KC-NCDDP provides an avenue for the indigenous people to identify their priority needs in the identification of their most pressing problems and the projects they see as most responsive to address these needs. While it can be argued that indigenous people have been generally excluded in decision making both in the identification and in the conduct of development programs that directly affect them, it is DSWD's mandate however to implement programs that are not only progressive but are also inclusive, while meeting the needs and fulfilling the aspirations of the indigenous people in the process of applying the models of development.

4.2 Impact of Badjao Community Involvement Towards Empowerment

The KALAHI-CIDSS-NCDDP started on 2015 in Dauis, Bohol. From its inception, there had been an increasing number of participants to the said program. The Badjao, as a community of people were among the pioneer beneficiaries of the program.

As narrated by the Chieftain's daughter:

"*The Chieftain is busy in attending seminars. Ever since he had participated in the activities, there are outputs already. Schools and classrooms are already built in Totolan wherein the Badjaos can go to study. Yes, there are a lot of changes because of participation."*

On the other hand, however, the observation of the Brgy. Captain negates the above-narration. To him:

"There is no development."

The recognition on the part of the Badjao people themselves that there has been a change in their daily routine, no matter how little as evidenced by them joining in the barangay assemblies is already an impact on community involvement and participation. The concept of engagement may vary as the Brgy. Captain, in his capacity as a local leader holds a higher expectation vis-à-vis community participation and involvement; which to him these expectations might not have been met. Whereas, for the Badjao their attendance and presence during assemblies and other related activities are already clear manifestation of their sense of community participation and involvement. Their acknowledgement that they are Filipinos, born in the Philippines is a manifestation of empowerment. This acknowledgment brings into fore their sense of identification as part of the Filipino community and thus, their "responsibility" to participate in the activities in the community. The decline in the average participation of the Badjao community can be attributable to their level of engagement and the sustainability of their participation. It is to be noted however that to them, there had been significant and positive changes brought about by their engagement and participation with the KALAHI activities. Inclusive growth had been the central theme to facilitate sustainable growth not just by the government (through the KALAHI) but also by non-government organizations (NGOs) and people's organizations (POs) that assist, and to certain extent, compliment the government's efforts toward the attainment of economic and social advancement (Dungog-Cuizon, 2014,

p. 15).

Poe et al. (2018, p.198) points out that initiative-driven attitudes towards community projects that demand active volunteerism from its stakeholders are often buried under deep-seated social norms unique to the culture of that community where systematic community engagement is not normalized. There can also be a general skepticism towards the collective efficacy and concretization of their expected goals. This means, to a great extent, that the attitudes of the indigenous locality need to be influenced towards a more 'volunteering' and 'engaging' attitude for the project to manifest a high or at least an ideal participation rate level. The idea that one can effect change if he/she participates and collectively, community participation would result to development.

As opposed to the statement of the Chieftain's daughter, the Barangay Captain opined that there is no development. This reflects the dynamics of the relationship of the Chieftain and the Barangay Captain vis-à-vis encouraging development initiatives and active participation. Thus, worthy to highlight that there are but several factors that would arouse participation especially in the case of indigenous communities. Poe et al. (2018, p.201) identifies these pertinent factors crucial in fostering active participation in the engaged indigenous communities. Socio-psychological elements which must be considered are, as follows: (1) normalizing 'community engagement' as a social norm among members of the indigenous community, (2) concretizing the possible impact and collective efficacy of their volunteering and engagement efforts, and (3) fostering positive attitudes by education. While the Badjao view a positive impact to their participation, much still needs to be done in terms of inculcating positive attitudes and in normalizing engagement from within their local community.

4.3 Characteristics of Empowerment of the Badjao Community

As Rocha, aptly puts it, the needs of socially and economically marginalized populations lie at the heart of empowerment. This is essential in the discussion of the characteristics of empowerment of the Badajos in Totolan, Dauis. Attendance and participation in assemblies for one, are affected in terms of economic challenges with issues of proximity and availability of money for fare. This however does not discount the fact of engagement and involvement of the Badjaos who have expressed their identification with development initiatives of the community.

Rocha's Ladder of Empowerment starts with Type 1 (Atomistic Individual Empowerment) where individuals as the locus are "solitary units" and that the goal is to increase individual efficacy and change the emotional or physical state of the individual. Type 1 is based on the Rational Actor Model and explains the competence of one person. Type 2 is Embedded Individual Empowerment which allows individuals to operate as effective actors in the context of larger groups, organizations, communities, or systems. Type 2 does not change the fundamental conditions of the system but rather helps people navigate and succeed in the existing system. Type 3 is Mediated Empowerment, one where the process of empowerment is mediated by an expert or professional. Depending on the circumstances, the locus for Type 3 can either be the individual or community, and the goal is to provide necessary knowledge for decision-making and action. Type 3 can be in two fundamental forms, the *prevention model* and the *rights model.* The *rights model* sees participants as having "the ability to exercise choice," while the *prevention model* sees them as "a child to look after". Type 4 is Socio-Political Empowerment which refers to individuals, groups, and organizations that challenge governmental or institutional authority by accumulating social and political power through mobilization. In this type, the focus is the process of change within a community (Rocha, 1997, p 3).

Empowerment of the Badjao falls squarely on Rocha's Type 3 of Mediated Empowerment in which the process of empowerment is mediated by KALAHI-CIDSSS-NCDDP and the locus is the Badjao Community. The goals are to provide the Badjao of necessary information and knowledge in terms of the identification of priority needs in order to align with the projects, programs, and activities of the local government unit responsive to said needs. Further, it is characterized as a 'rights model' type of mediated empowerment where the Badjaos are seen as having "the ability to exercise choice" (Rocha, 1997, p.4). As cited by the Chieftain's daughter, positive changes are visible because of community participation.

CDD is a precursor in providing avenues for future community transformation in the context of collaborative struggle in the hope of altering social, political, or economic relations where community members are transformed from mere bystanders, into active actors of development. This is the challenge in the current structure because of the patent lack of resources, capacity and training of marginalized communities. Albeit difficult, it is not however impossible as when laws are passed in order to protect the

rights and ensure empowerment of the marginalized. Such is the case of the Badjao in Barangay Totolan, Dauis, Bohol.

4.4 Ensuring responsive, inclusive, participatory decision-making

It is the thrust of the Kapit Bisig Laban sa Kahirapan - Comprehensive Integrated Delivery of Social Services -National Community Driven Development Program (KALAHI CIDSS-NCDDP) to achieve empowerment through priority projects which are directly identified by the community in response to their identified needs. It is inclusive as it seeks to cover the marginalized, in this case, the Badjao community. CDD seeks to forward development from the bottom-up. Development is sustainable when in promotes inclusive societies, one which ensures community participation and empowers the marginalized, including the indigenous people. This falls within the ambit of Target 16.7 of the Sustainable Development Goals (SDGs): Ensure responsive, inclusive, participatory and representative decision-making at all levels. This is aligned with the blue print for peace and prosperity for people and the planet with an urgent call for action through global partnership. At its heart are the Sustainable Development Goals (SDGs).

5. Conclusion

The community driven development (CDD) through the implementation of KALAHI-CIDSS-NCDDP in Barangay Totolan, Dauis, Bohol had definitely resulted to a positive impact in the lives of the Badjao community in the said locality, being thus engaged in development initiatives.

Though the degree of empowerment varies in the lens of the different stakeholders with the stark contrast of the views from the Badjao chieftain, as juxtaposed with that of the Barangay Captain, it is a fact however that the Badjao people themselves clearly recognize that the program had afforded them a stake and had in a way caused the betterment of their lives despite and inspite of its challenges.

The dynamics of their engagement is a welcome change in the existing institutional arrangements were the badjaos are marginalized and thus generally excluded from development initiatives and pent in the lowest tread of society. While a lot can still be done to improve active participation of the Badjaos in Totolan, Dauis, Bohol, the seeds of development had already been planted making development initiatives available to the indigenous community, who are otherwise 'excluded' in the process.

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Optimizing Village-Owned Enterprises (BUMDes) in Creating Dynamic Village Institutions and Adaptive Culture

WULANDARI*, KIKI AMALIAH*

ABSTRAK

The village is given the freedom to manage the village according to the potential in the village. One of those media is Village Owned Enterprises (BUMDes). The Village Sustainable Development Goals (SDGs) policy or village sustainable development goals in Indonesia are derivatives of existing provisions in the Sustainable Development Goals (SDGs). This formulation is found in point 16 of the SDGs Peace, Justice and Resilient Institutions which is then formulated with the Village SDGs in point 8 of Cultural Responsive Village letter b Number 18 which is Dynamic Village Institutions and Adaptive Village Culture. BUMDes which are interpreted as institutions at the village level have several problems such as BUMDesa management is not optimal, BUMDesa managers do not understand their duties and responsibilities, lack of good communication between the village government and BUMDesa managers. This research aims to strengthen dynamic village institutions and adaptive village culture through the optimization of BUMDes in the management of existing businesses in the village, so that it will have a positive impact on the village community. This research is a normative jurisprudential research with a focus on the positive laws of Indonesia that govern BUMDes based on Village SDGs and provisions of international law. The results of this research summarize the optimization of BUMDes by looking at the strategy that has been mentioned in the Regulation of the Minister of Rural Affairs, Development of Backward Regions and Transmigration Number 3 of 2021.

Keywords : Village-Owned Enterprise (BUMDes), Village SDGs, village institutions.

INTRODUCTION

The village is the smallest unit in the government system in Indonesia which has various potentials and resources. In carrying out the miniature state in the village, there is an element of government that will carry out the duties and functions of the village administration. The Village Government structure consists of several levels, each of which has its own portion. The village government is assigned by the central government to regulate local rural communities in accordance with existing laws in order to realize government development in village areas.

[1] Village Government is the Village Head or what is referred to by another name assisted by Village apparatus as an element of Village Administration.[2]

Freedom is given to villages to manage these resources according to the potential that exists within them. To achieve optimal village development, a forum is needed that can become a medium for developing the village's potential. One of the containers used is Village Owned Enterprises (BUMDes). Based on Article 1 number 6 of Law Number 6 of 2014 concerning Villages, Village-Owned Enterprises, hereinafter referred to as BUMDes, are business entities whose capital is wholly or substantially owned by the Village through direct participation originating from Village assets which are separated to manage assets, services, and other businesses for the maximum welfare of the Village community.

BUMDes is an institution tasked with managing economic enterprises in the village by involving the village government and the local community. Through BUMDes management which involves the community directly, it is hoped that it can boost the village economy and improve people's welfare. BUMDes has flexibility in managing businesses that are in accordance with the conditions and potential that exist in the village, such as the natural potential to be used as a tourist area or the agricultural products of the village community.

In order to achieve sustainable development goals, BUMDes also have an important role in realizing the Sustainable Development Goals (SDGs). Through optimizing BUMDes, it is hoped that villages can achieve sustainable development goals by maximizing dynamic village institutions and adaptive village culture. Village SDGs aim to improve people's welfare through development programs that can overcome unemployment and poverty problems by optimizing BUMDes institutional functions.
The existence of a village has diversity that is adapted to the cultural origins of the local community, namely: (1) Participation, that the administration of village governance and development must be able to realize the active role of the community so that the community always owns and takes responsibility for the development of life together as fellow citizens village, (2) Genuine autonomy, that the authority of the village government in regulating and managing the local community is based on the rights of origin and socio-cultural values contained in the local community organized by the village administration, (3) Democracy, governance and development in the village must accommodate the aspirations of the community which are discussed and then selected to be implemented through the BPD as a Village Government partner, (4) Community

[1] https://www.berdesa.com/5-struktur-pemerintahan-desa-beserta-tugas-dan-fungsinya/
[2] Pasal 1 angka 3 Undang-Undang Nomor 6 Tahun 2014 Tentang Desa.

empowerment, meaning that the implementation and development in the village are aimed at increasing the standard of living and welfare of the community through the establishment of policies, programs and activities according to the main problems and priority needs of the community.[3]

Efforts made by village officials, especially by making programs to improve the welfare and economy of the less fortunate, are carried out through the establishment of Village Owned Enterprises (BUMDES). Technically, BUMDES is an institution that contributes to increasing Village Original Income (PADes). Village Owned Enterprises (BUMDES) are business organizations managed by the community and village government, which are formed to strengthen village economic activities and are adapted to regional needs and potential..[4]

Businesses managed by BUMDesa vary according to the conditions and potential that exist in the village. Villages that have natural potential to be used as tourist areas, or the results of village community agriculture can be managed by BUMDesa. However, in fact, the existence of the BUMDes Institution is still experiencing many obstacles, so that the objectives achieved have not been realized optimally by the village community. Problems with Village Owned Enterprises include, first, the weakness of BUMDes institutions, especially village apparatus. Second, BUMDes institutional apparatus do not know the current village powers and responsibilities even though Law Number 6 of 2014 concerning Villages has been issued. Third, there has not been effective communication between village institutional movers and local residents regarding many issues. Fourth, the corrupt behavior of power is evident in the many cases of village leaders who have had to go to court. Fifth, many community empowerment programs fail and accountability is not clear. From the description of the problems above, it is necessary to conduct further investigations related to the constraints faced by BUMDesa managers in running their institutions in order to achieve dynamic and adaptive village institutional goals.

LITERATURE REVIEW

A. Sustainable Development Goals (SDGs)

a. Get to know the SDGs

TPB/SDGs aim to maintain an increase in the community's economic welfare on an ongoing basis, maintain the sustainability of the community's social life, maintain the quality of the environment and inclusive development and implement governance that is able to maintain an improved quality of life from one generation to the next. The SDGs are built based on historical trajectories that have been initiated by countries and the United Nations, including The Economic and Social Council (ECOSOC), which is a part of the United Nations. The SDGs agenda contains 17 Goals/Goals which are spread over the four pillars of sustainable development, namely the Social Development Pillar, the Economic Development Pillar, the Environmental Development Pillar, and the Law and Governance Pillar. For each Goal there is 1 (one) or more targets (total there are 169 targets), and for each target, there is 1 (one) or more indicators (as of April 2022 there are a total of 248 indicators).[5]

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[3] Somadi Alfaqih, 2013, Fungsi Badan Permusyawaratan Desa dalam Penyusunan dan Penetapan Peraturan Desa (Studi Kasus di Desa Dumeling Kecamatan Wonosari Kabupaten Brebes), Skiripsi Fakultas Syariah dan Hukum UIN Sunan Kalijaga Yogyakarta, Hlm. 2-3.

[4] Imam Mukhlis et. Al, Establishing an Autonomous Village through Bumdes (Village-Owned Enterprise) to Enhance Local Economic Activity. South Asian Journal of Social Studies and Economics. Hal. 266

[5] https://www.bpk.go.id/assets/files/attachments/attach_page_1652255145.pdf

As a manifestation of the government's political commitment to implementing the SDGs agenda, President Joko Widodo has signed SDGs Presidential Regulation (Perpres) Number 59 of 2017 concerning Implementation of Achieving Sustainable Development Goals. The Presidential Decree is at the same time a commitment so that the implementation and achievement of SDGs is carried out in a participatory manner by involving many parties, both national and regional level governments, as well as community groups, including academics and experts, philanthropists and business actors, as well as civil society organizations and the media. The government has carried out several mandates in the Presidential Decree, including: (1) National Roadmap for Sustainable Development Goals, as a planning document that contains strategic policies for the stages of achieving the National Development Goals up to 2030 according to national development goals; (2) through Regulation of the Minister of National Development Planning/Head of Bappenas Number 7 of 2018 concerning Coordination, Planning, Monitoring, Evaluation, and Reporting on the Implementation of Sustainable Development Goals, the Government has issued the National Action Plan (RAN) for the 2017-2029 period; and (3) until 2021, 29 Regional Action Plans (RAD) have been issued by the Regional Government..[6]

b. Village SDGs

Village SDGs are an integrated effort to realize a village without poverty and hunger, an evenly growing economic village, a health-care village, an environment-care village, an education-care village, a women-friendly village, a networked village, and a culturally responsive village to accelerate the achievement of the Sustainable Development Goals. In cool language, the Sustainable Development Goals are abbreviated as SDGs. Referring to the Regulation of the Minister of Villages, Development of Disadvantaged Regions and Transmigration Number 13 of 2020 concerning Priority for Using Village Funds in 2021, there are at least 18 development goals and objectives through the Village SDGs, namely:

1) Village without poverty
2) A village without hunger
3) The village is healthy and prosperous
4) Quality village education
5) Gender equal village
6) Villages have adequate clean water and sanitation
7) Villages with clean and renewable energy
8) Employment and village economic growth
9) Village innovation and infrastructure
10) Village without gaps
11) Residential village sustainable area
12) Village consumption and production that is environmentally conscious
13) Control and climate change by the village
14) Village marine ecosystem
15) Village land ecosystem
16) Peaceful and just village
17) Partnership for village development
18) Dynamic village institutions and adaptive village culture.

In implementation until 2030, villages can choose one or several of the 18 goals to be achieved in the Village SDGs. The Ministry of Villages, Development of Disadvantaged

[6] https://www.bpk.go.id/assets/files/attachments/attach_page_1652255145.pdf

Regions and Transmigration will provide guidance for achieving the chosen goals, for example villages without poverty and hunger. In this way village stakeholders and residents can more easily imagine the direction of activities to achieve development goals and also how to effectively use village funds to support efforts to achieve the intended goals..[7] Village SDGs have contributed 74 percent to the achievement of sustainable national development goals. The 74 percent figure was obtained based on regional and citizenship aspects. From a regional aspect, 91 percent of Indonesia's territory is village territory. As many as 12 of the 18 Village SDGs goals are closely related to village territoriality, especially goals 7 to 18 which are closely related to village territorialism. Apart from that, from the citizenship aspect, 43 percent of Indonesia's population lives in villages and the 6 SDGs goals are closely related to village residents. From these conditions, it can be seen that village SDGs have made a significant contribution.[8]

The PDTT Village Regulation regarding Village SDGs is the basis for 74,953 villages in Indonesia in preparing work plans and the 2021 APBDes. As much as 72 trillion rupiah of village funds will be prioritized for Sustainable National Development in villages. In this regard, there are three focuses on next year's village fund budget, firstly national economic recovery according to village authority, which consists of establishing, developing and revitalizing BUMDes/BUMDesma, providing village electricity, and thirdly developing productive economic businesses, mainly those managed by BUMDes/BUMDesma . Second, national priority programs according to village authority which include village data collection, mapping of potential and resources, and development of information and communication technology, development of tourist villages, strengthening food security and prevention of stunting in villages, and inclusive villages. Then the third, the priority of village funds in 2021, is the adaptation of new habits, namely the COVID-19 Safe Village. This determination is based on Presidential Regulation Number 59 of 2017 concerning Implementation of the Achievement of Sustainable National Development Goals or SDGs. As for the use of village funds in 2021, it will use the Village Cash Workforce (PKTD) mechanism, then work on a self-management basis and use it to finance BUMDes or BUMDes.

B. Village Owned Enterprises (BUMDesa)

Article 1 point 6 of Law Number 6 of 2014 concerning Villages states that a Village-Owned Enterprise, hereinafter referred to as a Village-Owned Enterprise, is a business entity in which all or most of its capital is owned by the Village through direct participation originating from Village assets which are separated to manage assets, services, and other businesses for the maximum welfare of the Village community. According to Article 1 point 6 of the Regulation of the Minister of Home Affairs Number 39 of 2010 concerning Village-Owned Enterprises, it is known that BUMDes are village businesses formed or established by the village government whose capital ownership and management are carried out by the village government and the community.
The establishment of BUMDes is based on Law Number 6 of 2014 concerning Villages in:

Article 87

(1) Villages can establish Village Owned Enterprises called BUMDes.

[7] https://baktinews.bakti.or.id/artikel/mencapai-tujuan-pembangunan-berkelanjutan-dari-desa
[8] https://baktinews.bakti.or.id/artikel/mencapai-tujuan-pembangunan-berkelanjutan-dari-desa

(2) BUMDesa is managed in a spirit of kinship and mutual cooperation.

(3) Village BUMDes can run businesses in the economic sector and/or public services in accordance with the provisions of laws and regulations.

Articles 88 to 90 further describe the arrangements regarding BUMDes.

Article 88

(1) The establishment of a Village BUM is agreed through a Village Conference.

(2) The establishment of a Village BUM as referred to in paragraph (1) is stipulated by a Village Regulation.

Article 89

The business results of BUM Desa are utilized for:
a. business development; And
b. Village development, Village community empowerment, and provision of assistance to the poor through grants, social assistance, and revolving fund activities stipulated in the Village Revenue and Expenditure Budget.

Article 90

The Government, Provincial Governments, Regency/City Regional Governments, and Village Governments encourage the development of BUM Desa by:

a. provide grants and/or access to capital;

b. provide technical assistance and access to markets; And

c. prioritizing BUM Desa in managing natural resources in the Village.

Based on the Regulation of the Minister of Villages, Development of Disadvantaged Regions, and Transmigration of the Republic of Indonesia Number 4 of 2015 Concerning the Establishment, Management and Dissolution of Village-Owned Enterprises, Villages can establish BUM Desa based on Village Regulations regarding the establishment of BUM Desa by considering:

a. Initiative of Village Government and/or Village community

b. Village economic business potential

c. Natural resources in the Village

d. Human resources capable of managing BUM Desa; And

e. Equity participation from the Village Government in the form of Village financing which is submitted to be managed as part of the BUMDesa business

Furthermore, the Regulation of the Minister of Villages, Development of Disadvantaged Regions, and Transmigration of the Republic of Indonesia Number 4 of 2015 concerning the

Establishment, Administration and Management, and Dissolution of Village-Owned Enterprises states that the establishment of BUMDes aims to:

a. Improving the village economy

b. Optimizing Village assets so that they are useful for the welfare of the Village;

c. Improving community efforts in managing the village's economic potential;

d. Develop business cooperation plans between villages and/or with third parties;

e. Creating opportunities and market networks that support the public service needs of citizens

f. Opening employment opportunities;

g. Improving community welfare through improving public services, growth and equal distribution of the Village economy; And

h. Increasing Village community income and Village Original Income

According to the Center for Development System Dynamics Study Team, Faculty of Economics, University of Brawijaya in his book entitled Guidebook for Establishment and Management of Village-Owned Enterprises (BUMDes) states that BUMDes is a pillar of economic activity in the village that functions as a social and commercial institution. institutions). BUMDes as a social institution sides with the interests of the community through its contribution to the provision of social services. Meanwhile, as a commercial institution, it aims to make a profit through offering local resources (goods and services) to the market. The following are the main characteristics that distinguish BUMDes from commercial economic institutions in general, namely: [9]

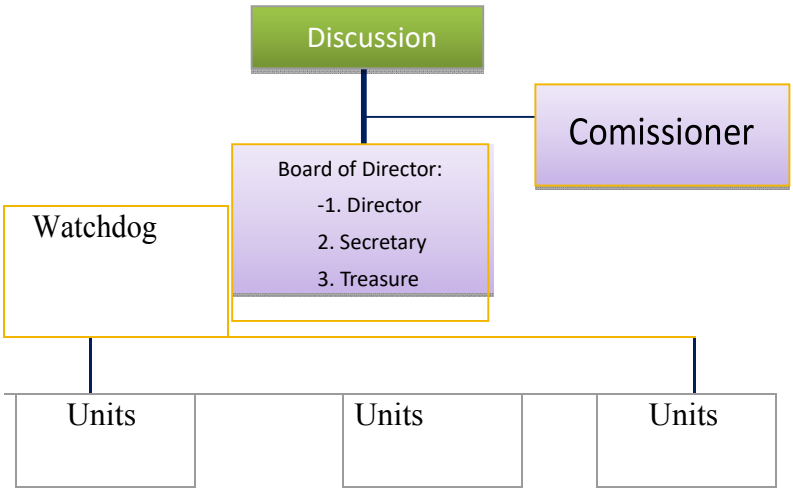
1. This business entity is owned by the village and jointly managed;
2. Business capital comes from the village (51%) and from the community (49%) through capital participation (shares or shares);
3. Executed based on the principles of kinship and mutual cooperation and rooted in values that develop and live in society (local wisdom);
4. The field of business that is carried out is based on the development of village potential in general and the results of market information that supports the economic life of the community;
5. The workforce empowered in BUMDes is a potential workforce in the village;
6. The profits obtained are intended to improve the welfare of the village community and or capital partners;
7. Decision making and problem solving are carried out through village meetings;
8. BUMDes regulations are implemented as village policies;
9. Facilitated by the Government, Pemprov, Pemkab, and Pemdes.

The formulation of the BUM Desa management organization considers the following points:[10]

[9] https://elib.unikom.ac.id/files/disk1/682/jbptunikompp-gdl-agusrusman-34099-8-unikom_a-i.pdf
[10] https://repository.uai.ac.id/wp-content/uploads/2020/09/pedoman-tata-kelola-bundes_fix.pdf

1) Whereas BUM Desa is the nomenclature of a business entity owned by the Village;
2) BUM Desa is not a holding company for village business units;
3) The BUM Desa management organization is a growing organization, meaning that the BUM Desa management organization can start from a simple form at the beginning of formation and will develop according to its business needs; And
4) Village BUM management organizations generally consist of Advisors, Directors, and supervisory elements.

Figure 1. BUMDes Management Organizational Structure



BUM Desa is an institution whose position is outside the organizational structure of the village government. The composition of BUM Desa management consists of:

1) The advisor is ex-officio Village Head.

2) The Board of Directors is a member of the community who is responsible for the operational activities of village businesses and is determined by a Decree of the Village Head.

3) The manager is the work unit of the directors in carrying out their duties and functions, the manager is appointed and determined based on the results of the village meeting and determined through a Village Head Decree.

4) Membership Position in BUM Desa. The existence of members in BUMDesa is not the same as membership in cooperatives, so that membership in BUM Desa can be aligned with customers at the Bank. Thus members of the BUM Desa will appear when the BUM Desa business unit is a microfinance institution.

METHODOLOGY

To answer the research questions as previously described, the research will use doctrinal or normative legal research methods. According to Sunaryati Hartono, in normative legal research one can search for legal principles, legal theory and the formation of new legal principles.[11] Meanwhile, according to Bagir Manan, normative research is research on existing legal principles and principles.[12] which focuses on research on library data or what is called secondary data. The normative juridical approach method is used with the intention of discussing the provisions of national laws and regulations relating to the preparation of laws relating to BUMDes. Data collection techniques using Document Study were carried out on secondary data to obtain a theoretical basis, in the form of positive law, opinions or writings of experts or other parties in the form of information either in formal form or through official texts. In this method, data collection is carried out through document studies (libraries) and field studies. Document studies are conducted for the following purposes:

a. Take inventory of relevant laws and regulations, particularly those related to village and BUMDes regulations;

b. Knowing the consistency of various laws and regulations;

c. Tracing the spirit or philosophy contained in various regulations related to BUMDes in the framework of economic development that is in favor of the community, village and government.

In the data analysis method, to analyze data and draw conclusions from research results, secondary data is analyzed using qualitative methods, which are intended as data analysis starting from efforts to find principles and related information. If it is complete enough, then the next step is to process and analyze the data. The data analysis technique used is a qualitative analysis technique, where after all the data has been collected, the data is processed, analyzed and constructed as a whole.

The descriptions and conclusions in interpreting the research data will be related to the theories, opinions and formal rules that have been put forward in the previous section. Furthermore, the data will be presented in a descriptive form, i.e. re-illustrating the results of the research to explain the problem to a conclusion.

The data that is summarized in the results of the research is then comprehensive in the form of policy ideas that are packaged in the form of international conferences so that the results of this research can be of benefit to policy makers, stakeholders and the public. This is because issues related to BUMdes are very enthusiastic for the entire world community, so that when these studies and ideas can be published through international conferences, access for all academics, government and also the public in general can find out the results offered in this research.

[11] C.F.G. Hartono S. 1994. Penelitian Hukum di Indonesia Pada Akhir Abad Ke-20. Bandung: Alumni Bandung, hlm. 12.

[12] Soekanto S., Mamudji S. 2001. Penelitian Hukum Normatif Suatu Tinjauan Singkat. PT Raja Grafindo Persada: Jakarta, hlm. 13.

RESULTS AND DISCUSSION

SUB-SECTION/SUB-TOPIC

Revitalization of Village-Owned Enterprises (BUMDes)

Village Owned Enterprises (BUMDes) are formed by the Village Government to utilize all economic potential, economic institutions, as well as potential natural resources and human resources in order to improve the welfare of the Village community. BUMDes specifically cannot be equated with legal entities such as limited liability companies or cooperatives. Therefore, BUMDes is a village-characterized business entity which, in carrying out its activities, is not only assisting in the administration of Village Administration, but also to meet the needs of the Village community.[13] BUMDes is built based on community initiatives, and is based on cooperative, participatory, transparent, emancipatory, accountable and sustainable principles with a member-based mechanism and self-employment.[14] The characteristics of BUMDes are that they are legal entities, do business in the economic sector (services, manufacturing, trade) where their capital consists of Pemdes participation and community participation with a ratio of 51% and 49% being the center of rural community economic activity, being a source of village income, and providing services on society. The businesses that can be run by BUMDes include: Village market, savings and loans, Waserda, water sources, transportation, village tourism objects, Home Industry, folk crafts, land fisheries, animal husbandry, agriculture and argo-industry.[15]

The goals to be achieved by BUM Desa/BUM Desa together as stated in Article 3 of Government Regulation Number 11 of 2021 concerning BUM Desa state:

a. carry out economic business activities through business management, as well as investment development and economic productivity, and Village potential;
b. carry out public service activities through the provision of goods and/or services as well as meeting the general needs of the Village community, and managing Village food storage;
c. obtain profit or net profit for increasing the Village's original income and developing the maximum benefit for the economic resources of the Village community;
d. utilization of Village Assets to create added value to Village Assets; And
e. developing a digital economic ecosystem in the village

Based on Article 23 paragraph (1), (2), and (3) PDTT Village Regulation Number 3 of 2021 that the guidance and development of BUM Desa/BUM Desa together is carried out by the minister for general guidance and development; and ministers/heads of non-ministerial government institutions for technical guidance and development, and development and development of BUM Desa/BUM Desa together can also be carried out by governors and/or regents/mayors. The guidance and development of BUM Desa/BUM Desa together is carried out in a synergistic and coordinated manner. Furthermore, in Article 25, that BUM Desa/BUM Desa joint development is carried out through the following strategy:

a. Institutional revitalization of BUM Desa/BUM Desa together;
b. mproving the quality of management and strengthening the BUM Desa/BUM Desa joint organization;

[13] https://akademidesa.id/2021/08/14/strategi-pengembangan-bum-desa-bum-desa-bersama/
[14] https://jurnal.unigal.ac.id/galuhjustisi/article/view/5020/3836
[15] https://jurnal.unigal.ac.id/galuhjustisi/article/view/5020/3836

c. Strengthening the management of BUM Desa/joint BUM Desa businesses and Business Units of BUM Desa/joint BUM Desa;
d. Strengthening cooperation or partnership;
e. Strengthening asset and capital management;
f. Improving the quality of administrative management, reporting and accountability; And
g. strengthening the management of profits and benefits for the Village and the Village community.

The institutional revitalization strategy for BUM Desa/BUM Desa Bersama in letter a is further elaborated in Article 26 paragraph (1), which contains : a. counseling/socialization of legal entities; b. monitoring and fostering laws and regulations at the regional level; c. capacity building for the preparation of the statutes and household budgets; d. strengthening the image of legal entities; e. dissemination of best practices in the business world; f. organizing consultations and/or assistance related to institutions; g. strengthening coordination between stakeholders in development; h. provision of consulting clinics that function to provide assistance in solving problems; i. assisting the manager of revolving fund activities for the former PNPM MPD community to become a BUM Desa together; j. programs or other activities in the context of institutional revitalization.

Explanation of Article 25 letter b is further explained in Article 26 paragraph (2) related to strategies for improving the quality of management and organizational strengthening of BUM Desa/BUM Desa Bersama.

a. increasing the effectiveness of the roles and functions of the BUM Desa/BUM Desa joint organization including Village Deliberations, advisors, operational implementers, and supervisors
b. increasing the capacity of advisors, operational implementers, supervisors, and employees in the preparation and implementation of work program plans
c. increasing the effectiveness of management and organizational governance including the implementation of standard operational management and standard operating procedures
d. assistance in the field of organizational restructuring
e. programs or other activities to improve the quality of management and strengthen the organization.

Explanation of Article 25 letter c is further elaborated in Article 26 paragraph (3) regarding the strategy for strengthening the business management of BUM Desa/BUM Desa together and BUM Desa/BUM Desa Bersama Business Units: a. establishment and development of BUM Desa/BUM Desa business units together; b. assistance and improvement of processing and production techniques; c. standardization of processing and production processes; d. improvement of quality control capabilities; e. assistance in marketing; f. business diversification in BUM Desa/BUM Desa together business units and/or BUM Desa/BUM Desa joint business units; g. programs or other activities in order to strengthen the business management of BUM Desa/BUM Desa together and BUM Desa/BUM Desa joint business units.

The strategy for strengthening cooperation or partnership as referred to in Article 25 letter d is described in the following programs or activities is elaborated in Article 26 paragraph (4):

a. facilitating and strengthening cooperation between BUM Desa/BUM Desa together;

b. facilitating and strengthening the cooperation between BUM Desa/BUM Desa together with the business world;
c. facilitating and strengthening cooperation between BUM Desa/BUM Desa together with financing/financial institutions;
d. facilitating and strengthening the cooperation between BUM Desa/BUM Desa together with government institutions;
e. facilitating and strengthening Village BUMDes cooperation with e-commerce; And
f. other programs or activities to strengthen cooperation or partnerships

Optimizing Village-Owned Enterprises (BUMDesa) in Creating Dynamic Village Institutions and Adaptive Culture

Starting from the localization of global SDGs into the National SDGs, which are called Sustainable Development Goals (TPB) by Presidential Decree 59/2017 in Indonesia. TPB was then localized to the provincial and district levels. The localization has at least three strategies to localize development, namely the civic aspect which emphasizes the use of By Name By Address (BNBA), placing development in micro-regions that can be managed such as villages, and using the participation strategy of many parties.[16] Localization of SDGs as Village SDGs covers all aspects of localization that have been carried out. All goals in the SDGs that have been Indonesianized in the Sustainable Development Goals, are then localized to the village level in the Village SDGs.

The Village Law mandates that the purpose of Village development is to improve the welfare of the Village community and the quality of human life as well as alleviating poverty through meeting basic needs, developing Village facilities and infrastructure, developing local economic potential, and utilizing natural resources and the environment in a sustainable manner. What is meant by sustainable is village development to meet current needs without compromising meeting the needs of future generations of villages. To operationalize Village development goals mandated by the Village Law, the use of Village Funds is prioritized to realize 8 (eight) Village typologies and 18 (eighteen) Village SDGs goals.[17]

In this study, the focus of the discussion is on point VII of Cultural Responsive Village point b SDGs Village Number 18, namely Dynamic Village Institutions and Adaptive Village Culture which are intended to encourage sustainable development through strong village institutions. SDGs This village seeks to maintain local wisdom, as well as revitalize and mobilize all elements of institutions at the village level. Because the involvement of all elements of the village, the strength and functioning of institutions in the village in community life, will support the life of diversity in a dynamic village, as well as a driver for achieving the SDGs.

The following is a description of SDGS Desa number 18: Dynamic Village Institutions and Adaptive Village Culture

1. Mutual help activities based on religious teachings

[16] https://dampaksosial.id/insight/mengenal-sdgs-desa/
[17] https://rancaekekwetan.desa.id/artikel/2022/8/26/sdgs-desa-dan-penerapannya-dalam-rkp-desa-dan-rpjn-desa

2. Religious leaders participate in village meetings (musdes) and implementation of village development
3. There are compensation/care activities for orphans and the poor
4. SOTK village government in accordance with applicable laws and regulations
5. Implementation of village meetings at least 4 times a year
6. RPJMDes, RKPDes, APBDes documents are available
7. There is a village boundary map that has been determined by the regent/mayor
8. Bumdes/MA accredited at least B
9. Culture is preserved up to 100%, traditional institutions are active
10. Solving social problems through a cultural approach > 50%
11. Village assets have increased
12. Village social institutions participating in village meetings >30%

The description of the Village SDGs above can be realized with the conditions, firstly BUMDesa must involve the full participation of the village government, village community and BUMDesa managers by continuing to strive so that the characteristics that exist in the Village are well maintained. Second, the business carried out by BUMDes in the village must represent the natural potential and businesses that will be able to support the income and income of the community. Third, there must be transparency in BUMDes management, so that trust is created between village communities, village government and BUMDes managers. Fourth, BUMDes managers make continuous improvements in managing BUMDes by visiting BUMDes that are well managed in other villages. Fifth, cooperate with third parties who are able to support the progress and goodness of BUMDes.

Village SDGs are an integrated effort for Village Development to accelerate the achievement of sustainable development goals. The Village SDGs are an integrated effort that is presented as an alternative action to accelerate the achievement of the Sustainable Development Goals at the Village level.[18] Village SDGs urgency for Village Government and Village residents:

- As an instrument for Village Development Planning so that it is right on target because it is based on real data and conditions of the Village community. In general, development plans that are not based on accurate data will result in development that is not on target.
- As a means to build critical awareness of the Village community to participate in every stage of the development planning process in the Village
- As one of the democratization processes in the village and a learning and maturing process for the village community through ownership and utilization of village data[19]

The Village SDGs are a form of crystallization of the total development of the village. All aspects of development must be felt by villagers without being left behind (no one left behind). The Village SDGs formula can integrally and systematically create villages without poverty and hunger, evenly growing economic villages, health care villages, environment care villages,

[18] Pasal 1 angka 14 Permendes PDTT Nomor 21 Tahun 2020

[19] https://rancaekekwetan.desa.id/artikel/2022/8/26/sdgs-desa-dan-penerapannya-dalam-rkp-desa-dan-rpjn-desa

education care villages, women friendly villages, networked villages, and culturally responsive villages to accelerate the achievement of sustainable development goals.[20]

CONCLUSION

The development of BUM Desa/BUM Desa bersama is carried out through the following strategies: a. Institutional revitalization of BUM Desa/BUM Desa bersama; b. Improving the quality of management and strengthening the BUM Desa/BUM Desa joint organization; c. Strengthening the management of BUM Desa/joint BUM Desa businesses and Business Units of BUM Desa/joint BUM Desa; d. Strengthening cooperation or partnership; e. Strengthening asset and capital management; f. Improving the quality of administrative management, reporting and accountability; and g. strengthening the management of profits and benefits for the Village and the Village community.

Point VII. Cultural Response Village point b. Village SDGs Number 18 namely Dynamic Village Institutions and Adaptive Village Culture which are intended to encourage sustainable development through strong village institutions. SDGs This village seeks to maintain local wisdom, as well as revitalize and mobilize all elements of institutions at the village level. Because the involvement of all elements of the village, the strength and functioning of institutions in the village in community life, will support the life of diversity in a dynamic village, as well as a driver for achieving the SDGs.

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[20] https://mipa.unnes.ac.id/v3/wp-content/uploads/2022/01/Buku-Panduan-GIAT_SDGs-Desa.pdf

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TRACK 10
Special themes

10d. Religion and Sustainable Development

Abstracts

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SYSTEMATIC LITERATURE REVIEW ON BEHAVIORAL INTENTION TOWARDS ISLAMIC CROWDFUNDING USAGE AMONG MALAYSIAN BUMIPUTERA SMES

Ms Engku Huda Mursyidah Engku Hassan Ashari[1], Professor Dr. Aisyah Abdul Rahman[1], PROF. MADYA DR. SALMY EDAWATI YAACOB[2]
[1]Universiti Kebangsaan Malaysia (UKM), Bangi, Malaysia. [2]Universiti Kebangsaan Malaysia, Bangi, Malaysia

MS ENGKU HUDA MURSYIDAH ENGKU HASSAN ASHARI

Abstract

SMEs are critical components of the Malaysian economy, and access to financing is extremely crucial for the sustainability of SMEs. Banks and official lender organizations are hesitant to disburse any financing due to the risk of SME business failure and default payment risks. Bumiputera SMEs' involvement in entrepreneurial activity are insignificantly low and they are facing challenges to obtain financing which eventually affect their growth, despite being the majority populations in Malaysia. However, there were still insufficient studies that systematically review the existing literature on behavioral intention towards alternative financing to fund SMEs' business. Hence the present article conducted a systematic literature review on behavioral intention towards Islamic crowdfunding usage among Malaysian Bumiputera SMEs. The present study integrated multiple research designs and the review was based on the publication standard, namely PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). This study selected articles using two leading databases namely Scopus and Web of Science. Based on the thematic analysis, this review has seven main themes namely 1) Financing Accessibility Among SMEs; 2) Intention to use Islamic Crowdfunding; 3) Performance Expectancy (PE); 4) Effort Expectancy (EE); 5) Social Influence (SI); 6) Facilitating Conditions (FC) and 7) Trialability. The study offered several significant contributions for practical purposes and the body of knowledge. The findings explained the importance of integrating indigenous knowledge into adaptation strategies, as follow: 1) to generate significant impact to the existing body of knowledge in the field of Islamic crowdfunding as one of the Islamic financing alternatives plus in the area of Fintech expansion; 2) to conjecture the SMEs' awareness towards financing alternatives and hence drafting the applicable regulations and policies in accordance to the analysis; and 3) to inform on the specific areas and content of researches that should be the focus of the future studies.

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ECOLOGICAL RESTORATION OF URBAN LAKES THROUGH SYNTHETIC SEED-BASED PHYTOREMEDIATION: INSIGHTS FROM ISLAMIC ETHICS.

MS. QURRATU AINI MAT ALI[1], TS. DR. FARAH AYUNI MOHD HATTA[1], PROF. TS. DR. RASHIDI OTHMAN[2], DR RAZANAH RAMYA[3], DR NUR HANIE ABD LATIFF[4], DR. WAN SYIBRAH HANISAH WAN SULAIMAN[4]

[1]Institut Islam Hadhari, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia. [2]Department of Landscape Architecture, Kulliyyah of Architecture and Environmental Design, International Islamic University Malaysia, Gombak, Kuala Lumpur, Malaysia. [3]Institut Alam Dan Tamadun Melayu, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia. [4]International Institute for Halal Research and Training, International Islamic University Malaysia, Gombak, Kuala Lumpur, Malaysia

Abstract

Urban lakes are crucial components of urban ecosystems as they serve various functions such as flood control, groundwater replenishment, biodiversity preservation, and habitat protection. However, urban lakes are also prone to pollution, particularly heavy metal contamination, which affects the water quality of downstream water channels and poses a significant threat to the environment and human health. In Islam, maintaining a clean environment, including air, land, and water, is mandatory for the benefit of all living things on earth. To address this issue, aquatic plants, particularly small-sized species like *Glossostigma elatinoides* (small mud-mat) and *Bacopa caroliniana* (blue water hyssop), are promising candidates for phytoremediation in slow-moving or stagnant water bodies such as urban lakes. Synthetic seed technology, an advanced technique that uses encapsulated meristematic tissues like shoot buds or somatic embryos, provides long-term storage capacity, easy handling, economical mass propagation, and an environmentally friendly approach to delivering phytoremediating plants. This study reviews the mechanisms of heavy metal uptake, translocation, and detoxification in plants, the potential of small-sized aquatic plant species for heavy metal remediation in urban lakes, and proposes the use of synthetic seed technology to remediate urban lake contamination. The principles and ethics of environmental sustainability, as explained by the Quran and Sunnah, can guide this study and all stakeholders in their efforts to preserve the environment and address the critical issue of urban lake pollution.

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THE ROLE OF RELIGION IN DECISION MAKING RELATED TO MODERN BIOTECHNOLOGY BREAKTHROUGHS

Professor Latifah Amin
Institute Islam Hadhari, Universiti Kebangsaan Malaysia, Bangi, Malaysia

Abstract

Advanced techniques of modern biotechnology in the 21st century empowers the geneticists to modify living organisms for various purposes. In Malaysia, biotechnology is one of the prime technology identified to accelerate the country's transformation into a highly industrialized nation (8th and 9th Malaysia Plan, Malaysia's Sn & Tech Policy for the 21st Century). Although modern biotechnology has huge potential for the betterment of Malaysia's economy and improvement of people's lives, its "too rapid" advancement have become the object of doubts, fears, concerns and as well as an intense and divisive debate locally and worldwide. It has been suggested that the main reason in the emergence of controversies surrounding biotechnology has been the neglect of the needs, interests and concerns of the primary stakeholders - the commoners. Modern biotechnology has been classified as a complex emerging issue that exhibits high salience combined with limited knowledge on part of the public. Various studies have shown that consumer acceptance of modern biotechnology tend to be conditional and dependent on many factors. It has been reported by social scientists that any complex object may be located in a variety of general classes where its evaluation may also be strongly affected by extraneous concerns. The complexity of issues related to modern biotechnology make it difficult for people to decide whether to support the technology or vice versa. Our studies have shown that consumer acceptance of modern biotechnology tends to be conditional and dependent on many interrelated factors such as perception of risks and benefits, trusts in institutions representing these as well as the value systems and cultural idiosyncrasies of societies. This presentation will highlight the role of religion in decision making related to modern biotechnology applications.

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Bridging the Digital Divide in Addressing Inequality and Social Discrimination Through Robotic Programming Training

Assoc. Prof. Ir. Dr. Nazrul Anuar Nayan
Universiti Kebangsaan Malaysia, UKM Bangi, Malaysia

ASSOC. PROF. IR. DR. NAZRUL ANUAR NAYAN

Abstract

Education in the fields of Science, Technology, Engineering, Arts, and Mathematics (STEAM) and enhancing computational thinking (CT) skills are important factors in accelerating progress in various sectors to achieve the Sustainable Development Goals (SDG). Therefore, it is important for students to be exposed to these skills in preparation for future challenges as well as improving social and economic injustice in society, in line with SDG 11, which is Sustainable Cities and Communities. A significant digital divide leaves many students in rural areas marginalized and unable to learn and move forward. These limitations can cause them to lose interest in STEAM fields and exacerbate social and economic inequality. If hands-on programs and STEAM activities can be carried out continuously, proactively involving more participants, this may increase the interest and tendency of more rural students to continue their studies in the field. This research aims to measure problem-solving skills using the concept of computational thinking as well as students' interests and tendencies in STEAM after following a robotic programming course. The study was carried out in Sebuyau, Sarawak in collaboration with Yayasan Bank Rakyat. A total of 116 students, aged 11 to 14, and 25 teachers were involved in this program, which lasted for 12 days. The students and teachers were divided into three groups, and each group was trained for four consecutive days. The four teaching modules used are CT concepts; Scratch, Arduino microcontroller, and mBot2 robot programmings, as well as a final competition held to encourage competitive learnings. As a result of the pre- and post-student psychometric test results, there is a 32% increase in problem-solving skills after applying the computational thinking module. In addition, the results of the survey showed a 21% increase in the positive tendency of students to study in the STEAM field. This program contributes to a better understanding of computational thinking and programming concepts. Apart from promoting STEAM education among teenagers, the competitive learning method gives students the opportunity to collaborate and learn problem-solving skills through mini-projects and hands-on activities. This project can equip students with the necessary tools to excel in today's world as well as provide motivation to bridge the digital divide. In essence, the heuristic skills developed through these initiatives can help students become more creative, analytical, and solution-oriented, which can ultimately drive progress and improve the quality of life for all.

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Thematic Analysis of the concept of Equity in the Quran and its Relevance towards achieving Sustainable Development Goals

Madam Liza Azahari[1,2], Professor Madya Fadzila Azni Ahmad[3]
[1]Centre for Islamic Development Management Studies, USM, Penang, Malaysia. [2]Sultan Sharif Ali Islamic University, Bandar Seri Begawan, Brunei Darussalam. [3]Centre for Islamic Development Management Studies, Penang, Malaysia

Abstract

This paper explores the concept of equity based from Islamic sources and further contrasts the definition of this concept with contemporary development issues such as the sustainable development goals. Sustainable development goals have focused on the concept of equality within the 5th, 10th and 16th goals to counter global socio-economic issues. However, there is a lack of importance highlighted on the application of equity to counter such issues. The aims of this paper are (1) to use qualitative inductive approach to analyze thematically the concept of equity from the perspective of Islamic sources, namely the Quran; (2) to compare the findings of this thematic inquiry with conventional sources of literature on equity; (3) To analyze equity from both Islamic-based and conventional sources in relation to how this concept can contribute towards the sustainable development goals. The findings show more results on the word equity appeared in the Quran compared to the word equality. Furthermore, the main themes derived from the Quran correlated with the 5th, 10th and 16th sustainable development goals by enjoining the concept of equity in line with Islamic practices as a mechanism towards the realization of these goals.

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Religious Approach in Addressing the Effects of Social Media Usage on Adolescent Psychological Well-Being

Prof Dr Fariza Md Sham, Ms Noor Amila Abdul Halim, Assoc.Prof Dr Mohd Al Adib Samuri
Institute Islam Hadhari,UKM, Kajang, Malaysia

P R O F D R F A R I Z A M D S H A M

Abstract

Social media is the main medium for adolescents to communicate, connect and spend leisure time. The use of social media among adolescents is becoming increasingly popular with the rise of social media influencers. There are several viral and popular social media content themes and lifestyles among young people today, such as fashion, fitness, adventure, beauty, and self-development. By following these social media influencers, young people aspire to achieve the same lifestyle success as these influencers. The inability of some adolescents to achieve the lifestyle portrayed on social media can lead to depression, low self-esteem, and affect adolescent emotional well-being. Therefore, this study aims to examine the religious approach in addressing the effects of social media usage on adolescent psychological well-being. This study uses a quantitative method involving 294 adolescent respondents aged between 13 and 20 years. The instrument used in this study is a set of questionnaires to assess the effects of social media usage on adolescent psychological well-being and the religious approach in addressing them. Descriptive and correlation analyses were used to analyse the data. The results of the study indicate that the effects of social media usage on adolescent psychological well-being include feeling guilty, sleep disturbance, and inability to concentrate in class. This study found a significant relationship between the effects of social media usage on adolescent psychological well-being and the religious approach ($r = -.253$: $p = 0.000$). This proves that the religious approach can help in addressing the effects of social media usage on adolescent psychological well-being.

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LEVERAGING NIGELLA SATIVA-BASED NANOPARTICLES IN THE FIGHT AGAINST NEURODEGENERATION: A GREENER APPROACH TO A SUSTAINABLE FUTURE

Dr. Nurul Hafizah Mohd Nor[1], Assoc. Prof. Dr. Farahidah Mohamed[2], Assistant Professor Abd Almonem Doolaanea[2], Dr. Nur 'Izzati Mansor[3], Assoc. Prof. Dr. Mohd. Affendi Mohd Shafri[4]
[1]Institute Of Islam Hadhari, Universiti Kebangsaan Malaysia [2]Kulliyyah Of Pharmacy, International Islamic University Malaysia, Kuantan, Malaysia. [3]Faculty Of Medicine, Universiti Kebangsaan Malaysia. [4]Kulliyyah Of Allied Health Sciences, International Islamic University Malaysia, Kuantan, Malaysia

DR. NURUL HAFIZAH MOHD NOR

Abstract

Neurodegenerative diseases such as Alzheimer's disease and Parkinson's disease are major public health problems affecting millions of people worldwide, and their prevalence is expected to increase as the world's population ages. For decades, various therapeutic approaches have been explored to treat neurodegenerative diseases, focusing on the regulation of cell differentiation and survival, neuroprotection and neuroregeneration through the use of neurotrophins, nerve growth factors, and therapeutic compounds. However, since these substances reach the central nervous system only to a limited extent due to enzymatic degradation and impermeability of the blood-brain barrier, neurodegenerative diseases cannot be effectively treated. To circumvent these problems, this study aimed to develop a neurotrophin substitute from N. sativa oil encapsulated in nanoparticles and investigate its neurotrophic effects on neuro-2a murine neuroblastoma cells (N2a cells). N. sativa, a miracle herb in Prophetic medicine is known for its neuroregenerative, neuroprotective, and antioxidant activities, making it the best candidate for neurodegenerative treatment purposes. In this study, N. sativa-based nanoparticles were prepared using the diffusion-solvent-evaporation method. The obtained nanoparticles were characterised in terms of particle size distribution and surface morphology. The neurotrophic effects of the N. sativa-based nanoparticle formulations were evaluated based on cell attachment, neurite outgrowth, growth behaviour, and polarity of the projections following loading of the nanoparticles into the N2a cells. The results showed that treatment with the N. sativa-based nanoparticles was able to induce neurite outgrowth, changes in morphology, and behavioural changes in N2a cells cultured in serum-free media without significant toxicity effects. The developed system for delivering the therapeutic compounds of N. sativa in the form of nano-scale particles successfully improved its water solubility and thus its uptake by aqueous cell lines. In conclusion, the N. sativa-based nanoparticles formulated in this study provide a promising therapeutic approach for the treatment of neurodegenerative diseases by promoting neurite outgrowth and neuroprotection. As this greener approach to neurodegenerative diseases promotes well-being and ensures healthy lives for people of all ages, it is in line with SDG 3: Target 3.4 and the 5Ps (people) of the SDG, which are essential to address global health challenges and thus promote a sustainable and healthier future worldwide.

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PSYCHOLOGICAL CHALLENGES OF WOMEN WORKING FROM HOME (WFH) DURING THE COVID-19 PANDEMIC

PSYCHOLOGICAL CHALLENGES OF WOMEN WORKING FROM HOME (WFH) DURING THE COVID-19 PANDEMIC NURHAZIQAH HISHAMUDIN, A'DAWIYAH ISMAIL, FARIZA MD SHAM, NORSHARIANI ABD RAHMAN, ROZIAH SIDIK @ MAT SIDEK, ERMY AZZIATY ROZALI
Universiti Kebangsaan Malaysia, Selangor, Malaysia

PSYCHOLOGICAL CHALLENGES OF WOMEN WORKING FROM HOME (WFH) DURING THE COVID-19 PANDEMIC NURHAZIQAH HISHAMUDIN

A'DAWIYAH ISMAIL

FARIZA MD SHAM

NORSHARIANI ABD RAHMAN

ROZIAH SIDIK @ MAT SIDEK

ERMY AZZIATY ROZALI

Abstract

In fulfilling the demands of work and responsibilities, women had to face various challenges during the Covid-19 pandemic. From a psychological point of view, some of these challenges include fatigue caused by too much time spent working on the tasks given by their employers and the amount of workload that affects their ability to balance between work and emotional stability. This article examines the psychological challenges faced by women working from home (WFH) during the Covid-19 pandemic. As described in this article, this study uses the qualitative methodology. Analysis of research findings is made based on interview data through a Round Table Discussion (RTD) involving interested parties and parties who can provide information. The findings of the study show that women who work from home (WFH) have a heavy workload and are psychologically challenged with regard to work performance, finances, as well as time and family management. The various impacts faced by working women due to the challenges in their career is undeniable, yet this situation has become more prominent during the COVID-19 pandemic. This study found that mental health needs to be really emphasised to balance the responsibilities that women have to bear. Hence, this study needs to be empowered so that women may continue pursuing their career even by working from home, and actions and solutions can be taken in guiding them.

Keywords: psychology, women, working from home, Covid-19 pandemic, challenge

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THE ROLE OF WAQF DEVELOPMENT IN COMMERCIAL HOUSING IN ACHIEVING SUSTAINABLE DEVELOPMENT GOALS (SDGs)

Ms Norazlina Mamat[1], Dr Mohd Izzat Amsyar Mohd Arif[2], AP Dr Mohd Afandi Mat Rani[1], Dr Faezy Adenan[1]
[1]Universiti Teknologi MARA, Shah Alam, Malaysia. [2]Universiti Kebangsaan Malaysia, Bangi, Malaysia

MS NORAZLINA MAMAT

DR MOHD IZZAT AMSYAR MOHD ARIF

AP DR MOHD AFANDI MAT RANI

DR FAEZY ADENAN

Abstract

Wakaf is a transformation of the property system to open up opportunities for Muslims to continue contributing towards the development, empowerment and economic stability of the community. Wakaf plays a very important role when the distribution of waqf assets as a result of the investment will cover many projects of a social and community development nature such as education, health, economic empowerment and the environment. Statistics show that almost 88% of the 30,000 hectares of waqf land worth RM1,177,084,450.59 throughout Malaysia have yet to be developed. The development of commercial housing waqf is the solution to the turmoil that has plagued the country, especially the issue of rising house prices every year, homelessness and houses that are not conducive for families to live in. These issues can contribute indirectly to the increase in crime statistics and social problems among the community. Among the housing projects that have been implemented on waqf land in Malaysia are Al-Ehsan Flats in Melaka, Seetee Aisah Housing Park Project in Penang, and PWS-UME Housing Project in Selangor. These projects are in line with the Sustainable Development Goals (SDGs) 2030 for the advancement and welfare of people and the environment. 17 goals have been set, including several forms of sustainable development like ending poverty, enhancing health, and combating climate change. Therefore, this study aims to analyze how commercial housing waqf development functions as a vital tool in accomplishing the objective of sustainable development. This qualitative study collects primary data from semi-structured interviews and secondary data from books, journal articles, papers, and other sources. The data was then analysed inductively and deductively through content analysis. As a result, the first (eradicating poverty) and third (promoting good health and wellbeing) of the 17 designated Sustainable Development Goals (SDGs) were most closely related to the contribution and function of commercial housing waqf development. Hence, it is envisaged that this study would help policymakers in Malaysia determine if waqf development is acceptable for meeting the 2030 Sustainable Development Goals (SDGs).

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Legalising Micro-Takaful to Achieve Inclusivity And Sustainability In The Islamic Financial System.

MS. NIK NURAISYA NIK BADRUL AZAHAR, ASSOC. PROF. DR. RUZIAN MARKOM
FAKULTI UNDANG-UNDANG, UKM, selangor, Malaysia

MS. NIK NURAISYA NIK BADRUL AZAHAR

ASSOC. PROF. DR. RUZIAN MARKOM

Abstract

Micro-takaful is a type of Islamic insurance with the potential for financial inclusion and social welfare. It has the characteristic of risk sharing, cooperation, and affordability. The target market is to protect low-income individuals and marginalized communities. Zakat is a mandatory form of charitable giving to Muslims. The objective of zakat is poverty alleviation, wealth redistribution, and community development. The Islamic Financial Services Act 2013 ("IFSA 2013/Act") is the authoritative law in Islamic finance and regulates and supervises Islamic financial institutions, including takaful. The current market did not meet the demand for takaful and protection for low-income populations, including zakat recipients. There is a lacuna in the legal framework of the micro-takaful and zakat relationship. This study aims to unfold the initial intention of micro-takaful and explore the potential of enacting micro-takaful into the Islamic Financial Services Act 2013 for the sustainability of zakat recipients. The qualitative method is used to determine the suitability of the Islamic Financial Services Act with micro-takaful. The findings revealed that applying the zakat fund to micro-takaful is a sensitive issue. Therefore, the application of zakat fund to micro-takaful was complex. Integrating micro-takaful within the Act is recommended to enhance the impact of zakat distribution and widen the takaful market.

Full Papers

Psychological Challenges of Women Working from Home (WFH)During The Covid-19 Pandemic

Nurhaziqah Hishamudin*[1], A'dawiyah Ismail[1], Fariza Md Sham[1], Roziah Sidik@Mat Sidek[2], Ermy Azziaty Rozali[2], Norshariani Abd Rahman[3]

[1]Research Centre for Dakwah and Leadership, Faculty of Islamic Studies, Universiti Kebangsaan Malaysia
[2]Research Centre for Arabic Language and Islamic Civilization Faculty of Islamic Studies, Universiti Kebangsaan Malaysia
[3]Institute of Islam Hadhari, Universiti Kebangsaan Malaysia
Felo Institute of Islam Hadhari, Universiti Kebangsaan Malaysia

*nurhaziqah707@gmail.com

Abstract

In fulfilling the demands of work and responsibilities, women had to face various challenges during the Covid-19 pandemic.From a psychological point of view, some of these challenges include fatigue caused by too much time spent working on thetasks given by their employers and the amount of workload that affects their ability to balance between work and emotionalstability. This article examines the psychological challenges faced by women working from home (WFH) during the Covid-19 pandemic. As described in this article, this study uses the qualitative methodology. Analysis of research findings is made based on interview data through a Round Table Discussion (RTD) involving interested parties and parties who can provideinformation. The findings of the study show that women who work from home (WFH) have a heavy workload and are psychologically challenged with regard to work performance, finances, as well as time and family management. The variousimpacts faced by working women due to the challenges in their career is undeniable, yet this situation has become more prominent during the COVID-19 pandemic. This study found that mental health needs to be really emphasised to balance the responsibilities that women have to bear. Hence, this study needs to be empowered so that women may continue pursuingtheir career even by working from home, and actions and solutions can be taken in guiding them.

Keywords: psychology, women, working from home, Covid-19 pandemic, challenge

1. Introduction

The spread of Covid-19 around the world has disrupted the order of daily life. All countries are intensifying various efforts such as health care system as many are still struggling with disease variants, waves of infections,and deaths. At the global scene, there is economic turmoil and social issues related to an increase in suicide ratesand mental health issues (Loo Seng Neo et al. 2021). According to that study, as countries grapple with the pressure on their healthcare systems, there has been little focus on the impact of the pandemic on family relationships, especially on women, who have been doing more unpaid care work than men before the pandemic.

According to the Centre for Health Protection (CHP) (2020), Covid-19 is a novel disease that began to

spread inthe human population since December 2019. It is part of the coronavirus family, the same group of viruses that caused the outbreak of the Severe Acute Respiratory Syndrome in Southeast Asia in 2002 and the outbreak of theMiddle East Respiratory Syndrome in 2012. Presently, the main known mode of transmission is through breathing; it is thus taken to spread through close contact with other people. Presently, the only method of combating the spread of this virus are through the proper use of masks, social distancing, and good practises of hand hygiene. The World Health Organisation (WHO) declared the Covid-19 outbreak as a global health emergency on January 31st, 2020 (World Health Organisation 2020). Since then, the virus has spread rapidly (Lina Vyas, Nantapong Bukakhieo, 2021).

The Work from Home Policy (WFH) provides the facility for employees to carry out essential or official duties from home on working days, either full day or half day, for a certain period, subject to the approval of the Head,and is taken as being on duty (JPA, 2020). According to the Public Service Department (JPA) 2020, the aim of working from home is to reduce or to avoid losses and damages due to reasons such as environmental pollution,the spread of infectious diseases, or natural disasters that may threaten safety or public order, whether in the office, premises, or residential areas. Those situations include, for example, the worker's inability to present himself at the workplace because the worker's residential area is subjected to the movement control order or otheractions that cause the movement of workers to be hindered

The Work from Home Policy also creates a balance and welfare management between the agency's or employer'sneed for the continuity of duty for the sake of service, and the employees' need to manage personal matters in situations where they are not allowed to be on leave. Among such situations are the need to take care of childrenaged 12 and below due to the closure of day care centres or childcare centres, or primary schools due to urgent matters, or by order of the government (JPA, 2020).

The WFH measure reveals various challenges in making the WFH concept a success throughout the Covid-19 period, especially for women. Some of the challenges and obstacles include the lack of physical and financial resources, such as being subjected to a small workspace, being outside the organisational structure of the office,lacking in inspiration, no support from colleagues, and to feel isolated. The biggest challenge is in being more productive outside of the organisational structure of the office (Rusli 2020). A similar challenge is also expressedby Ismail Sulaiman (2020) in relating the biggest challenge of WFH implementation to work productivity, whichshould not be affected although the task is performed outside of the organisational structure of the office. Hence,to fulfil the demands of both the career and family simultaneously requires for good time management.

Although various studies have been conducted to examine the impact of Covid-19 challenges on women's psychological well-being, the discussion regarding the situation of women working from home

is not very widespread. Thus, this study will discuss issues related to the psychological challenges of women working fromhome during Covid-19 to ease their mental burden.

In this study, the researcher would initially explain the factors and the psychological impact of Covid-19 pandemic on women, and the work from home policy in accordance with the guidelines set by the Malaysian Public Service Department (JPA). Next, the researcher would elaborate on the challenges faced by women working from home during Covid-19.

2. Literature Review

According to the study by Norhafizah Mustaffa (2020), using the techniques or therapies of Rational Emotive Behaviour Therapy (REBT), emotional imbalance is caused by irrational thinking. Humans are born with one potential; to either think rationally or irrationally. Thus, a person feeling disturbed is not influenced by external sources but is self-inflicted (Dryden & Bernard, 2019). This theory explains that a person needs to change the destructive way of thinking into a rational concept of thinking to change or add positive emotions that can eventually change the destructive behaviour into a positive and constructive behaviour (Norhafizah Mustaffa et al. 2015). by 2020).

According to the newspaper, Berita Harian (2020), the United Nations (UN) mentioned the risk of Covid-19 pandemic in triggering a global crisis of mental problems and requires immediate action to address the psychological problems caused by this transmission (Abdul Rashid et al. 2020). Devora (2020) also mentioned that psychological stress is caused by an individual experiencing situations of fear, uncertainty, and anxiety aboutthe economy. The increase in the number of infected patients also results in other individuals hearing it to experience emotional stress, including among the Covid-19 patients themselves. Therefore, the situation will further affect family members and close individuals as well as health workers who care for the patients due to the increase in workload (Abdul Rashid et al. 2015).

Based on the current report of the Malaysian Department of Statistics in the Malaysian Labour Forecast (2020),the rate of unemployment in March 2020 climbed to 3.9 percent. The rate of unemployment has increased from
3.3 percent in the previous month, which is the highest rate since June 2010 (3.6 percent). In the survey, the number of unemployed individuals has increased to 610.5 thousand people (17.1 percent) from 521.3 thousand in the same month of the year 2019. The high unemployment rate in March 2020 is influenced by the negative impact of the Movement Control Order (MCO) on the labour market. It is estimated that the statistic will continueto increase following the spread of the Covid-19 outbreak that has not yet subsided (Abdul Rashid et al. 2020).

A study by Siti Sarawait, Mohamad Isa and King Zirwatul (2021) proved that working from home has contributedto the increase in the percentage of depression, anxiety, and stress among employees. The findings of the study also showed a significant relation between the perception of working from home

with the scale of depression, anxiety, and stress. The policy of working from home is not less important in influencing family members who are working in stabilizing issues related to depression, anxiety and stress caused by the current Covid-19 pandemic.

Referring to the study by Tan (1992), women bear types of burden, responsibility to the family and also to their work, regardless of it as a career or even just part-time work. Women are the basis for the harmony in the family;the role they play is dynamic, they can bear the responsibility of either a household manager or a contributor to the family income, even contributes to the country. This responsibility is not only played by married women, butalso becomes part of the responsibility among unmarried women (Siti Nur Husna, Mohd Izhar Ariff, MuhammadAdnan, 2017).

Various countries have used different ways in dealing with and defending themselves from the Covid-19 pandemic, including Hong Kong. Hong Kong was among the first places in the world to be hit by the outbreak, where the city announced the first confirmed Covid-19 case as early as 23rd January, 2020. Since the start of theoutbreak, the city has experienced four waves of infection. The third wave was the worst while the fourth wave is being experienced at the time of writing. In response to the outbreak, Hong Kong has taken a slightly differentapproach compared to its counterparts. The city has not implemented the order for the entire shut down; on the contrary, several measures have been implemented, including limiting public gatherings, suspending schooling time, making special work arrangements including WFH and remote work for public servants, and making appeals to the private sector to make the same arrangements as far as possible (Lina Vyas, Nantapong Butakhieo,2021).

Social impact of women in Turkey is more to negative effects of Covid-19 on their emotional health that they have experienced (Yasemin Kalylioglu, 2020) that's why in South Africa see that daily work engagement was related to daily psychological availability, daily positive work-home interaction and daily positive home-work make the women feel better to do work and responsibility at home (Laba, K et al. 2018). In Singapore, influence of Covid-19 on women's perception show that the negative impacts of Covid-19 increased Work-Family conflict levels (Loong Seng Neo, Jean Yi Collette Tan, Tierra Wan Yi Chew, 2021) but in India, lockdown situation made women more active, mobile and balance their official work along with the family setup (Raju S, Vijay Krishna Kumar, 2020). The research find that balancing work-family are very important to women to get the healthy life (Tojin Ajibade et. Al, 2020).

3. Methodology

This study is performed using the method of content analysis and qualitative approach, which is the interview. This method of content analysis begins by examining the content, evaluating the arguments and facts, making comparisons, giving positive criticisms, and drawing up the conclusion.

The interviews method is conducted through a Round Table Discussion (RTD) involving 7 women who representstakeholders and parties who can provide information on the challenges of women working from home (WFH). The expert panel consists of representatives of the Ministry of Women, Family and Community Development, representatives of the Department of Public Services, representatives of the National Board of Population and Family Development, the Department of Women's Development as well as employees involved with the private and government sectors representing the fields of management and professionals, services and support.

This method enables for information to be collected directly through round table discussion organized by the researcher. The identified group is given a title or question to be discussed with all group members so that the problem can be delineated and shared from a sincere heart by those who are truly involved. The researcher can identify the attitude or the level of the respondents' agreeableness on the topic discussed, thus enabling the researcher to obtain a consensus based on their responses.

The number of participants is between 6 to 10 people, but ideally should be between 7 to 8. The moderator can control the minutes of the members speaking and encourage them to comfortably express their opinions and experiences. All forms of discussion must be recorded with the permission of the participants (Ahmad SunawariLong, 2015).

4. Result and Discussion

The results of the round table discussion of the study participants show that women who work from home face various psychological challenges during the Covid-19 pandemic. Among these challenges are psychological well-being, work performance, as well as time, family, and financial management.

4.1 Psychological Challenges of Women Working from Home

Based on the Round Table Discussion, the result of the study shows a participant as saying that her emotions were disturbed and had to refer to a psychiatrist because she had to work long hours and had no time for herself.The problems and challenges she had to face when working from home include the need to take care of the children, and to meet the requirements of the employer within a specified time. Thus, she had no time for herself,causing her emotions to be disturbed (Elfina Study participant, 2021).

The study participants also experienced excessive fear and concern regarding the easy spread of the Covid-19 virus during the pandemic, regardless of age. They were scared of obtaining the Covid-19 test result due to the fear of receiving bad news.

Women who work from home during the Covid-19 pandemic often felt mentally drained although they have hadadequate rest. This situation is common among most women who work from home because they feel tired of theworkload and had to maintain a balanced life managing their families. The intensity of their fatigue causes a person to lose focus. The quality of sleep during the Covid-19 pandemic (Masliah Suatan; Denise Koh, 2022) is among the great challenges people face to balance their role and commitment to attain physical health (MohamadIkram; Wan Ahmad Munsif, 2022) and their mental well-being. Women who work from home face difficulties adjusting because they have to perform work-related tasks while taking care of the family at the same time, whichwas previously conducted separately at the workplace and at home (Laila Wati et. al, 2021).

The hectic life of working from home while juggling the responsibilities managing the household cause women to experience burnout and extreme stress to the extent of fearing to answer incoming calls from their employers (Study Participant, 2022). This often leads to them having negative feelings about work, which can reduce their professional ability to perform their work (Firdaus Abdul Ghani, 2019). Burnout is a syndrome caused by the impact of chronic stress at the workplace that has failed to be managed. Individuals who experience burnout exhibit three main characteristics - exhaustion or fatigue, increased negative feelings towards work, anddecreased professional effectiveness (WHO, 2019).

Women who suffer from panic attacks (Annisa Hapsari, 2022) will experience extreme heart palpitations that would disturb their emotions and affect their work performance as it inhibits all activities at that time. The declinein work performance will cause a person to become less self-confident so much so that this situation becomes prolonged. Hence, psychological training or treatment is very important for a person to recover, and thus act morerationally and reduce the workload (Zemni I et. al, 2023).

Completing tasks online is not as easy as attending work physically at the office. The reality of working in an office is to focus solely on the work at hand until it is completed, or to continue at home or even the next day. However, those who work from home cannot divide their time and attention only on either the family or work because they are faced with both situations at the same time (Loo Seng Neo et. al, 2022). Therefore, they wouldtry to endure it until they experience a phase of burnout, fatigue, and palpitations if their employer calls to ask them to complete their work (Elfina Study participant, 2022).

This excessive worry is not only about oneself, but also includes the circumstances of others and the surroundings(Norhazirah, 2020). This infectious disease can become widespread at any time at a rapid rate, thus causing heightened worries. This situation does not only occur among family members, but also involves those who are at the front line such as nurses (Ahmed Sami Hammami et. al, 2021), who have to work hard and strive to save lives at the hospital.

The results of the study show that women felt very stressed during the early stages of the Covid-19 pandemic because they were shocked by a situation that has never happened and had to endure it for a long period of time.Women who bear multiple responsibilities and roles face the problem of balancing between the demands of workand family life because there are times when work has to take precedence over family matters (Loo Seng Neo et.al, 2022). However, in line with the changing phase of the pandemic, some women are able to organize their timeand responsibilities well after getting a working rhythm.

Biological factors are elements that contribute in shaping a person's behaviour. If the body is too tired, the personmight behave erratically. However, not all human behaviour is shaped by biological factors alone. When a personis given motivation or a message that touches the heart, his behaviour will change for the better (Khaidzir, Kadar& Khairil Anwar, 2019).

Women also face the challenge of being ill and diseased during the Covid-19 pandemic that can lead to social and physical implications for them. Physical pain also affects women’s psychology (SIti Sarawati, Mohamad Isa,2021). Their minds will often be disturbed by worrying about what will happen if they are infected with the disease because their role as the family's backbone will be affected. The emotional stress that women often had to face is mostly due to financial problems, feeling alone in facing the pandemic crisis, suffering from sleep disorders that disrupt the normal sleep cycle, feeling restless and anxious at home due to too much work or no

activities to do, as well as losing their temper easily even over small matters because there is no understanding with their partner or family (Siti Marziah et. al, 2021).

4.2. Work Performance Challenges for Women Working from Home

Women who have multiple commitments at one time face the challenge in maintaining work performance at theirworkplace, especially those who hold high position and have a family that needs to be taken care of on their own.The workload is also constantly increasing due to limited time and use of equipment. In fact, the way of socializing with one's colleagues is also different due to the long duration of the Covid-19 pandemic.

The workload is increasing due to time and equipment usage. In fact, the method of socializing with colleagues is also different due to the long period of the Covid-19 pandemic. The quality of the work is influenced by a person's current condition. If the person is in an unstable state, his work performance will be interrupted and thetargeted results cannot be achieved.

Those who work from home are challenged in terms of multi-directional disturbances such as small children, surrounding noise, and limited workplace that can lead to decreased work performance (Lina Vyas & N. Butakhieo, 2021). They are forced to isolate themselves from other workers (Collins and Moschler, 2009) to reduce direct communication. However, this situation (Gajendran and Harrison, 2007) causes the relationship between employees to become more strained (Lina Vyas and Nantapong Butakhieo, 2021).

Despite the various challenges faced by women when working from home, in Hong Kong they make working from home as an important government policy to address the pandemic issue (Lina Vyas dan Nantapong Butakhieo). This policy is applied to both the employees and employers so that work performance continues to improve and various methods can be used to solve problems related to the new norm.

The work performance of some female employees increases alongside complete work procedures that facilitate their work. Programs that are conducted online have a great impact not only on the participants but also on the organizers who receive good feedback because the process of handling online programs is easier across the statesor even abroad. SOPs or official regulations that were previously difficult to be approved have become easier andmore relaxed because they are conducted online. Therefore, the work goals can still be achieved although the program is conducted online due to the pandemic (Yuhaniz reseach participant, 2022).

During the pandemic, some individuals experienced a conflict between their career and family, resulting in unstable work performance. They feel less productive because the work environment has to be done other than at the usual workplace. This less productive environment causes them to lose focus on their

work, hence their work performance started to decline either gradually or suddenly. Women, on the other hand, will be distracted with the responsibility of managing the household and family members at home because their working time is mixed with the time of managing the household (Siti Marziah et. al, 2021)

4.2. Time Management Challenges for Women Working from Home

It is not easy for women to juggle between managing time while bearing various responsibilities. Furthermore, the responsibilities that are undertaken need to be equally divided between the family, work and self-care. The right for self-care needs to be given attention to so that other tasks can have a positive impact.

It was found that women work unpaid overtime compared to men or more than 75 percent of the required hours(Judith; Franziska; Vanessa; Mader; Eva, 2021). This situation can result in time management becoming a challenge for them. Furthermore, the conflict between work and family matters is difficult to overcome if women are not able to manage tasks in the household institution wisely while being responsible for their work at the same time (Bakar et. al, 2012).

Inefficient time management puts pressure on women. Women who work from home are under pressure during the Covid-19 pandemic because they need to ensure that all aspects, especially the aspect of time, can be managedefficiently and effectively (Nor Shela, 2021). If time cannot be managed well and fairly, then other aspects will also be affected, either a lot or a little.

The time management of women who have small children or children who have reached adolescence is also different because it depends on the busyness of their children's schedules. Some women experience difficulty inbalancing between the demands of work and family matters because they have young children at home. Young mothers or those with small children need a high level of patience when taking care of their children as childrenof this age require complex care methods. The same situation applies for mothers of teenage children; they requiredifferent methods based on their children’s age. This is because the children are exposed to more social problems(Nor Shela, 2021).

It is undeniable that working from home can support career women to take care of their families while working at the same time. However, time management remains a challenge because they have to balance between two equally important things. Ultimately, improper time management will result in negative effects, including longerworking hours, the burden of multiple roles, conflicting roles, as well as exhaustion and mental fatigue (Siti Marziah, 2021). Therefore, women who work from home need to manage their time well so that it does not become an obstacle to maintain or even to increase their work performance even when they are at home.

4.3. Family Challenges for Women Working from Home

Women who work from home have a lot of time to spend with their family. However, they still face challenges because the tasks and responsibilities have increased. Before the outbreak of the Covid-19 pandemic, women were able to work according to the time and scope of work set at the office or at their place of duty. However, after the pandemic, women's life patterns began to change according to their current commitment or responsibilities.

Married women are faced with very tight family management. They not only have to take care of their husband and children, but also have to shoulder the responsibility as an employee and divide their time fairly. Therefore,the husband and those around them need to help ease the burden of women who work from home so that the challenges faced can be alleviated (Syamlina research participant, 2022).

Apart from yourself, the people around you and your family are challenges that need to be considered. The challenges will test one's patience and sensitivity in solving them. Likewise with women, those who work from home have 24 hours to see their families by their side while performing duties as trustees of work at the office orat any place of duty. However, they have very limited time for themselves, or may not even have any time to recuperate and re-charge for the coming days. So, the most important aspects that are required in a family are good communication and concern for each other that can lighten the daily workload (Research participants Syamlina, Salmi, Elfina, 2022).

Besides that, another challenge faced by married women is the education of their children during the Covid-19 pandemic. As we all know, students had to study online for the first time with various preparations although thissituation has been done outside of Malaysia. Mothers are faced with their children's acceptance of the lessons they learn through online method that is slightly different from the face-to-face learning method. Children were not able to concentrate well because they were distracted by other things when they were at home (Salmi ResearchParticipant, 2022).

4.4. Financial Challenge for Women Working from Home

The financial aspect became a big issue during the Covid-19 pandemic due to the loss of income. Women who are the backbone of the family's economy also worked hard although they had to work from home (WFH) to savethe family's economy. Those who faced financial problems due to the loss of livelihood were willing to bear theshame of trying various ways to continue surviving during the pandemic (Muhammad; 2020, Abdul Rahman; 2021, Parzi and Abd. Karim, 2020).

The financial challenges during the Covid-19 pandemic to women working from home mostly affected those working in the private sector and the self-employed because they depended on the financial stability of these institutions. According to Khatijah Othman (2021), both women and men faced financial challenges depending on the type of work they do, the way they managed their lifestyle, family commitments, and the personality traitsof the people around them.

However, there are women who work from home yet do not face challenges from a financial point of view as they have the support from their spouse, family and also having a stable job. Most of them only had to fork out acertain budget that exceeds the rate to be paid for additional commitments such as electricity and water bills, theinternet and so on. Therefore, some women who work from home thought that expenses were not a strong challenge to life during the Covid-19 pandemic (Salmi Research Participant, 2022).

According to Purwanto et al. (2020), one of the challenges of those working from home is having to bear electricity and internet bills at a higher rate compared to before the outbreak of the Covid-19 pandemic (Lina Vyas & Nantapong Butakhieo, 2021). As a result of the decline in national economic income, women were alsoaffected because they had to work online to help their husband and family to generate income. However, this situation is not isolated to the local scene as other countries also had to experience the same situation (Siti Aisyahet. al, 2021).

The study shows that 100% of the female respondents faced financial problems that impacted their mental health;they had to bear excessive workload on top of the existing one (Farah, 2022). Their income during the pandemicwas not the same as their original salary due to the condition of the Covid-19 pandemic that reduced their work performance and placed a limit on their workspace.

5. Conclusion

The challenges of the Covid-19 pandemic have had a tremendous impact on everyone, especially on women. Theworkload they carry caused them to feel stressed, thus affecting their psychological stability. The researchers have explained the challenges faced by women from the aspect of psychology, work performance, time and familymanagement, as well as finances, forcing women to seek for solutions when faced with these challenges.

6. Acknowledgement

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The Role Of Commercial Housing Waqf In Achieving Sustainable Development Goals (SDGs)

Norazlina Mamat[1], Mohd Afandi Mat Rani[2], Mohd Izzat Amsyar Mohd Amsyar[3*] Faezy Adenan[4]

[124]Academy of Contemporary Islamic Studies, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
[3] Faculty of Law, National University of Malaysia, 43600 UKM Bangi, Selangor, Malaysia

[*] izzatamsyar@ukm.edu.my

Abstract. *Waqf is a property system reform that allows Muslims to continue contributing to the community's development, empowerment, and economic stability. When the distribution of waqf assets as a consequence of the investment would encompass many social and community development projects, such as education, health, economic empowerment, and the environment, waqf plays an important role. According to statistics, about 88% of Malaysia's 30,000 hectares of waqf land valued RM1,177,084,450.59 have yet to be developed. The growth of commercial housing waqf is the solution to the country's instability, particularly growing house prices year after year, homelessness, and houses that are unsuitable for families. These factors may indirectly contribute to an increase in crime statistics and social difficulties in the neighbourhood. Seetee Aisah Housing Park Project in Penang and PWS-UME Housing Project in Selangor are two housing projects built on waqf land in Malaysia. These initiatives are in line with the 2030 Sustainable Development Goals (SDGs) for the advancement and well-being of people and the environment. There are 17 goals, including different aspects of sustainable development such as eradicating poverty, improving health, and addressing climate change. As a result, the purpose of this research is to examine how commercial housing waqf development might be used to achieve the goal of sustainable development. This qualitative study uses semi-structured interviews to obtain primary data and secondary data from books, journal articles, papers, and other sources. The data was then subjected to inductive and deductive content analysis. As a result, of the 17 designated Sustainable Development Goals (SDGs), the first (eradicating poverty), third (promoting good health and well-being), eighth (Decent Work and Economic Growth), and eleven (Sustainable Cities and Communities) were most closely related to the contribution and function of commercial housing waqf development. As a result, this study will assist Malaysian authorities in determining if waqf development is acceptable for reaching the 2030 Sustainable Development Goals (SDGs).*

Keywords: Commercial Housing Waqf; Malaysia; Poverty; SDGs; Waqf Development

1. Introduction

Waqf is a property system reform that allows Muslims to continue contributing to the community's development, empowerment, and economic stability. Waqf also plays an important part in the distribution of waqf assets as a result of investment in many social and community development programmes such as education, health, economic empowerment, and the environment. Malaysia is one of the emerging countries that is experiencing financial difficulties; data reveal that Malaysia also has a bundle of waqf land that is rising every year, with approximately 14,356 waqf land lots totaling 30,888.89 hectares (JAWHAR, 2023). However, figures show that about 88% of Malaysia's 30,888.89 hectares of waqf land worth RM1,177,084,450.59 are idle and have yet to be developed (Omar, 2020).

In keeping with the changing circumstances and needs of today's society, the creation of residential dwellings on public waqf land is a dynamic, progressive, and fruitful kind of waqf investment. In addition to the market value of the house, which is improving at a much faster rate than household income growth (Suhaimi & Ab Rahman, 2019), the underprivileged Muslim community continues to be marginalised in asset ownership and equity in the country when compared to other races. This is because difficulties such as high living costs, rising urban poverty rates, and high property prices are factors in many Muslim communities that, in comparison to other races and religions, still do not own a home (Syahnaz, 2016).

As a result, it is appropriate for waqf to be able to provide inexpensive housing to the community while supporting the government's goal of ensuring that every person owns his or her own home. Housing or housing is a necessity for every individual or household today. Thus, purchasing and owning a home should take precedence over other assets and liabilities (Awang, 2004; Ibrahim, 2016). Although Islam categorises the need for humanity to own a home or habitation for refuge, it is required at the level of daruriyyah (Suhaimi & Rahman, 2019). According to Goulet (1971), one of the key components that humans require is the ability to access requirements such as food, shelter, health, and protection. According to Idris (2009), the inability of poor people to access needs such as good housing will have an impact on the country's economic progress. When housing building is largely concentrated on pricey types of houses above income affordability, Malaysia faces a housing dilemma where supply exceeds demand (Suhaimi & Ab Rahman, 2019).

Making products goods and services that can be created for society is one of the initiatives to promote society's economic progress and well-being. As a result, rising economic growth in the country is one form of successful economic development for societal well-being (Lahuri et al., 2021). The addition of the number of industrial output, improvement of infrastructure, rise and increase in the number of assets, and increase in manufactured products are indicators of the achievement of economic development and well-being (Lahuri et al., 2021).

As a result, this paper explores and illustrates how commercial housing waqf (CHW) might play an important role in attaining and achieving the Sustainable Development Goals (SDGs), notably in Malaysia.

2. Literature Review

2.1 The Overview of Waqf

Waqf is one of the instruments of property management in Islam that is recommended to be strengthened and empowered in addition to zakat, hibah, will, and so on. It was developed in Islam to demonstrate the importance of systematic and organised property maintenance in meeting the economic and social demands of Muslims (Kamus Dewan Bahasa, 2017).

Waqf denotes standing or opposing sitting down and stopping (Ibn Manzur, 2010). While there are various definitions of waqf by jurists, the definition given reaches a consensus from the point of view of the main principle of waqf itself, which is the property of waqf is the property of Allah SWT, waqf is lost ownership of the property that has been pledged, and waqf can be used for the human race. Waqf is an unique instrument founded on three fundamental principles that must be followed and protected in order to ensure the long-term viability of waqf property in Islam, which cannot be sold, given, or bequeathed to others. On this basis, it distinguished waqf instruments from other Islamic instruments such as zakat, hibah, and so on. Property that has been proclaimed a waqf asset is naturally bound by three major constraints that are debated among classical jurists, which are perpetual (perpetuity), irrevocable (irrevocability), and non-transferable (inalienability) (Syahnaz, 2016).

2.2 The Overview of Commercial Housing Waqf

In today's context, this waqf instrument is seen as an important resource for developing the ummah's economy and society by optimising the waqf's results. The waqf land serves as a platform for Muslims' economic prosperity and the country's overall wellness. Waqf assets also function as a tool for Muslim social development. Furthermore, waqf assets are observed to provide high-quality income when developed on top of commercial buildings such as business premises, residential houses, hotels, and so on, which are not exclusively focused on education and health elements (Rashid, 2011; Cizakca, 2000).

The management and administration of waqf property is essential to the plan's success. The creation of the Department of Waqf, Zakat, and Hajj (JAWHAR) inside the Prime Minister's Department seeks to assist the State Islamic Religious Council in implementing more effective waqf property development (Zainur & Sumayyah, 2023). The commercial housing waqf (CHW) has been developed in Malaysia by the State Islamic Religious Council (SIRC); it could generate income for the SIRCs through lease or rent of the property to support the needs of society and economic growth of a country, as well as Muslim well-being.

The Penang State Islamic Religious Council (MAINPP) was pioneering in developing waqf properties through Waqf Seetee Aisah items. Development involves two assets that benefit waqf property investment and enabling the Muslim community to help Muslims own assets. MAINPP and UDA Land (North) Sdn Bhd adopted the joint venture technique (Joint-Venture) to create 76 units of 2-story houses and 27 units of shop houses (Nuruddin et al., 2019; Ismail et al., 2021). Furthermore, the Selangor Islamic Religious Council (MAIS), in collaboration with Urus Maju Ehsan (UME), has developed affordable residential homes on waqf land that has been substituted (Istibdal) due to the greater visibility (maslahah) of the existing mosque in the area. The Majlis Agama Islam dan Adat Melayu Terengganu (MAIDAM) does the same thing by building houses on waqf land in the village of Banggol Peradong, Kuala Terengganu, with zakat funds to be utilised by asnaf. This study believes that all SIRC in Malaysia worked hard to improve the development of waqf through commercialisation projects, whether in the form of residential, business premises, hotels, and so on, if it can generate income and be used widely by beneficiaries and Muslim societies.

According to Tan Sri Mohd Yussof Latiff, President of the Penang Malay Association (Pe Win), the present waqf land has been inhabited for more than two to three generations. With the quick pace of socioeconomic growth, Penang's position is shifting, and it continues to squeeze, particularly among the disadvantaged Malay Muslims. If the waqf property is not developed right away, this settlement will remain the same throughout time due to development, which causes losses to the race and religion itself. As the Malays fall behind Penang's increasingly important socioeconomic and geopolitical issues, the existing waqf land area offers an alternative for housing Penang's Malay community. In the Penang area, for example, 150 acres of waqf property might be developed. If the project is completed, it will be able to house 18,000 Malay residents in apartment buildings. Furthermore, it can give 3,600 company premises to help strengthen the socioeconomic and geopolitical elements of the Malays in Penang.

Thus, taking the spirit of waqf itself, which aims to benefit both Muslims and non-Muslims indirectly, the development of waqf land to develop affordable housing for the community is seen as a very progressive and productive solution and initiative in this problem, as well as increasing Muslims' asset holdings in the country. Furthermore, the creation of homes on waqf land aims to demonstrate that waqf instruments, as a kind of waqf property investment, are actually a stimulus for Muslims' economic and social progress.

2.3 Sustainable Development Goals (SDGs)

Development is an endeavour to structure a society in order to advance and improve the quality of human life, both individually and in society. According to Todaro and Smith (2006), a country's development is a multifaceted process that encompasses significant changes in social structure, attitudes, and government institutions. Development must represent both material and spiritual advancements in the social structure. According to Ridwan (2018), the ultimate purpose of progress in Islam is to honour human dignity in this world and obtain bliss in the afterlife. As a result, one of the most important characteristics of development is the output of productive activities (Lahuri et al., 2021). Sustainable economic development based on Islamic principles is not only confined to economic variables, but also includes social, moral, material, and spiritual qualities (Lahuri et al., 2021). Furthermore, it is linked to raising people's living conditions (Muliadi, 2020).

The United Nations (UN) has begun the Sustainable Development Goals (SDGs), which have received consensus from 193 UN member countries, including Malaysia, and are committed to achieving them

(Lahuri et al., 2021). The SDGs are global and national commitment an effort to improve the welfare of society also the environment which; consists of 17 goals, namely [1] No Poverty; [2] Zero Hunger; [3] Good Health and Well-Being; [4] Quality Education; [5] Gender Equality; [6] Clean Water and Sanitation; [7] Affordable and Clean Energy; [8] Decent Work and Economic Growth; [9] Industry, Innovation and Infrastrusture; [10] Reduced Inequalities; [11] Sustainable Cities and Communities; [12] Responsible Consumption and Production; [13] Climate Action; [14] Life Below Water; [15] Life on Land; [16] Peace, Justice and Strong Institutions; and [17] Partnership for the Goals (Martin, 2018).

3. Methodology

3.1 Data Collection

Because this study intended to analyse the role of waqf, specifically in developing commercial housing waqf (CHW) on waqf land in achieving the Sustainable Development Goals (SDGs), the qualitative method was chosen as the primary approach to data collection. Thus, Creswell (2009) employed in-depth or open-ended interviews to collect data from the selected participants. Participants are sampled based on developing knowledge until theoretical saturation is reached (Strauss & Corbin, 1998), which occurs when no new information is generated by the additional data (Locke, 2000).

Participants in this study were chosen based on their experience with Sharia and the property development sector. All of the responses were Malaysians with a documented track record of offering related services. They are also referred to as subject matter experts in their respective businesses. As a result, Penang State Islamic Religious Council (MAINPP) was chosen as a case study and a good fit for this research because it was Malaysia's first MAINPP to develop waqf land with built commercial buildings, such as dwellings and business premises. Many difficulties have arisen in this state, including Muslim equity ownership and socioeconomic issues among Malay-Muslims. This is because the value of assets continued to rise, which was hampered by a lack of home or equity ownershipThese problems were linked to a lack of law and order as well as declining social and moral standards.

Face-to-face in-depth interviews with a semi-structured interview were the primary data collection approach. The participants were contacted by phone, email, and personal visits to their offices, as well as the project Seetee Aisah, to inquire about their availability and consent to participate in this study.

3.2 Data Analysis

The data was then analysed and manually transcribed to suit the study's objectives. The data for this study was analysed in stages, beginning with conducting, transcribing, and assessing individual interview sessions. Cross-checking was used and confirmed by the participants about the information and data given earlier through interview sessions to ensure the dependability of this study (Janesick, 2000).

4. Results And Discussion

The findings indicated that the function of waqf in addressing societal needs, such as housing, must be considered in accomplishing numerous SDG targets in general. This is demonstrable, whereas CHW plays an important part in SDGs through tackling numerous socioeconomic difficulties. In general, there are two key elements in waqf: a spiritual element and a material element (Lahuri et al., 2021). The first element is a kind of prayer that can bring the wakif closer to Allah SWT by transferring Allah SWT's assets for general or specific humanitarian causes. While the second aspect is defined as an endeavour to convert assets into a better benefit to the ummah, not just in terms of welfare but also in terms of increasing society's socioeconomic well-being (Lahuri et al., 2021; Salleh & Adham, 2014).

Based on the data acquired from primary and secondary sources, the researchers concluded that the CHW is one of the most important contributors to accomplishing the following SDGs:

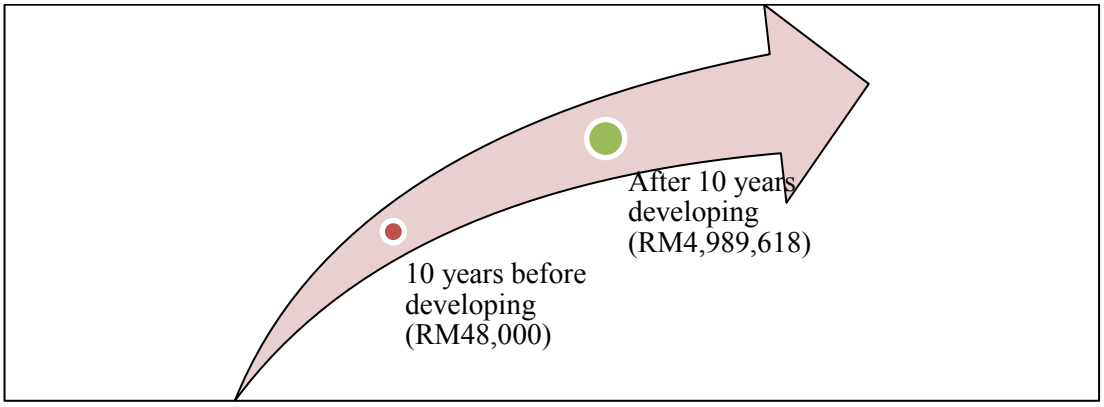
4.1 No Poverty (SDG 1)

Poverty reduction through affordable housing, which offers low-income individuals and families with options, is the goal of how commercial housing waqf (CHW) can be fitfully realised by the SDGs. As a result, the income created by the waqf homes is reinvested into the other housing project, ensuring that cheap housing remains accessible to people in need. CHW addresses one of the most fundamental issues confronting those living in poverty by providing affordable housing.

This was demonstrated in Penang by assigning affordable housing through lease or rent to ensure that the Muslim society is not sidelined in the economic momentum dominated by non-Muslims. Aside from

that, the value addition of the waqf assets demonstrates MAINPP's accomplishment in generating waqf land in Seberang Jaya. Through the renting of 27 store units totaling RM56,050.00 each month. MAINPP also obtains 30% of the RM600,000 Musyarakah (partnership) earnings. This amount has exceeded the amount set aside for distribution to *mawquf 'alayh* under the terms of the trust deed. This is clear when the initial waqf land of paddy fields, which earns only RM400 per month in rental returns, skyrockets to a figure that multiplies following commercial housing development. The revenue is seen not just in terms of profit generating, but also in terms of having a larger impact later on when the earnings can help the local Muslim community own assets and grow the assets of the Muslims in Penang by purchasing other property to be reclaimed for various development objectives. Figure 1 shows a comparison of what occurred before and after 10 years of development of Seetee Aisah waqf land in Penang.

Figure 1: Profit Comparison of Commercial Housing Waqf Development in Penang Before and After 10 Years



Sources: Interview Session with MAINPP

Based on the above, Figure 1 shows how significant variances occur in creating profit, which can benefit the waqif and the beneficiaries named in the trust deed in the long run. In addition, Table 1 below illustrates the total profit generated by the Seetee Aisah Project after ten years of development from 2013 to 2022:

Table 1: Profit from Seetee Aisah Waqf Land Development after 10 Years

YEAR	PROFIT (RM)
2013	225,750.00
2014	544,600.00
2015	593,534.00
2016	614,986.00
2017	616,328.00
2018	597,253.00
2019	623,887.00
2020	417,480.00
2021	397,800.00
2022	358,000.00
TOTAL	**4,989,618.00**

Sources: MAINPP, 2022

4.2 Good Health and Well-Being (SDG 3)

Nonetheless, CHW money can be used to support a variety of social welfare programmes, such as healthcare and community development efforts. By providing resources and infrastructure to promote access to basic services, this contributes to SDG 3 (excellent health and well-being). Furthermore, CHW is one of the investment options for long-term stability. As we all know, CHWs are often endowed in

perpetuity to ensure long-term profitability and that the waqf asset can continue to benefit wakif and beneficiaries. By doing CHW, the funds gained can be used to purchase additional land while disregarding current waqf land and staying away from idle waqf land.

Furthermore, commercial housing waqf can help to create social support networks inside housing complexes. This can be accomplished through community engagement activities, social events, and programmes that encourage resident connection and mutual support. Solid relationships have a positive impact on mental health, social well-being, and general quality of life. The researchers discovered that the houses and surrounding environment in Seetee Aisah Housing Park Project (MAINPP) were so good with the strategic location that the occupants and Muslim community remained supporting each other. By offering affordable leasehold settlements on waqf land to the Malay population, it will also help to reduce large-scale migration of this community to the mainland of Seberang Perai, especially Sungai Petani and Kulim, Kedah. This migration has a tremendous geopolitical influence. Thus, whether intentionally or unconsciously, the waqf land becomes a saviour; MAINPP must expand the number of Muslims residing on the island. The development of housing estates will also result in an increase in the number of Malay-Islamic community settlements. Thus, it is MAINPP's responsibility to guarantee that the public, particularly individuals who dwell on the land, first understands the waqf.

However, while the growth of CHW may not be sufficient to address the greater issue of high housing prices, it can give an alternative and make housing more affordable and accessible. It works in tandem with other affordable housing programmes to close the gap between market demand and affordability, especially for low-income persons and families.

4.3 Decent Work and Economic Growth (SDG 8)

Commercial housing waqf properties can help strengthen local economies by producing jobs, encouraging entrepreneurship, and attracting investment. This contributes to SDG 8, which fosters inclusive, long-term economic growth, full and productive employment, and decent work.

Commercial residential unit development is taking place on the Seetee Aishah waqf site, which is located at the intersection of two important highways, the North-South Motorway and the Butterworth-Kulim Highway. The Waqf property site is conveniently positioned because multiple hypermarkets, including Carrefour, Tesco Extra, Sunway Carnival, Billion, and Giant, are close. As a result, the strategic location may assist the society and community acquire opportunities, either by producing jobs or by locating jobs in the developed area.

4.4 Sustainable Cities and Communities (SDG 11)

By providing rental options, commercial housing waqf developments can help to address the housing affordability challenge. This is consistent with SDG 11, which calls for cities to be inclusive, safe, resilient, and sustainable. CHW improves living circumstances and community quality of life by providing inexpensive and excellent housing. Nonetheless, CHW owns the house and may supply reasonable rental properties as an alternative to the market's high-priced housing. Offering affordable housing units at reasonable rents allows people and families to obtain accommodation without incurring the financial strain of acquiring pricey properties. This helps to lessen the impact of rising housing prices and gives inexpensive solutions for individuals who cannot afford to buy a home.

It is also for long-term stability, whereas CHW are often endowed in perpetuity, guaranteeing rental prices. Housing prices, unlike the unpredictable real estate market, can fluctuate dramatically. As a result, CHW can offer a steady and predictable renting environment. This stability can shield tenants from unexpected spikes in housing prices while also providing them with more secure and cheaper housing options in the long run.

According to 2020 projections, ethnic Bumiputera dominate all districts in Penang, with the exception of the Northeast District, where ethnic Chinese account for 57.8 percent (340.3 thousand people) of the population. The number of Places of Residence in the State of Penang in 2020 is predicted to be 566.9 thousand units. In comparison to other districts, the Northeast District has the most Residential and Household Places, with 196.0 thousand units of Places of Residents. The South Seberang Perai District in Penang has the fewest residential units at 69.4 thousand TK. The increase in residence in Penang will occur from time to time in accordance with the population growth.

In 2018, the number of existing residential units in Pulau Pinang increased by 2.1%, from 497.4 thousand in 2017 to 507.8 thousand in 2018. Terraced houses accounted for 24.0 percent of residential units (122,302 units), followed by flats at 21.0 percent (106,562 units). The Northeast District had the most existing

residential units in Pulau Pinang, with 173,778 units. The most units were flats (77,044 units), followed by condominiums/apartments (45,762 units).

5. Conclusion

In conclusion, the growth of commercial housing waqf is the solution to the country's turmoil, particularly growing house prices year after year, homelessness, and houses that are inappropriate for families. These factors may indirectly contribute to an increase in crime statistics and social difficulties in the community. Thus, commercial housing waqf plays an important role in addressing these issues by providing affordable housing, generating sustainable income, promoting social development, empowering individuals, and encouraging philanthropic engagement, ultimately working towards the goals of essential aspects of the Sustainable Development Goals (SDGs) in the eyes of the world.

As a result, while this commercial housing waqf development did not cover or assist with all of the United Nations (UN) goals, it cannot be denied that it is a prestigious contributor to achieving the essential goals in SDGs such as no poverty (SDG 1), good health and well-being (SDG 3), decent work and economic growth (SDG 8) and sustainable cities and communities (SDG 11).

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TRACK 10
Special themes

10e. ICT for Sustainable Development in IR4.0 Era

Abstracts

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UNIFYING INFORMATION DASHBOARD DESIGN: EXPLORING SHARED PRINCIPLES, PRACTICES, AND CHALLENGES

Ahadi Haji Mohd Nasir, Associate Professor Dr. Mohammad Nazir Ahmad @ Sharif, Dr. Ely Salwana Mat Surin
Universiti Kebangsaan Malaysia, Bangi, Malaysia

AHADI HAJI MOHD NASIR

ASSOCIATE PROFESSOR DR. MOHAMMAD NAZIR AHMAD @ SHARIF

Abstract

In the era of data-driven decision-making, information dashboards have emerged as a powerful tool for consolidating and displaying vast amounts of data in a single, unified visual display. These dashboards provide valuable insights to decision-makers, supporting business success through improved efficiency, growth, reputation, risk management, and sustainability. However, the effectiveness of an information dashboard depends on its design and visual presentation. Despite their importance, the universal standard method to govern dashboard design is unavailable, resulting in varied and heterogeneous approaches. This study represents a preliminary investigation into the potential for unifying the design of information dashboards by adopting a narrative review method to identify commonalities among principles, practices, and challenges associated with the information dashboard design. The findings reveal that a user-centric dashboard is the pillar of numerous commonalities in information dashboard design, with design principles, best practices, and challenges serving as the building blocks. This strengthens the argument for the feasibility of unifying approaches. By unifying the information dashboard design method, the effectiveness of these critical decision-making tools can be improved, ultimately supporting business sustainability through more informed and accurate decision-making.

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Blockchain Technology for Traceability Monitoring in Food Supply Chain

Mr Mohammad Fairus Zulkifli, Assoc. Prof. Dr. Rabiah Abdul Kadir, Assoc. Prof. Dr. Mohammad Nazir Ahmad
Institute of IR4.0, Universiti Kebangsaan Malaysia, Bangi, Malaysia

MR MOHAMMAD FAIRUS ZULKIFLI

ASSOC. PROF. DR. RABIAH ABDUL KADIR

ASSOC. PROF. DR. MOHAMMAD NAZIR AHMAD

Abstract

Food supply chain can be referred to the network of companies, individuals activities and resources involved in the creation and delivery of food product to customers. The food chain include all the stages of the food process, from raw material acquisition to final delivery of the finished food product. In Malaysia, food supply in a critical issue because the country is heavily reliant on food imports to meet its domestic demand. The country's food supply chain in Malaysia is complex because of involving various stakeholders including farmers, producers, wholesalers, retailers, and logistics providers. The factors influence the food supply chain in Malaysia are Malaysia dependence on imports food, climate change, infrastructure and logistics, food safety and security and consumer demand. Based on this issues, rising prices of food are happened in Malaysia. Rising prices, known as inflation, is a common issue faced by many countries, including Malaysia. There are some causes the issue of rising prices such as increased demand, shortage of supply, fluctuation in exchange rates and global commodity prices. From this causes, Malaysia government introduce food subsidies where the government provides subsidies on essential food items such as rice, flour, cooking oil, and sugar to ensure that they remain affordable for consumers or particularly low-income households. Government also implement price controls on food to limit the extent to which prices can rise. Based on this issues many retail or seller in supply chain are take advantages and irresponsible increasing the price more than commodity price. Malaysian Enforcement have been taking action but rising price issues still happen because of lack of monitor, where enforcement out of hand because of seller can raise the food anytime when enforcement not on their places. There is some technology and application we can applied form this situation that is blockchain. The Blockchain technology has the potential to change the food supply chain by providing an efficient, secure, and transparent system for tracking and verifying the movement of food products from the farm to the table. Here are some ways that blockchain can be used in the food supply chain to control the prices. Feature like traceability in Blockchain can provide end-to-end traceability of food products, allowing consumers to track the entire journey of a product from the farm to the store. This can help improve food safety and prevent food fraud by identifying the original price state by government. Second feature is transparency in Blockchain can provide greater transparency in the food supply chain by enabling stakeholders to share data on the movement and handling of food products. This can help improve efficiency in sharing information of the food product including the price. Blockchain technology are the solution can be suggested to against rising price without permission among reseller and seller. Target of a food supply chain is to create value for the customer by delivering the product or service in the most efficient and cost-effective way possible.

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Application of New-Age Technology 5G and drones in Disaster Risk Reduction in India

Ms. Amrita Dhiman, Dr. S Rajeshwaran
Development Management Institute, Patna, India

MS. AMRITA DHIMAN

Abstract

Digitisation and transfer of data over wireless means is taken for granted today. This gains importance with the recent introduction of cutting-edge technologies like 5G and drones in India and policies of the government pro-actively supporting their usage. Combined with other new-age technologies like Big Data, Machine Learning, Artificial Intelligence and IoT, the scope for using data in a digital form opens up a new paradigm in Disaster Risk Reduction and Management. They enable us to assign repetitive activities to machines vide algorithms and combine it with pre-determined well-thought out targeted action(s) with zero time delay. Here, only the information on action taken by the system is shared with all concerned. Further, their usage makes early warning of disaster a reality. This, gives the personnel involved in disaster management time to ideate, learn and work on newer and more creative aspects of disaster management and benefit the people. In pre-disaster situations, drones can be used in risk assessment, mapping and planning.

This paper is an attempt to explore the application of new-age technology in the domain of disaster risk reduction in the Asian continent, while analyzing the feasibility of usage of these technologies in our country. The paper referes to the disaster situations in Bihar and attempts to draw parallels for the usage of these technologies in disaster risk reduction. The paper emphasizes on collaborating efforts required from all the concerned stakeholders in this regard.

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Artificial Intelligence and the Social Dimension of Sustainable Development – Obstacles and opportunities

Ms Irja Malmio
Swedish Defence University, Stockholm, Sweden

MS IRJA MALMIO

Abstract

Artificial Intelligence, or AI, has been described as one of the greatest threats and hopes for human society (Saetra, 2022). When viewed in relation to the social dimension of the Sustainability Development Goals, algorithmic processes have been suggested to produce new knowledge on how to prevent and correct environmental and human health challenges (Song et al. 2017), bolster social transformation (Boyd and Holton 2017), and lead to enhanced self-realization and increased human agency (Floridi et al. 2018). These propensities can thus arguably be a force for "good" where the development of "trustworthy" or "responsible" AI can advance the fulfillment of United Nations Sustainable Development Goals (Floridi et al., 2018; Saetra, 2022; Theodorou et al., 2022). In this frame, AI harbors a great potential that can help to identify unused capacity and spread resources more fairly, thus assisting society in creating a social environment that is more sustainable and inclusive. At the same time, there is a growing concern that algorithmic applications steer society in the opposite direction by reinforcing biases and unfairness which can consolidate and amplify inequalities (Benjamin 2019; Browne 2015; Eubanks 2017). Because of the entangled nature of AI and its social context, there is a propensity at the heart of this technology to absorb and reflect society's default norms and power structures (Benjamin, 2020), which can reproduce sociotechnical harms (Shelby et. Al 2022), while normalizing specific kinds of responses to social instabilities (McQuillan, 2022). Conclusively, the increasing reliance on AI for solving complex problems related to the social dimension of the SDGs is a contested phenomenon.

This presentation explores the opportunities and obstacles of AI to either support or hinder the progress of social goals in the SDG. It proceeds from a literature review and case studies that highlight the connection of AI, social norms and its potential consequences for the realization of the social goals of Agenda 2030. The link between technology, society and sustainability is imperative to consider because it highlights the complex process of the materialization of social values where AI in particular functions as a co-creator and mediator of societal norms and moral frameworks (Mittelstadt et al., 2016); thus, effectively shaping the perception of sustainability too. Understanding this link can open possibilities for developing technology that contributes to fortifying the "good society," including ideals associated with social sustainability, while identifying propensities in these systems that breed "sociotechnical harms," where bias can lead to increased polarization, intolerance, and, ultimately, a deteriorated security situation.

Full Paper

Application of New-Age Technology 5G and drones in Disaster Risk Reduction in India

Amrita Dhiman[1] and Dr S Rajeshwaran[2]

[1] Faculty & Coordinator, Centre of Excellence in Disaster Management, Development Management Institute, Patna; Email: adhiman@dmi.ac.in; Contact: +91 7091496209 (Corresponding author)
[2] Faculty, Development Management Institute, Patna

Abstract. Digitisation and transfer of data over wireless means is taken for granted today. This gains importance with the recent introduction of cutting-edge technologies like 5G and drones in India and policies of the government pro-actively supporting their usage. Combined with other new-age technologies like Big Data, Machine Learning, Artificial Intelligence and IoT, the scope for using data in a digital form opens a new paradigm in Disaster Risk Reduction and Management. They enable us to assign repetitive activities to machines vide algorithms and combine it with pre-determined well thought out targeted action(s) with zero-time delay. Here, only the information on action taken by the system is shared with all concerned. Further, their usage makes early warning of disaster a reality. This, gives the personnel involved in disaster management time to ideate, learn, and work on newer and more creative aspects of disaster management and benefit the people. In pre-disaster situations, drones can be used in risk assessment, mapping, and planning. This paper is an attempt to explore the application of new-age technology in the domain of disaster risk reduction in the Asian continent, while analyzing the feasibility of usage of these technologies in our country. The paper refers to the disaster situations and attempts to draw parallels for the usage of these technologies in disaster risk reduction. The paper emphasizes on collaborating efforts required from all the concerned stakeholders in this regard.

Key words: Technology, 5G, Drones, Disaster Risk Reduction, Disaster Response

1. Introduction

Digitisation of data has now become part of our lives. It is no different in the field of disaster management (DM) and disaster risk reduction (DRR). There are four distinct parts to it. First is digitization of the data point itself. Second is collating it and putting it in various order in a quick manner. Third is the ability to analyse each set of permutation and combination individually in a cross-sectional manner. Finally, getting a view of the same as time-series data for a better and holistic perspective. The objective is to make effective and timely decisions in an efficient manner for minimizing the losses that may occur. The basic assumption is that those responsible for collecting data on disaster will make it available to one and all, public and private, institutions and individuals for analysis. Past data and trend are two reference points that add immense value to the present data.

To begin with, one has to realize that the lens we use and the perspective with which we as researchers and users look at data in an analogue form has to be different when view the same data in digital form. To put it simply, using the same methods and lenses that we are familiar with and use to look at and for analyzing data in analogue form, with digital data is akin to trying to fit a square peg in a round hole. This is a common mistake since we all make either from the fear of the unknown or failure or the technology per se or from sheer habit. Further, there is the fear amongst those in power that their position and status will reduce once information related to disaster becomes easily available, open and transparent. We need to be consciously aware of this and initiate all necessary steps to minimize it. This is because technology is growing by leaps and bounds and the methods and ways with which we could look at and analyse data are becoming more and more so much so that our present ways of using our minds and human behaviour itself become the constraint. This is where Artificial Intelligence excels over human intelligence.

Hence, the ability of personnel to understand and use it in an effective manner is of utmost importance. For this, the data in a digital form has to be made available to one and all in an open data ecosystem and classified as a public good, one which is non-rival and non-excludable. Here, the social and economic value of research is maximized. The resultant positive externalities will be in many sectors and benefits people will individually receive will far outweigh the costs involved. Again it must be emphasized here that this becomes the basic foundation on which DM and DRR can function effectively.

We shall build our discussion on the use and benefits of the two technologies drones and 5G in DM and DRR, after delving into the other technologies which are already in use; for these two will have to be used in tandem with the others, for a better and synergestic outcome in terms public welfare. We must remember here that as per a report of the International Bank for Reconstruction and Development, 95% of deaths caused by disaster in the World occurs in developing nations. Irony is that every one of them was completely preventable.

2. Literature Reviews

DM and DRR necessarily involve large volumes of data over time and the ability of the system to use it effectively becomes of utmost importance. Big Data enables us to visualize, analyse and predict disasters (Akter & Wamba, 2019; Arslan, Roxin, Cruz, & Ginhac, 2017; Yu, Yang, & Li, 2018)

Satellite imagery by its very nature can capture much physical data vide rapid mapping at a very micro level and any and every data point of various parameters being monitored could be of immense benefit in times of large-scale emergency. Since imaging using satellite has no physical boundaries, various agencies private and public in different countries have come together to collaborate as an earth-observation community, for the benefit of mankind, in all phases of disaster, before, during and after. (Voigt et al., 2007).

IoTdevices add value to the data being captured by satellite imagery and used for triangulation. This field is so well developed and mature that ready-made products / services are already available using IoT devices to address all issues related to DM and DRR. IoT devices being light in weight and easily deployable, can be paired easily with many other devices.(Ray, Mukherjee, & Shu, 2017) (Shah, Seker, Hameed, & Draheim, 2019). IoT can be useful in every stage of DM from risk identification, disaster preparedness, emergency response, resources allocation, reaction planning upto disaster recovery, in a cost effective manner.(Saha et al., 2017).

ML using AI combined with data mining, pattern recognition and statistical learning can provide algorithms in a dynamic manner and enable the system make the best decision amongst the many options available in the quickest possible time. There are four broad flood management techniques. They are object extraction, edge detection, image acquisition through drones and pixel based threshold on Synthetic Aperture Radar (SAR) images. Machine learning is quick, cost-effective and easy to validate. It has proved its efficacy especially in the field of flood predictions. The Artificial Neural Network (ANN) models have been proven to be the most powerful tool for flood prediction of floods in the tail end, using the image data received from upstream. The Multilayer Perceptron (MLP) uses the time-series data on rainfall and water levels upstream to predict the course and speed of flood, down stream. Some of the other models of Machine Learning for flood prediction are Adaptive Neuro Fuzzy Interface System (ANFIS), Support Vector Machine (SVM), Wavelet Neural Network (WNN). In flooded areas, identification of landmarks and populated areas help in mapping the rescue routes. Experimental results using such models have given an accuracy of prediction of nearly 90% with about 3,300 images. North Bihar being a flood prone zone, use of ML can be of much benefit to accelerate the flood mitigation and rescue missions undertaken by the state. (Munawar, Hammad, Ullah, & Ali, 2019). ML/DL methods can be used for early warning of impending earth quake and minimize false alarms. It can also be used in monitoring of disaster, assess the damage that has occurred, identify survivors, help in search and rescue operations, quantify the damage incurred, provide assistance in medical response, etc. (Linardos, Drakaki, Tzionas, & Karnavas, 2022) Since, ML algorithms can handle large volumes of data, it provides assistance in management of pandemic, predicting and monitoring the spread of the disease, decide evacuation routes etc. (Chamola et al., 2021).

Artificial Intelligence is the process of simulating human behaviour in an objective and quick manner. Machine Learning is a modern aspect of Artificial Intelligence, wherein the machine accomplishes a given task without being given orders. It is the quickness in response and the ability to

learn in a given pathway that is useful in DRR and DM area. It is required to analyse the huge volumes of data obtained through Geographical Information System (GIS) and Remote Sensing (RS) (Abid & Sulaiman, 2021).

Decision-making under uncertain and a dynamic condition is crucial in number of scenarios like disaster response, where every second things are changing for better or for worse. Low probability occurrences and complicated situations are difficult for humans to think about. A computational method may provide enormous value to a decision-making process. It relieves the human decision maker of having to foresee all possible scenarios. Algorithmic decision-making is the delegation of decision-making and implementation to machines. When creating automated decision-making, it is vital to account for numerous sources of uncertainty and carefully balance several objectives.

3. Methodology

This paper is an attempt to explore the application of new-age technology in the domain of disaster risk reduction in the Asian continent, while analyzing the feasibility of usage of these technologies in our country. The paper refers to the disaster situations in India and attempts to draw parallels for the usage of these technologies in disaster risk reduction. The paper emphasizes on collaborating efforts required from all the concerned stakeholders in this regard. The study is based on literature review, analysis of information available from secondary sources.

4. Results and Discussion

It has been found that youth are generally one third of those who suffer from disaster, due to the top-down approach of any activity related to disaster. Hence, youth of an area be it rural or urban have to be considered and treated as an asset in DRR and DM; since they are more technically savvy, have more energy and have good peer-to-peer relationship amongst themselves as a cohort and quickly learn from each other. As a result all the technologies that are being talked about here can easily be assimilated and used by them. Hence, the youth need to be formally inducted into the fields of DRR and DM by incorporating these subjects as part of their formal school curriculum, informal sessions and by conducting mock exercises with them actively participating in it. Once they are involved, they become a resource person at every stage of their life from then on. Earlier studies give support to this statement.(Manesh, 2017) (Akeyo, 2010).

4.1 Open Data ecosystem

All the above will be useful only and if only the relevant data is collected, stored in digital form and made available to one and all for analysis and informed decision making. This is all the more important in a disaster scenario wherein every man / woman is on his own and have to fend for himself / herself based on whatever he / she knows. Here, availability of data and information can not only be literally life-saving but also give them a sense of ownership on the outcome in their lives. Every person be it a child or adult will have to be treated as an adult and talked to as such. Unfortunately certain studies by Asher et. al (2021)have shown that the greatest weakness is in the last mile, which is making the government data freely accessible to public at zero cost 24 x 7. Here, the role and responsibility of civil society plays an important role to act as a bridge between the state and the citizen. Asher goes on to enumerate the basic four principles of unlocking the benefits of public data. First, Government data must be available on cloud and freely accessible 24x7 by any citizen using a smart phone. Second, the Government's primary role is to generate and disseminate live data. Third, the data should be of quality, verifiable and trustworthy. Fourth and finally, the data should be provided to any interested citizen freely. In fact, the Right to Information Act 2005 grants all citizens the right to ask the government for information that it holds on behalf of its citzens.

A typical example of this is the US National Oceanic and Atmospheric Administration (NOAA), a scientific agency which focuses on weather and atmospheric conditions. Many private players including Google (maps) use this data and provide it to citizens adding value to it. Asher et. al conclude by stating that open data eco system will have a positive impact on the economic condition of every citizen of the country. Accordingly, they suggest that private sector could also be roped in to provide data as a public good, invest in data literacy by default and create an open data eco-system which will be in line with the 73rd and 74th Amendment to the Indian Constitution which commits to improved governance through decentralization of powers to rural panchayats and urban local bodies.

Barriers to to adoption of technology: Richardson (2011)has identified and the different barriers / constraints one will face before diffusion of new innovation. They are hardware incompatibility, complexity, language barrier, lack of power, internet access, computer, lack of practice or simply inability to understand technology.

Trust is an important factor when we want someone to use accept and adopt new technology. (Bahmanziari, Pearson, & Crosby, 2003) So, before we introduce the technology one needs to ensure that trust built first, for it is the foundation on which everything else follows.

Having understood the entire eco-system, we now move on to the two new technologies drones which are Unmanned Aerial Vehicles (UAVs) or drones and 5G in mobile communication that Government has just given permission to be used in the country. It goes without saying that these two have to be used in conjunction with all those that are already present and in use.

4.2 Drones

Drones are Unmanned Aerial Vehicles (UAVs) are also referred to Remotely Piloted Aircraft System (RPAS) or Umanned aerial Systems (UAS). It flies with the assistance of a ground operator or through automated flight with no human intervention. Drones are said to be of nine types, including fixed wing, flapping wing, rotary wing, tilt rotor, ducted fan, helpicopter, ornithopter and unconventional. Very little research has been done on the use of drones in disaster management. Drones are used to transport primary / secondary material in disaster situations quickly and efficiently. Priority is for secondary material, which can then further support the management functions post-disaster, especially one which will facilitate communication. Primary material like medicine and food can follow the secondary material. (Daud et al., 2021)Reconnaissance and monitoring post-disaster in the area in a 24x7 manner using different types of cameras with night vision is also much required. Hence, decisions in terms of Plan A, B and even C and its various sub-branches are well thought out and pre-decided with little subjectivity. Drones can be used in risk assessment, mapping and planning, remote broadcasting, object detection, multi object tracking and re identification. In addition they are capable of searching for live victims buried under rubble using heat sensor, vibration sensor, binary and noise sensor. They complement traditional relief operations by becoming ears and eyes of the area, 24X7. Main benefits of drones are low cost, reach, speed and safety.

However, there is very little evidence to show that drones are regularly used in disaster management field. So, to that extent it seems an untouched area where there is much scope for its use and benefit from it. The four areas that are under study are mapping, search and rescue, transportation and training.

Following are the requirements of communication system in Disaster Management: Fast response, Life expectancy of the network or system, interoperability, tariff-free operation, network coverage, support heterogenous traffic types, easy to use and low equipment cost, Support indoor and outdoorin a seamless manner and high precision for accurate location. It should be able to provide voice, data connectivity, messaging, push to talk, security services and location services (Rawat, Haddad, & Altman, 2015). The speed of communication is the key. Setting up of local area networks using 5G platform on the fly is now distinctly possible. This facilitatea providing of various communication services in an online mode, in a seamless manner. The moment an area has been declared under "disaster" the entire area needs to come under a central command wherein all public actions are pre-decided and known to all such that it can be followed by everyone. However, if 5G is still not available, the 4G cellular technology LTE and LTE-A does offer a good quality of experience (QoE). In fact, LTE-A (release 12 of 3GPP) features have been enhanced specifically to meet the requirements of public safety and disaster situation.

Our discussion on 5G will not be complete in disaster situations without considering D2D communication. D2D which is specifically for communication for public safety and warning announcements during disaster with efficient radio spectrum allocation with low energy consumption directly on to mobile phones of people in the disaster area without delay. (Rawat et al., 2015). Thomas and Raja have designed a framework FINDER (Finding Isolated Nodes D2D for Emergency Response). If the link with the cell tower is lost due to some problem at the Base station / cell tower, the mobile will automatically link switch to D2D and continue the intelligent and reliable connectivity.

4.3 Importance of feedback

Every disaster is a valuable learning experience and all those involved in DRR and DM in any country should have opportunity to learn from it in an on-going basis with little or no delay whatsoever. Especially about the initiatives that did not work and the reasons thereof. This has to be at an international level, on a continual basis. Every disaster is a learning opportunity to enable better Disaster Risk Reduction and Disaster Management in future. For this data related to the disaster of all kinds are required to be in the public domain. . Open data result in informed decision making and thus improve policy, ensure accountability, empower citizens, create new opportunities for private sector and lead to a quicker response and redevelopment post any disaster in future. Unfortunately, very little seem to have been learnt from the earthquake in Bhuj in January 2004 while attending to the tsunami that affected the Tamilnadu coast in December 2004. This is inspite of many NGOs and personnel who worked in Kutch helped in Tsunami affected in TN.

5. Conclusion (11pt Times New Roman)

There are some serious constraints that we need to overcome to get any benefit from the use of these technologies. Some are extrinsic and some are intrinsic to the individual. This is based on past studies and our own experience of working with the Government at differ levels. The following intrinsic factors could be affecting the availability, accessibility, and use of these new age technologies.

Inability to practice and use ICT skills. As one goes up the seniority level in the Government, it becomes next to impossible to admit that one is constrained / awed by ICT and unable to use it. Some senior officials do not even know how to handle the keyboard of a computer so much so that they have an assistant to type even short emails! They are also constrained by lack of time to practice these basic skills. Fear of the unknow and losing power and position by sharing of information are exhibited in different forms and act as inertia to change.

If we juxtapose this with the unified theory of acceptance and use of technology explained in detail by Blackwell et. al (2013) vide their experiment and conclusion that the teacher's attitude and positive belief in children, plays an important role in the children using the technology provided to them, can we say that the attitude of the policy makers and implementers who provide various technologies and their belief in people play an important part in their acceptance and usage? For making available a technology, its acceptance and its actual usage are three distinct outcomes, and we are aiming for the last, for sure.

Since majority of all deaths caused by disasters occur in developing countries, it is incumbent all these countries to learn to use different technologies and processes to reduce disaster related risks. And being a public good, this rests on the shoulders of the respective governments as a duty and responsibility towards its own citizens.

Further, as discussed earlier the usage of these technologies may depend on the attitude of those who provide them. The use of UAV and 5 G in disaster management is an untapped area both in terms of practice and research, especially in India. Hence, it is incumbent on the Government to promote dry runs to observe its practicality of not only these two technologies but also others mentioned herein in different combination. They have already been used successfully in developed nations in disaster situations and that can provide important secondary information. But only live experience in our country across all states will help us know its practical utility. Daud et al (2021) have also concluded in their study funded by the Malaysian Government on the use of drones in disaster situations, that much needs to be further explored, studied and reviewed on the use of drones in disaster situations though it is known that they are a good tool for mapping, search and rescue operations, transport and training. It would be of interest to gather some of the personnel who had been involved in DRR and DM in various parts of the country 2-10 years ago and get their ideas and opinion on the use of these new technologies based on their experience, a sort of counter-factual thought experiment. It could give much insight into the way and manner and priority in which these technologies could be supported as public initiative and public good.

However, to begin with, there is much to be done in terms of risk reduction prior to any disaster that may strike suddenly, specifically flood in monsoon season and earth quake any time of the year, in specific areas of the country.

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